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Interim Report and Presentation for the TxDOT Administration

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Disclaimers

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Pavement Condition Goals:
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Interim Report #1

Texas Department of Transportation

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April 2010

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Multi-Tier Pavement Condition Goals

DESCRIPTION:

TxDOT maintains 194,000 lane miles of pavement which is the largest State maintained highway system in the U.S. The current statewide pavement condition goal, set by the Texas Transportation Commission in 2002, is to achieve 90 percent of State-maintained lane miles in "Good" or better condition by 2012. This is a "one size fits all" goal: high-traffic metro Interstates are treated the same as low-traffic rural FM roads.

Funding for pavement preservation (routine maintenance, preventive maintenance, and rehabilitation) is becoming increasingly limited. Available pavement preservation funds have been reduced by: Federal rescissions; construction cost inflation; reduced fuel tax revenue receipts (and projected receipts) due to reduced travel and increased vehicle fuel efficiency; debt service; and increased competition to address mobility, bridge, and safety issues.

During the August, 2009 Commission meeting, it was noted that the TRENDS revenue assessment computer program predicted pavement funding allocations from FY 2010 to FY 2030 that are well below the 2030 Committee's pavement needs estimate to achieve and maintain 80 percent 'Good' or better pavement Conditions. Based on this observation, TxDOT Administration requested an analysis of predicted future pavement Condition Scores using the same methodology and assumptions as was used in the 2030 Pavement Needs study, but based on the current and future projected funding allocations.

The analysis indicated that the 90% 'Good' or better goal cannot be achieved and system conditions will deteriorate to unacceptable levels based on the FY 2010–2035 funding projection developed by TxDOT, as shown in Figure 1. The FY 2010–2035 funding projection is presented in Table 1.
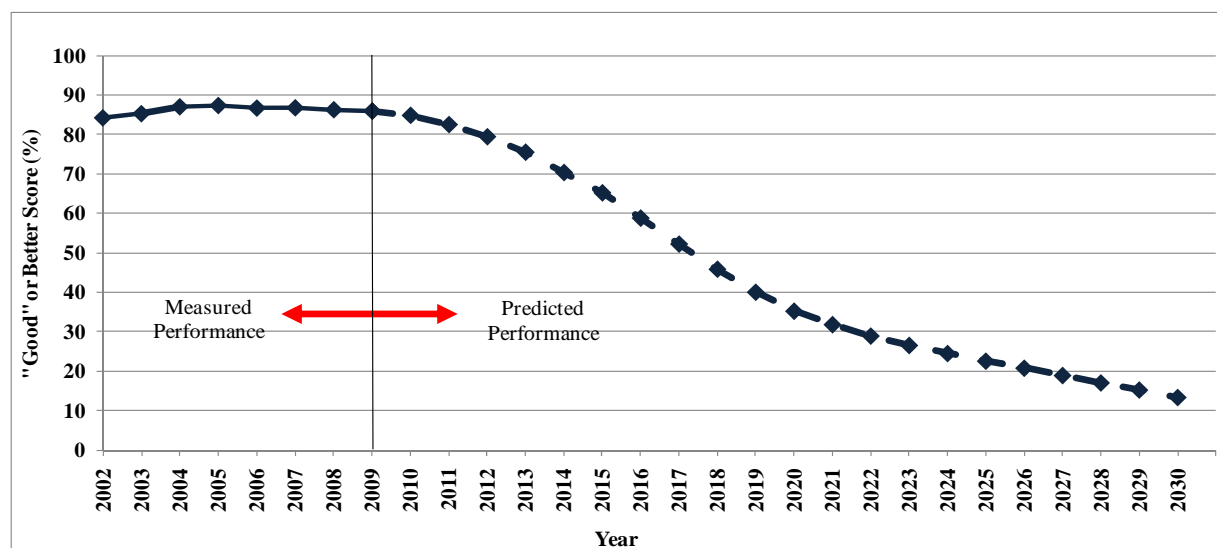
Figure 1. Predicted Pavement Performance Trend for FY 2009-2030 [Zhang *et al* 2009]

Multi-Tier Pavement Condition Goals

Table 1. FY 2010–2035 UTP Funding Projection

Year	Cat 1 Total	Cat 1 Total (Constant Value in 2008 Dollars)
2009(Base Year)	$1,198,984,327	$1,164,062,453
2010	$391,704,544	$369,219,101
2011	$852,064,920	$779,760,105
2012	$1,289,503,110	$1,145,706,811
2013	$879,207,181	$758,411,838
2014	$927,844,163	$777,054,879
2015	$940,402,463	$764,633,260
2016	$1,063,647,825	$839,653,415
2017	$1,086,722,706	$832,882,466
2018	$1,071,532,346	$797,320,698
2019	$1,082,852,781	$782,275,889
2020	$1,082,852,781	$759,491,154
2021	$1,368,355,161	$931,783,281
2022	$1,321,384,391	$873,590,749
2023	$1,249,795,875	$802,196,414
2024	$1,173,006,070	$730,978,602
2025	$1,055,721,023	$638,728,581
2026	$1,027,531,254	$603,566,318
2027	$971,083,323	$553,795,250
2028	$814,036,117	$450,712,061
2029	$632,832,652	$340,178,734
2030	$439,742,216	$229,498,165
2031	$547,767,401	$277,549,222
2032	$422,312,886	$207,749,956
2033	$306,765,814	$146,513,061
2034	$200,624,889	$93,028,703
2035	$103,333,911	$46,519,796

It should be noted that pavement funding drops drastically after FY 2025. This aggravates the already expected downward trend in pavement conditions.

In response to this finding, the Administration directed TxDOT personnel and University researchers to investigate alternate pavement condition goal systems and a funding allocation formula that preserves the State pavement network under a constrained budget. In addition, the group was directed to assess potential risks and consequences associated with these goals.

Multi-Tier Pavement Condition Goals

GENERAL ISSUES:

- What are the most effective strategies to preserve the system and provide the highest achievable pavement conditions for the greatest number of Texans?

- How do we manage risk as pavement system conditions deteriorate due to limited pavement preservation funding?

- What are the consequences in terms of road user costs and other factors of allowing portions of the state network to deteriorate?

- How should the Category 1 Pavement funding allocation formula change?

- How are other State DOTs facing the challenges of a constrained budget?

AN OVERVIEW OF THE APPROACH:

Resource management is part of the pavement management process, where two categories of problems usually have to be dealt with: 1) budget planning; and 2) budget allocation. The objective of budget planning is to estimate the minimum budget required annually to achieve and maintain the established pavement condition goals over a planning horizon; therefore, it is commonly referred as needs analysis. The purpose of budget allocation is to evaluate various allocation alternatives that can optimize the overall pavement condition under a given budget projection. The major components of the analysis approach and the relationship among them are illustrated in Figure 2, where the five major tasks to be performed are:

1. **Define tiers**
2. **Establish goals for tiers**
3. **Estimate needs to achieve and maintain the goals**
4. **Compare estimated needs to available preservation funding**
5. **Update funding allocation policy**

Budget Planning

Budget planning or needs analysis can be conducted under the scheme of either a single-tier system or a multi-tier system. As an example of the needs analysis with a single-tier system, an earlier budget planning analysis was conducted under the 2030 study by CTR, where a 90 percent "Good" or better pavement condition goal was used for the entire on-system pavement network. The pavement M&R needs for FY 2009 through FY 2030 were estimated and expressed in constant FY 2009 dollars. Since the analysis was conducted for planning purpose, the needs were presented as estimates for the entire state instead of breakdowns for the individual districts.
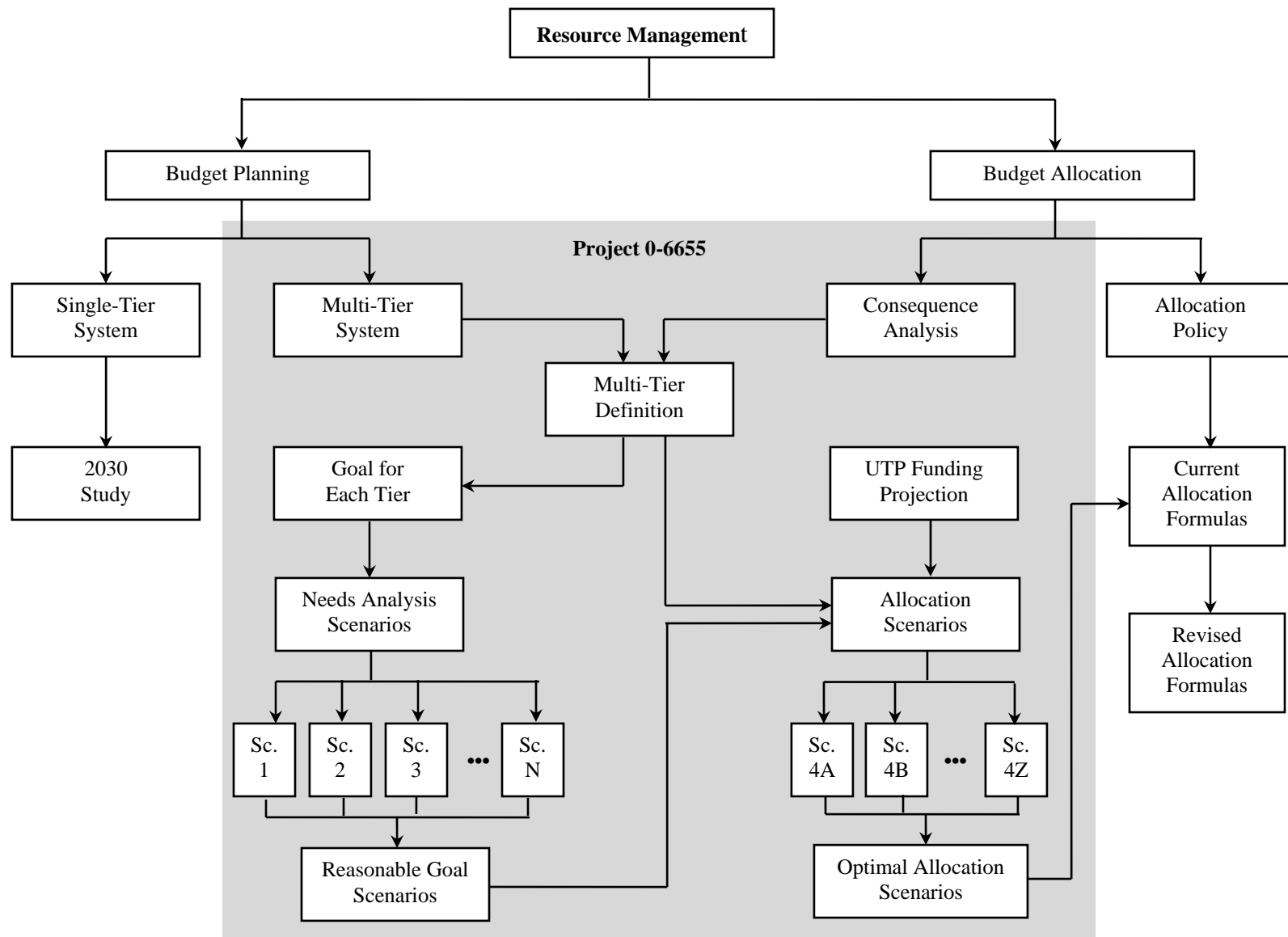
Multi-Tier Pavement Condition Goals

Figure 2. Major Components of the Analysis Approach and the Relationship among Them

Multi-Tier Pavement Condition Goals

Multi-Tier System

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 in terms of which element(s) of the pavement network should be given the priority first 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 tilted more towards the pavement group or Tier that is deemed to be the most important. Moving from a single-tier system to a multi-tier system also marks a shift of the resource allocation philosophy from a lane-mile based approach to a utilization based approach. To work with a multi-tier system, the first step is to define the Tiers.

ISSUES AND CONCERNS:

- Since moving from a single-tier system to a multi-tier system is a shift of the resource allocation philosophy from the traditional lane-mile based approach to a utilization based approach, are the Legislature, the Commission, the Administration, the Districts, and the general public ready for such a shift?

- Is such a shift even necessary?

Multi-Tier Definition

To conduct the multi-tier analysis, the first step is to define the tiers, using criteria such highway functional class, ADT, truck ADT, etc. As of now, fifteen versions of the Tiers have been developed. Based on this preliminary assessment, a proposed three-Tier system based on Version 1.6 was initially selected for conducting the preliminary analysis. The three tiers are shown in Table 2, along with their corresponding lane miles, percentage in lane miles, VMT, and truck VMT. It is proposed to set goal percentages for 'Good' or better conditions and goal percentages (not to exceed) for 'Poor' and very poor conditions for each Tier.

Table 2. Preliminary Proposed Three-Tier System with Tier Descriptions and Statistics*

Category	Description	Lane Miles	Percentages of...		
			Lane Miles	**VMT**	**Truck VMT**
Tier 1	High-traffic major corridors (such as IH and US)	47,106.6	24.22	64.68	70.40
Tier 2	Intermediate-traffic routes, including state and local corridors important to the economy	30,463.2	15.67	18.07	15.01
Tier 3	Low-traffic routes (mainly FM, but some SH and US).	116,890.6	60.11	17.25	14.58

* Based on Version 1.6 of the defined Tiers.

Multi-Tier Pavement Condition Goals

> **ISSUES AND CONCERNS:**
>
> - Roadways with high ADT but not high truck ADT should be considered for tiers higher than Tier 3.
>
> - Roadways with low ADT but having special significance (such as connections to military installations) or special requirements (such as roadways to egg farms) should be considered in a special Tier.
>
> - How often will Tier maps (and therefore formula distributions) be updated? With growing area and industry (especially drilling), roads can go from Tier 3 to Tier 2 quickly. Will need additional money to upgrade to handle increased loading.

Goal for Each Tier

When the overall condition of a pavement network is relatively good, the percentage of pavement sections falling into "Poor" and "Very Poor" might be small and should not be a concern; however, when the overall condition keeps deteriorating, the percentage of "Poor" and "Very Poor" could be significant and result in various adverse implications. It is therefore proposed to set a higher goal or percentage for 'Good' or better conditions and a lower goal or percentage (not to exceed) for 'Poor' and "Very Poor" conditions for each Tier. While the higher goal for each Tier can be set at various levels for conducting scenario analysis, the lower goal should be fixed at some predetermined levels to avoid making the analysis process too cumbersome. More specifically, two sets of lower goals (1, 3, and 5 percent; and 3, 5, and 7 percent) are proposed for Tiers 1, 2, and 3, respectively.

> **ISSUES AND CONCERNS:**
>
> - Roadways with high ADT but not high truck ADT should be considered for tiers higher than Tier 3.
>
> - Roadways with low ADT but having special significance (such as connections to military installations) or special requirements (such as roadways to egg farms) should be considered in a special tier.
>
> - Current goals are all based on "good" or better condition. Do we set some Tiers at "fair" or better, or even based on distress instead of condition?

Multi-Tier Pavement Condition Goals

Needs Analysis Scenarios

Since the M&R needs are the minimum budget required to achieve and maintain a specific goal, different goals will result in different levels of M&R needs. In other words, to various needs analysis scenarios can be defined by setting various goal scenarios. The Center for Transportation Research (CTR) has conducted three needs analysis scenarios identified by the TxDOT Project Monitoring Committee (PMC). The three Scenarios include different percentages of 'Good' or better goals for the 3 Tiers. Please note that there is no longer a statewide goal for percentage of lane miles in 'Good' or better condition, though the statewide score can be calculated as analysis output. Table 3 shows the goals for the three needs analysis scenarios and the corresponding M&R needs to achieve and maintain these goals, where the lower goals were not considered in the analysis. It should be pointed out that, the three scenarios conducted so far are just the beginning. It is anticipated that additional needs analysis scenarios will be defined by the Multi-Tier Pavement Management Workgroup and analyzed by CTR.

Table 3. Preliminary Results of Three Goals and the Corresponding Needs*

	FY 2009 Condition	Scenario 1		Scenario 2		Scenario 3	
		Goals (H/L)	Needs (billions)	Goals (H//L)	Needs (billions)	Goals (H/L)	Needs (billions)
Tier 1	85.69/2.72	90/1	$11.02	90/1	$10.88	80/1	$8.46
Tier 2	80.99/3.86	90/3	$4.61	80/3	$3.76	70/3	$3.11
Tier 3	87.31/1.74	90/5	$25.28	70/5	$14.79	50/5	$9.01
Total	**86.84/2.80**		**$40.90**		**$20.43**		**$20.68**

* The lower goals were not considered in the analysis.

ISSUES AND CONCERNS:

- How can the estimated needs be confirmed?

- What would be the cost to bring the pavements to their current condition when the pavements are allowed to deteriorate to poor or very poor condition?

- Should the lower goal be set at 1, 3, and 5 percent for Tier 1, Tier 2, and Tier 3, respectively, or should they be 3, 5, and 7 percent instead? Please note that every one percent increase in the lower goal adds $390 to $780 million of eventual reconstruction costs to the statewide pavement needs estimate.

- Once there is a Tier system in place, TxDOT needs to look very hard at the level of design standards that we are rehabilitating roadways. If there are not enough funds for the state, TxDOT needs to work with FHWA and see how we can lower Interstate design standards so that all possible money can be put to the pavements and not be spent on appurtenances if not absolutely necessary (4R vs. 3R etc.)

Multi-Tier Pavement Condition Goals

Reasonable Goal Scenarios

The purpose of conducting various needs analysis scenarios is to identify reasonable goal scenarios that can serve as the basis for conducting budget allocation analysis. Reasonable goals scenarios should be those that are achievable to TxDOT, acceptable to TxDOT districts, and sensible to the Legislature and the general public.

ISSUES AND CONCERNS:

- What would be the impact on safety when the goal for pavement condition is set at a very low value? As the roads get a lot rougher, vehicles will have to slow down some, but the current rate of vehicle accidents on rural roads is higher. Add the future rougher roads to the higher speeds some will drive anyway plus the higher accident rate and you start getting more people killed on the Tier 3 road.

- Effect of Tiered System on Thin Surface Pavements? The cost is going to be excessive to bring back some of these roadways if we let deteriorate to poor condition.

- Consider percent of "Fair" for Tier 3 rather than percent of "Good" or better? Include percent of "Good" or better and a percent of "Fair."

- A policy on gravel roads need to be considered. We are fighting Texans' expectations of what rural roads should be like. I grew up in Iowa and the vast majority of rural roads is gravel and maintained by the county. The State DOT only maintained the interstate, US and state designated roads. They have no FM system maintained by the state DOT.

- I believe our goal has to be tied to funding and that a tier system of management is probably the correct method for the situation. I would hope that the tier 3 pavements would be able to have a high enough minimum goal that they can remain reasonably safe and that they will not be "lost completely" so that they can hopefully be improved without a complete rebuild if resources become available and which would allow a raising of the goal. As far as really liking such a drastic reduction in goals, I do not; however, we can accomplish no more than resources and best practices allow.

- When I presented to our supervisors I tied it in with the Kansas DOT Road Rallies attempting to obtain public opinion on what is acceptable and not acceptable. In Texas I am unaware of previous attempts to obtain public opinion on acceptability standards for various classifications of roadways to validate our decisions for improvements. Road Rallies are one way to qualify data to validate that we are doing what Texans find acceptable. The bad part, as I see it, is it will take years to gather a statistically valid sampling of data to make any firm decisions that could affect our policies. Kansas DOT has been doing this for around 10 years.

Multi-Tier Pavement Condition Goals

Budget Allocation

As briefly discussed earlier, the purpose of budget allocation is to evaluate various allocation alternatives that can optimize the overall pavement condition under a given budget projection. While the consequences of various allocation alternatives can be analyzed technically, the allocation policy should be set by the TxDOT decision-makers based on the results of the consequence analysis along with other factors.

Consequence Analysis

Consequence analysis is intended to examine the potential consequences of various allocation scenarios in terms of risks, implications, and long-term social and economical impacts. It can also provide information on the relative proportion of the funding by district under an allocation scenario, given a constrained budget such as the UTP funding projection.

UTP Funding Projection

The consequence analysis of an allocation scenario is based on a constrained budget. The UTP funding projection can provide information on the constrained budget. For example, the current UTP funding projection for FY 2010–2020 is $11.4 Billion in constant FY 2008 dollars.

Allocation Scenarios

The Center for Transportation Research (CTR) has conducted two allocation scenarios identified by the TxDOT Project Monitoring Committee (PMC): Scenario 4A and Scenario 4B:

Scenario 4A: Predetermined percentages of the FY 2010–2020 UTP Cat 1 funding were used for the allocation: 55 percent for Tier 1, 25 percent for Tier 2, and **20** percent for Tier 3. We assumed that these percentages will treat the same amount of mileage in each Tier (assuming that Tier 1 will be the most expensive to treat and Tier 3 will be the least expensive to treat).

Scenario 4B: Funding was allocated to achieve and maintain the goal of Tier 1 first (Based on Scenario 3); then any remaining funding was used for Tier 2; any remaining funding after Tier 2 was allocated to Tier 3.

Figure 3 shows how the pavement condition changes from FY 2010 to FY 2020 under allocation scenario 4A.

Spending 55 percent of the money on Tier 1 is not enough to keep it at current condition. Instead, Tier 1 drops to 70 percent "good" or better in FY 2020. Spending 25 percent on Tier 2 is also not enough to maintain current condition, but Tier 2 only drops to 70 percent "good" or better in FY 2020. Spending only 20 percent on Tier 3 produces a rapid decline – down to less than 30 percent "good" or better in FY 2020.

Multi-Tier Pavement Condition Goals
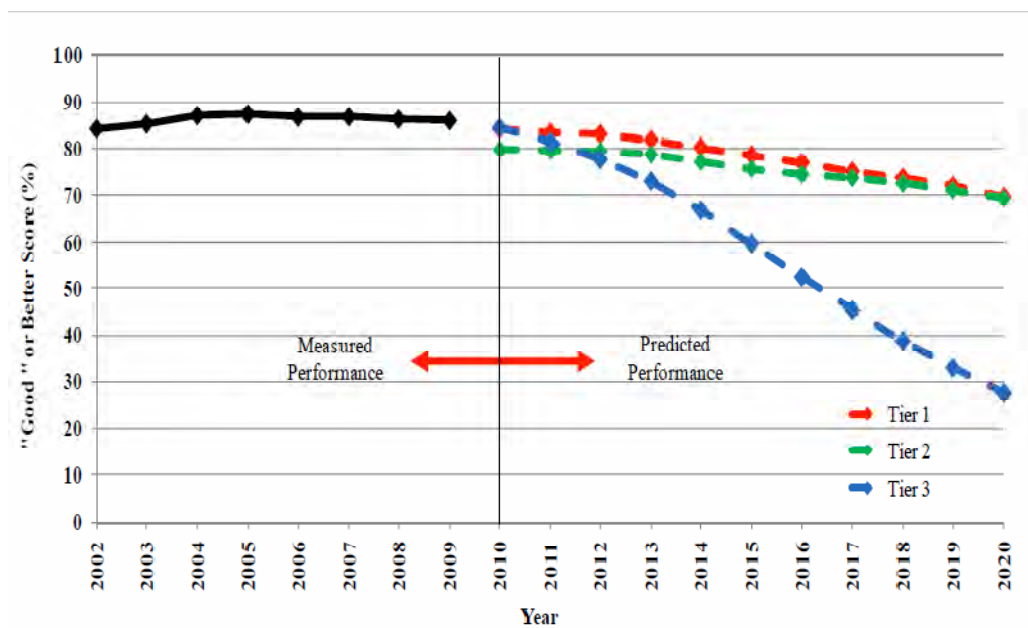
Figure 3. Pavement Condition Trend under Allocation Scenario 4A

Figure 4 shows how the pavement condition changes from FY 2010 to FY 2020 under allocation scenario 4B.

Spending money on Tier 1 first keeps it at the goal of 80 percent "good" or better, but leaves very little money for Tier 2 and Tier 3. As a result, the condition of Tier 2 and Tier 3 mileage declines rapidly to a very low level by FY 2020.
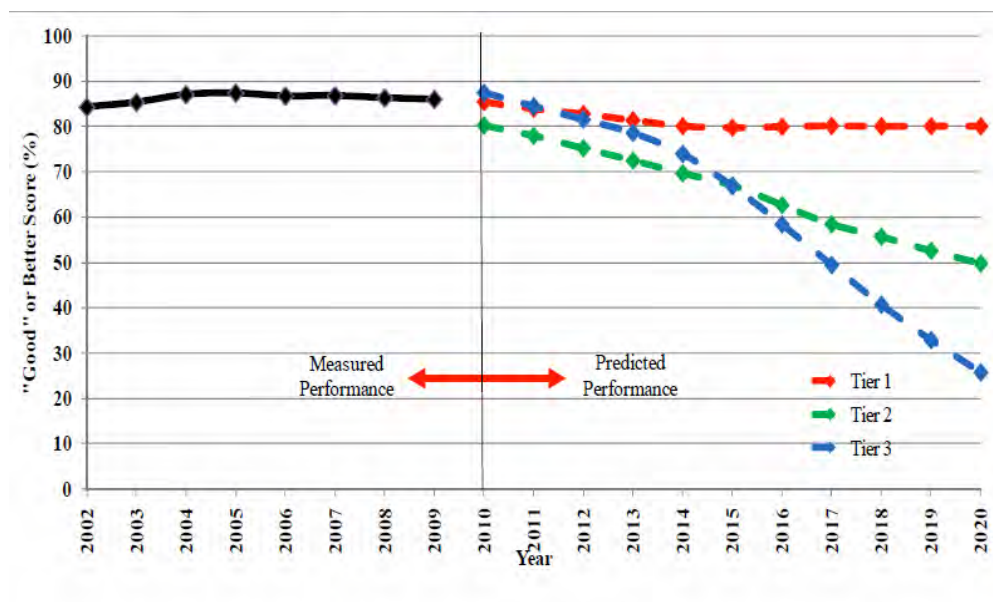

Figure 4. Pavement Condition Trend under Allocation Scenario 4B

Multi-Tier Pavement Condition Goals

As for the significant disproportion of the allocations among different districts (especially rural vs. urban), it is the result of compound effects of two primary factors: 1) the allocation method (such as 4A and 4B), and 2) the percentage of lane miles of each Tier in a district.

It should be pointed out that the two allocation scenarios conducted so far are just the beginning. It is anticipated that additional allocation scenarios will be defined by the Multi-Tier Pavement Management Workgroup and analyzed by CTR.

ISSUES AND CONCERNS:

- Thin surfaced flexible pavements are either going to be "Fair" or "Failure;" there is really no in between, especially in moderately wet seasons. How can such a failure process be taken into consideration?

- Look at the dollars that we are putting into Tier 3 Preventative Maintenance (PM) in both Scenarios 4A and 4B. We are saying this is the money "left over" and that Tier 3 is mostly PM but if we have only enough funding for a 18-20 year seal coat cycle, then we are no longer performing Preventative Maintenance by the definition, we are throwing "band aids" at failing roads.

- We feel that we are pushing Tier 3 roads shown in Scenarios 4A and 4B too low, down to near 25% Good or Better. Perhaps Tier 1 should be 70% "Good" or better, **OR** 80% "Fair" and this could raise Tier 3 up some. As we all have discussed, maybe we should consider only two Tier levels for the state.

- If we match Funding to percentage of "Good" or better goals (4A and 4B), we as managers/administrators need to ensure there are expectations/incentives to exceed the goals.

- After quick look, three tired system makes sense. I prefer scenario 4A which puts more emphasis on Tier 2 roadways. Tier 3 roadways currently have the highest condition scores. Tier 3 roadways also have the lowest traffic and loading. It will take longer for these roads to deteriorate than Tier 1 and especially Tier 2. Instead of looking at deterioration curve for all roadways, look at deterioration curves for each tier roadway. My belief is curve will be much flatter for Tier 3, Tier 2 probably has steepest deterioration curve (more loads and volume on less structure). Scenario 4A puts more emphasis on Tier 2.

Optimal Allocation Scenarios

The objective of conducting various allocation scenarios is to identify the optimum distribution of limited pavement preservation money. This optimum distribution would serve as the basis for revising the current TxDOT pavement funding allocation formulas—in fact, it could become the "formula" itself.

Multi-Tier Pavement Condition Goals

An "optimum" allocation should be one that maximizes pavement condition and economic impact while (of course) staying within the expected budget. Please note that "maximizing pavement condition" and "maximizing economic impact" can be defined for either one year or for a range of years.

If developing such an "optimum" allocation proves to be beyond the scope of this project, TxDOT can modify its allocation formulas instead.

ISSUES AND CONCERNS:

- Mileage-based versus utilization-based allocations. PMIS data suggests that districts are primarily using a lane-mile based approach to improve condition with limited funding. This approach does have some value: it protects the most mileage from the risk of deterioration, which protects the state from having to spend much larger amounts of (limited) money to rebuild mileage. The lane miles were built for a reason – they were built to be used – so there is some "utilization" benefit gained from treating lane miles. A strictly utilization-based approach runs the risk of spending all of the money on a very small amount of high-cost mileage, while exposing the large portion of the network to the risk of deterioration and eventual loss.

- For what it's worth, PMIS uses both approaches in its optimization program. "Benefit" is simply the expected gain in condition over time. "Cost" is the treatment cost annualized over the expected life of the treatment. The "benefit-cost" ratio is adjusted for mileage (lane miles) and utilization (log VMT) to produce a final "Cost-Effectiveness Ratio" used for ranking projects.

- Do we de-emphasize ride in funding computation? Yes.

- Do we break out the concrete roadways in the calculations, since many of those deficiencies center on ride? PMIS is not a good tool to rate concrete vs. flexible roads side by side.

- There should be a different formula to develop pavement condition scores on asphalt versus concrete pavement, or if using the same formula, the ride scores should have different weights.

- Every district has to have a good PM program. Based on the need for PM, it would probably be wise to establish a minimum amount of funding for each district. Rehab funding could then be based on distress scores.

- Strategy 105/144 Operating funds need to continue to be allocated to the districts by formula, as we currently do, and not by a Multi-tier allocation. Districts could then be evaluated on how they are spending their allocation, Multi-tier or not. This would also serve the districts in funding at a minimum level for operating and responding to emergencies as we have been.

Multi-Tier Pavement Condition Goals

TABULATED ISSUES AND CONCERNS FROM TxDOT DISTRICTS:

Though the comments, issues, and concerns received from TxDOT districts have been categorized into the "Issues and Concerns" boxes in the previous sections. The original comments, issues, and concerns are summarized in Table 4.

Table 4. Summary of Issues and Concerns from TxDOT Districts

Region	Issues and Concerns
West	1) There is a concern that the numbers in the "Estimated M&R Needs" slide may not be accurate. Some things to consider include whether we are absolutely sure we are showing the costs to rehabilitate the various Tiers accurately. They may all be accurate but it is imperative to confirm. 2) As you and I have discussed, we would like to see some "Progression Curves" for the decline of a roadway's surface from "Good or Better" Condition to "Total Failure" for the various types of pavement structures (concrete, thick surfaced flexible structure, and thin surfaced flexible structure). I believe what this will show is that your thin surfaced flexible pavements are either going to be "Fair" or "Failure", there is really no in between, especially in moderately wet seasons. This is somewhat evident in the pictures from Doug Eichorst. 3) Strategy 105/144 Operating funds need to continue to be allocated to the districts by formula, as we currently do, and not by a Multi-tier allocation. Districts could then be evaluated on how they are spending their allocation, Multi-tier or not. This would also serve the districts in funding at a minimum level for operating and responding to emergencies as we have been. 4) Higher ADT roadways that may not be carrying the higher truck volumes (700 ADT) need to be considered on an individual basis for higher than Tier 3. Example is a controlled access facility in this region that has 30,000 ADT but low truck traffic and is a main thorough fair for commuting traffic. 5) Look at the dollars that we are putting into Tier 3 Preventative Maintenance (PM) in both Scenarios 4A and 4B. We are saying this is the money "left over" and that Tier 3 is mostly PM but if we have only enough funding for an 18-20 year seal coat cycle, then we are no longer performing Preventative Maintenance by the definition; we are throwing "band aides" at failing roads. 6) We feel that we are pushing Tier 3 roads shown in Scenarios 4A and 4B to low, down to near 25% Good or Better. Perhaps Tier 1 should be 70% Good or Better OR 80% Fair and this could raise Tier 3 up some. As we all have discussed, maybe we should consider only two Tier levels for the state. 7) Last, once there is a Tier system in place, TxDOT needs to look very hard at the level of design standards that we are rehabilitating roadways. If there are not enough funds for the state, TxDOT needs to work with FHWA and see how we

	can lower Interstate design standards so that all possible money can be put to the pavements and not be spent on appurtenances if not absolutely necessary (4R vs. 3R etc.)
North	1) Do we de-emphasize ride in funding computation? Yes. 2) Do we break out the concrete roadways in the calculations, since many of those deficiencies center on ride? Yes, PMIS is not a good tool to rate concrete vs flexible roads side by side. 3) Establish a minimum amount of funding for a District? Absolutely yes. If not some rural districts would get almost nothing. 4) Effect of Tiered System on Thin Surface Pavements? The cost is going to be excessive to bring back some of these roadways we let deteriorate to poor condition. 5) Consider % Fair for Tier 3 rather than % Good or Better? Include % Good or Better and a % Fair. As the roads get a lot rougher, vehicles will have to slow down some, but the current rate of vehicle accidents on rural roads is higher. Add the future rougher roads to the higher speeds some will drive anyway plus the higher accident rate and you start getting more people killed on the Tier 3 road. 6) A policy on gravel roads need to be considered. We are fighting Texans' expectations of what rural roads should be like. I grew up in Iowa and the vast majority of rural roads are gravel and maintained by the county. The State DOT only maintained the interstate, US and state designated roads. They have no FM system maintained by the state DOT. 7) If we match Funding to % good or better goals (4A and 4B), we as managers/administrators need to ensure there are expectations/incentives to exceed the goals. 8) I believe our goal has to be tied to funding and that a tier system of management is probably the correct method for the situation. I would hope that the tier 3 pavements would be able to have a high enough minimum goal that they can remain reasonably safe and that they will not be "lost completely" so that they can hopefully be improved without a complete rebuild if resources become available and which would allow an increase of the goal. As far as really liking such a drastic reduction in goals, I do not; however, we can accomplish no more than resources and best practices allow. 9) Some of the identified issues are safety related to poor quality roads due to allowable moderate to severe rutting on Tier 3 roads causing loss of control, hydroplaning and reduced braking efficiency. The biggest concern is allowing roads to further deteriorate costing more money later to rehabilitate, if we can ever afford it. At least 3 of the department's goals are violated in rural areas with

the proposal and 4 to 5 of the goals in suburban and urban centers.

10) When I presented to our supervisors I tied it in with the Kansas DOT Road Rallies attempting to obtain public opinion on what is acceptable and not acceptable. In Texas I am unaware of previous attempts to obtain public opinion on acceptability standards for various classifications of roadways to validate our decisions for improvements. Road Rallies are one way to qualify data to validate that we are doing what Texans find acceptable. The bad part, as I see it, is it will take years to gather a statistically valid sampling of data to make any firm decisions that could affect our policies. Kansas DOT has been doing this for around 10 years.

11) Ironically, I have discussed this concept with two County Judges and they completely understand our funding dilemma and said "there is only so much you can do with limited funds." I believe counties are facing similar challenges on their systems.

12) All this being said, we generally agreed that barring any miracles in new revenue, the 90% good or better goal is not achievable and we appear to be on an unsustainable course of funding for preventative maintenance goals. One note is that we indirectly have a tier system in place currently. In an overview of PMIS data statewide indicates the interstate system is rated the highest followed by US Highways, State Highways, and FM roadways. It is based on roadway classification. So, it may not be an extreme departure to formally designate a Tier system of evaluation.

13) After quick look, three tired system makes sense. I prefer scenario 4A which puts more emphasis on tier 2 roadways. Tier 3 roadways currently have the highest condition scores. Tier 3 roadways also have the lowest traffic and loading. It will take longer for these roads to deteriorate than tier 1 and especially tier 2. Instead of looking at deterioration curve for all roadways, look at deterioration curves for each tier roadway. My belief is curve will be much flatter for tier 3, tier 2 probably has steepest deterioration curve (more loads and volume on less structure). Scenario 4A puts more emphasis on tier 2.

14) Ok to de-emphasize ride in formula. I did this long ago and concentrated on distress.

15) I like % fair for tier 3 roads instead of good. Lower, more even standards as opposed to extremes of good vs poor.

16) How often will tier maps (and therefore formula distributions) be updated. With growing area and industry (esp. drilling), road can go from tier 3 to tier 2 quickly. Will need $$$ to upgrade to handle increased loading.

17) We agree that we should break out the concrete roadways in the calculations and de-emphasize ride in funding computations.

18) Every district has to have a good PM program. Based on the need for PM, it would probably be wise to establish a minimum amount of funding for each district. Rehab funding could then be based on distress scores.

19) If funding does not change, we will need to figure out how to score unsurfaced roads. Know we joked but what will 1991 dollars buy for us in 2025 and hopefully a much more fuel efficient fleet.

20) There should be a different formula to develop pavement condition scores on asphalt versus concrete pavement, or if using the same formula, the ride scores should have different weights.

REFERENCE:

[Zhang *et al* 2009]   Zhang, Z, M. Murphy, K. Persad, and R. Harrison, "Pavement Condition Analysis Based TxDOT Funding Projections," Technical Memorandum 0-6581-CT-01, Center for Transportation Research, The University of Texas at Austin, Austin, TX, November 2009.

Multi-Tier
Pavement Condition Goals:
DOT MTG Survey Summary

Interim Report #2

Prepared by

The Multi-Tier Pavement Management Workgroup
**Michael R. Murphy, Zhanmin Zhang, Magdy Mikhail, Bryan Stampley,
and Robert Harrison**

May 2010

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Background

The following commentary summarizes information obtained from the state DOT Multi-tier pavement condition goal (MTG) systems survey. The survey contained 13 questions organized in three categories:

1) Process used to develop an MTG (q1 – q5 & q9);
2) MTG implementation - budget allocation & project selection (q6 – q8);
3) Feedback and Lessons Learned (q10 – q13).

Additional information was obtained from Pavement Condition Reports and other documents provided by the DOTs. A copy of each completed Survey with the supporting information attached is posted on the following SharePoint site.

http://txsappl/cst/ppo/shared%20Documents/Forums/AllItems.apx

Report Format

Project 6655 Draft Report #1 'Multi-Tier Pavement Condition Goals: Issues and Concerns' discusses the background information which resulted in this study including projected future decreased funding and resulting lower statewide pavement condition scores.

During the discussion of different Multi-Tier Goal Scenarios, a number of Issues and Concerns have been raised by the Project Monitoring Committee during project meetings and by District Engineers during Regional meetings. These Issues and Concerns were used as a framework for categorizing and assessing relevant MTG DOT Survey responses.

Numbers are assigned to each 'Issue and Concern', which are shown in bold blue text, along with the Report #1 page number to support cross-referencing. Comments from the Surveys are then listed verbatim or paraphrased with a notation indicating the DOT source. Not every Issue and Concern was addressed by the Survey comments. However, in many cases, other DOTs have faced similar issues and a number of comments do relate. [TxDOT 2010]

An assessment of the DOT Survey comments, DOT and FHWA on-line information, and relevant reports is provided immediately following each 'Issue and Concern / DOT Survey comments listing. The assessment seeks to provide insights regarding each Issue and Concern and may highlight opportunities for further investigation.

For reference purposes, Tables 1 and 2 provide the decision tree criteria for V1.11 and V1.13 which is currently being considered by the PMC. Table 3 provides a summary of each state DOT MTG system and the number of years the system has been in use. Tables 4 – 7 contain data obtained from the FHWA Policy Information Statistics webpage and are referenced in the discussion of Issues and Concerns. [FHWA 2008]

Table 1 Multi-Tier Goal Version 1.11 [TxDOT 2010]

Tier 1	Tier 2	Tier 3
Interstate (IH)	IH Frontage Roads	US ≤ 700 Truck ADT
NHS US	US ML or FR ≥ 10,000 ADT	US ML or FR ≤ 10,000
NHS SH	US ≥ 700 Truck ADT	SH ≤ 700 Truck ADT
NHS FM	SH ≥ 700 Truck ADT	SH ≥ 10,000 ADT ≤ 55 mph
	SH ≥ 10,000 ADT ≥ 55 mph	SH ≤ 10,000 ADT
	FM, BR, PA ≥ 700 Truck ADT	FM, BR, PA ≤ 700 Truck ADT
	FM, BR, PA ≥ 10,000 ADT ≥ 55 mph	FM, BR, PA ≥ 10,000 ADT ≤ 55 mph

Table 2 Multi-Tier Goal Version 1.13 [TxDOT 2010]

Tier 1	Tier 2	Tier 3	Tier 4
Interstate (IH)	IH Frontage Road	US ≤ 700 Truck ADT	US ≤ 500 ADT
NHS US	US ML or FR ≥ 10,000 ADT	US ML or FR ≤ 10,000 ADT	SH ≤ 500 ADT
NHS SH	US ≥ 700 Truck ADT	SH ≤ 700 Truck ADT	FM, BR, PA ≤ 500 ADT
NHS FM	SH ≥ 700 Truck ADT	SH ≥ 10,000 ADT ≤ 55 mph	
	SH ≥ 10,000 ADT ≥ 55 mph	SH ≤ 10,000 ADT	
	FM, BR, PA ≥ 700 Truck ADT	FM, BR, PA ≤ 700 Truck ADT	
	FM, BR, PA ≥ 10,000 ADT ≥ 55 mph	FM, BR, PA ≥ 10,000 ADT ≤ 55 mph	

Tables 4 – 7 and Figures 1 & 2 were obtained from the FHWA Policy Information webpage and provide statistics about the highway system length, number of lane miles and expenditures. [FHWA 2008] In addition, specific information about the National Highway System and Strategic Highway Network (STRAHNET) is provided along with maps of East- and West Texas showing the NHS and STRAHNET route locations. This information will be used throughout the report to support discussions about the DOT MTG systems.

Table 3 State DOT Multi-Tier Goal Systems

State	Multi-tier System (y/n) how many years implemented?	# of Tiers	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Tier 6	Tier 7	Comment
Alabama	yes - 5 years	2	IH ≥ 60 IRI	Other routes ≥ 95 IRI						Goal is to maintain IH in Good or better Condition and non-IH in Fair or better condition
Colorado	yes - 16 years	4	IH ≥ 85%	Non-IH NHS ≥ 70%	Other highways ≥ 55%	Statewide ≥ 60%				% 'Good' or Fair. However, statewide goal is not linked to tiers; rather it is based on traffic levels
Florida	yes - > 10 years	3	IH 90% meet stds	Arterial 77% meet stds	Statewide 80% meet stds					Florida uses PCS 0 -10. A PCS of 6.4 is considered deficient except for roads posted at < 50 mph and ride between 5.5 - 6.4 & other ratings > 6.4.
Georgia	Investigating multi-tier approach									
Idaho	yes - > 20 years	2	IH ≥ 2.5	Arterials ≥ 2.5	Collectors ≥ 2.0					82% 'Fair' or better for all systems based on Cracking or Ride Index (CI) or (RI)
Illinois	previously 2 tier, considering returning to this system	2	IH 100% Acceptable	85% Acceptable for State maintained System						Illinois used 2 tiers from 2003 - 2006 then switched back to 1 tier - 90% Acceptable or better for the entire system. Considering returning to the 2 tier system.
Indiana	Investigating multi-tier approach									
Iowa	yes	4	IH miles with PCI < 65	non-IH NHS ≤ 60	Rest of Primary ≤ 50	All other ≤ 45				Still waiting to receive survey - however, DOT tracks miles with Pavement Condition Index below the target, but has not set goals as of yet.
Kansas	yes > 20 years	2	IH ≥ 85% Good and ≤ 3% Poor / VP	Non IH ≥ 80% Good and ≤ 5% Poor / VP						Based on Performance Level (PL) which combines distress ratings and ride measurements.
Louisianna	yes - 6 years	4	97% IH < 171 in/mi	95% NHS < 201 in/mile	90% SH < 226 in/mile	80% Regional < 226 in/mile				Measure based on IRI in inches/mile. FHWA <95 in/mile = 'Good' between 95 and 170 in/mile 'Acceptable' > 170 'Unacceptable'
Maine	Investigating multi-tier approach - participated in survey	4	A-1 corridors: IH and routes carrying ≥ 15th percentile ADT	A-2 corridors: non-IH NHS carrying ≥ 40th percentile ADT	B-1 corridors - heavy truck corridors and high traffic routes not includes in A-1 or A-2	C roadways. All other state maintained roadways.				Plan to implement a multi-tier goal system, but have not quite established all criteria.
Maryland	Investigating multi-tier approach									
Massachusetts	yes - unsure when developed no records	2	80% IH: ≥ 3.0	70% NHS: ≥ 2.8						PSI on scale from 0 - 5 for ride, distress and condition. Worst of these three measures is reported as the PSI of the pavement.
Minnesota	yes - 10 years	2	Principal Arterials 70% G/b and < 2% P/vp	Minor Arterials 65% G/b and < 3% P/vp						Ride Quality Index (RQI) 0 - 5. VG = 4.1 to 5.0; Good 3.1 to 4.0; Fair 2.1 to 3.0; Poor 1.1 to 2.0; and Very Poor 0.0 to 1.0
Mississippi	yes - 10 years	3	100% IH with PCR > 72 and avg rut depth < 0.2"	100% 4-lane hwys with PCR > 72 and avg rut depth < 0.25"	100% 2-lane hwys with PCR > 62 and avg rut depth < 0.25"					PCR ranges from 0 (worst) to 100 (perfect)
Montana	yes - 10 years	3	IH avg Ride Index > 60 and < 5% with RI < 60	non-IH NHS avg Ride Index > 60 and < 5% with RI < 60	Primary Highways avg Ride Index > 60 and < 5% with RI < 60					Three tiers but the targets are the same for all three.

Table 3 State DOT Multi-Tier Goal Systems (continued)

State	Multi-tier System (y/n) how many years implemented?	# of Tiers	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Tier 6	Tier 7	Comment
New York	yes - unsure when developed no records	3	IH	non IH NHS	Non-NHS					Conditions are measured and reported for each of the 3 tiers. However, specific goals for each Tier are only communicated internally with the DOT.
North Carolina	yes - 2 years	3	IH PCR 85% ≥ 93	Primary System PCR 80% ≥ 86	Secondary System PCR 75% ≥ 86					Pavement Condition Rating (0 - 100) based on Present Serviceabilty Index.
North Dakota	yes - 7 years	5	IH	Interregional Corridor	State Corridor	District Corridor	District Collector			Note: North Dakot recently changed ride condition measurement from Public Ride Perception Index (PRPI) to IRI with revised targets for each Tier. At present goals and IRI targets are under evaluation.
Ohio	yes - 12 years	3	IH with 90% PCR > 65	Urban System with 90% PCR > 60	Rural System with 90% PCR > 55					Pavement Condition Rating (0 - 100) does not include ride quality.
Oregon	yes - > 10 years	4	IH > 90% Fair or Better	Primary > 85% Fair or Better	Secondary > 68% Fair or Better	Overall > 78% Fair or Better				Percentage of miles in 'Fair' or better condition. Rating is based on surface distress
South Dakota	yes - 3 years	7	IH Avg > 3.9	Major Arterial Avg > 3.7	Minor Arterial Avg > 3.4	State Secondary Avg > 3.0	Urban Avg > 3.9	Municipal Avg > 3.9	Overall Network Avg > 3.9	Average Surface Condition Index (SCI) function of ride and distress.
Utah	yes - 10 years	3 (now)	90% IH 'Good' or better	70% Arterials 'Good' or better	50% Collectors 'Good' or better					Utah has developed a new 4-tier system that sub-divides IH routes into high and low truck routes.
West Virginia	Investigating multi-tier approach									

Table 4 Maintenance Expenditures, Mileage, and Daily Vehicle Miles Traveled by State (http://www.fhwa.dot.gov/policyinformation/statistics/2008/) Tables PS-1b and SF12P4

STATE	EXPENDITURES 1000s of DOLLARS (2008)						CENTER LINE MILES (2009)			LANE MILES (2009)			DAILY VEHICLE MILES TRAVELED (2009) 1000s		
	STATE HIGHWAY AGENCY MAINTENANCE BY FUNCTIONAL CLASS						RURAL	URBAN	TOTAL	RURAL	URBAN	TOTAL	RURAL	URBAN	TOTAL
	INTERSTATE	OTHER PRINCIPAL ARTERIAL	MINOR ARTERIAL	MAJOR AND MINOR COLLECTOR	LOCAL	TOTAL									
Alabama	26,630	83,095	45,883	8,976	17,501	182,085	8,751	2,187	10,938	20,651	7,470	28,121	44,515	48,055	92,570
Colorado	28,069	46,280	30,388	9,505	-	114,242	7,702	1,399	9,101	17,710	5,238	22,948	30,613	45,710	76,323
Florida	106,563	508,743	206,754	32,761	1	854,822	5,968	6,116	12,084	16,506	25,933	42,439	66,253	226,122	292,375
Idaho	49	723	-	78,641	7,655	87,068	4,633	325	4,958	11,000	1,137	12,137	16,212	6,725	22,937
Illinois	89,232	129,847	78,472	86,344	1	383,896	10,936	5,104	16,040	25,078	17,072	42,150	51,832	113,879	165,711
Iowa	26,747	37,020	12,774	16,810	2	93,353	7,941	954	8,895	19,496	3,540	23,036	34,824	15,961	50,785
Kansas	60,506	56,393	17,627	3,060	8	137,594	9,619	750	10,369	21,198	2,790	23,988	26,695	17,511	44,206
Louisiana	-	4,363	-	-	193,431	197,794	13,197	3,488	16,685	28,460	10,041	38,501	46,074	57,381	103,455
Maine	58,238	11,293	14,065	66,911	7,890	158,397	7,517	993	8,510	15,749	2,366	18,115	24,782	9,906	34,688
Massachusetts	28,276	29,714	3,544	736	180	62,450	708	2,126	2,834	1,623	7,036	8,659	4,998	68,982	73,980
Minnesota	133,930	109,471	41,957	6,446	1	291,805	10,538	1,355	11,893	24,196	5,070	29,266	48,668	47,807	96,475
Mississippi	10,752	18,393	29,600	28,511	1,734	88,990	9,564	1,409	10,973	23,086	4,657	27,743	43,701	25,484	69,185
Montana	22,528	21,163	10,972	8,259	766	63,688	10,497	299	10,796	23,584	906	24,490	17,928	3,543	21,471
New Mexico	16,938	14,915	9,790	37,979	40,556	120,178	10,991	960	11,951	25,841	3,396	29,237	29,679	16,077	45,756
New York	318,976	267,250	93,645	72,226	10,696	762,793	9,936	5,033	14,969	22,043	16,099	38,142	43,532	141,992	185,524
North Carolina	37,607	98,306	120,098	116,911	250,893	623,815	62,890	16,576	79,466	130,116	39,968	170,084	99,078	139,735	238,813
North Dakota	1,720	7,548	6,891	2,042	-	18,201	7,167	217	7,384	16,235	751	16,986	11,236	2,646	2,646
Ohio	70,959	56,957	15,216	17,402	2,517	163,051	14,253	5,005	19,258	32,070	16,964	49,034	61,367	120,266	181,633
Oregon	-	-	-	-	189,553	189,553	6,688	850	7,538	15,329	2,935	18,264	29,936	24,946	54,882
South Dakota	13,000	17,078	15,705	5,288	19	51,090	7,608	228	7,836	17,184	887	18,071	14,202	3,102	17,304
Texas	293,544	531,006	245,058	224,903	6,375	1,300,886	66,419	13,648	80,067	147,558	45,630	193,188	175,728	300,847	476,575
Utah	41,433	33,135	20,593	1,854	922	97,937	4,781	1,060	5,841	11,591	4,108	15,699	17,298	32,076	49,374

Note: Chapters 8 & 12 of the 'Guide to Reporting Highway Statistics' provide DOTs with the FHWA reporting requirements for Highway expenditures and other information contained in the FHWA 2008 Statistics Tables. Based on a discussion with FHWA Policy Information staff, it was noted that, with respect to expenditures, the accuracy of the information contained in Table SF-12-P4 is useful for general comparisons, however it should be noted that the availability of expenditure data varies from state to state and may not be precise in every case.

Table 5 National Highway System (NHS) lane-miles by Functional Class) (http://www.fhwa.dot.gov/policyinformation/statistics/2008/)

OCTOBER 2009	NATIONAL HIGHWAY SYSTEM LANE-MILES BY FUNCTIONAL SYSTEM - 2008														TABLE HM-43
	RURAL							URBAN							TOTAL LANE MILES
STATE	INTERSTATE	OTHER PRINCIPAL ARTERIAL	MINOR ARTERIAL	MAJOR COLLECTOR	MINOR COLLECTOR	LOCAL	TOTAL	INTERSTATE	OTHER FREEWAYS AND EXPRESSWAYS	OTHER PRINCIPAL ARTERIAL	MINOR ARTERIAL	COLLECTOR	LOCAL	TOTAL	
Alabama	2,188	5,447	44	49	-	-	7,728	1,747	149	2,339	173	21	2	4,431	12,159
Colorado	2,754	4,433	28	11	3	-	7,229	1,295	1,206	1,792	34	12	-	4,339	11,568
Florida	3,442	4,834	93	13	-	-	8,382	4,180	2,255	3,427	318	61	12	10,253	18,635
Idaho	2,087	3,797	36	-	-	-	5,920	389	-	290	15	4	-	698	6,618
Illinois	5,450	3,778	7	27	-	5	9,267	4,243	410	5,916	305	109	21	11,004	20,271
Iowa	2,515	5,999	-	-	-	-	8,514	711	-	1,460	61	1	2	2,235	10,749
Kansas	2,647	5,932	20	-	-	-	8,599	1,051	618	527	14	4	-	2,214	10,813
Louisiana	2,160	2,565	196	16	-	-	4,937	1,676	213	2,012	329	20	13	4,263	9,200
Maine	1,253	1,613	14	-	-	-	2,880	276	51	294	9	13	-	643	3,523
Massachusetts	417	390	-	-	-	-	807	2,795	1,317	2,341	86	15	29	6,583	7,390
Minnesota	2,540	6,733	-	-	2	-	9,275	1,455	698	1,410	16	10	-	3,589	12,864
Mississippi	1,973	5,655	101	104	7	1	7,841	909	247	1,486	45	39	2	2,728	10,569
Montana	4,518	5,485	-	-	-	-	10,003	247	-	221	-	-	-	468	10,471
New Mexico	3,386	5,200	-	-	-	-	8,586	714	10	935	7	-	-	1,666	10,252
New York	3,457	3,553	196	29	1	-	7,236	4,447	3,405	3,981	291	39	27	12,190	19,426
North Carolina	2,269	5,290	529	376	-	4	8,468	3,000	1,423	1,650	104	49	10	6,236	14,704
North Dakota	2,077	5,031	-	-	-	-	7,108	220	-	246	-	-	-	466	7,574
Ohio	3,266	5,068	74	38	-	3	8,449	4,701	1,919	2,376	143	40	16	9,195	17,644
Oregon	2,263	5,888	3	5	-	5	8,164	861	230	1,010	68	13	9	2,191	10,355
South Dakota	2,414	5,040	27	3	-	-	7,484	354	40	237	9	-	-	640	8,124
Texas	8,353	18,168	749	109	2	-	27,381	6,802	6,473	10,627	331	147	7	24,387	51,768
Utah	2,919	2,248	43	6	-	-	5,216	1,338	51	976	37	2	1	2,405	7,621

Table 6 National Highway System (NHS) Daily Vehicle Miles Traveled (1000s) (http://www.fhwa.dot.gov/policyinformation/statistics/2008/)

Oct-09				NATIONAL HIGHWAY SYSTEM DAILY VEHICLE MILES TRAVELED (1000s)										TABLE HM-44
	RURAL							URBAN						
STATE	INTERSTATE	OTHER PRINCIPAL ARTERIALS	MINOR ARTERIALS	MAJOR COLLECTOR	MINOR COLLECTOR	LOCAL	TOTAL	INTERSTATE	OTHER FREEWAYS AND EXPRESSWAYS	OTHER PRINCIPAL ARTERIALS	MINOR ARTERIALS	COLLECTOR	LOCAL	TOTAL	GRAND TOTAL
Alabama	15,450	15,020	145	93	-	-	30,708	20,005	1,555	13,355	548	41	-	66,212	96,920
Colorado	12,071	9,667	79	27	5	-	21,851	20,019	11,608	11,625	142	33	-	65,279	87,129
Florida	26,259	18,220	263	14	-	-	44,756	67,455	30,198	24,041	2,037	197	19	168,704	213,459
Georgia	25,826	15,031	2,817	339	-	-	44,014	52,342	5,024	17,164	1,240	123	52	119,959	163,973
Idaho	5,752	5,574	66		-	-	11,392	3,422	-	1,448	57	5	-	16,326	27,718
Illinois	24,564	7,614	25	66	-	3	32,271	61,429	3,091	39,291	1,591	490	52	138,215	170,486
Iowa	12,671	10,628	-		-	-	23,299	6,949	-	5,210	148	3	3	35,611	58,910
Kansas	8,876	10,615	22		-	-	19,513	10,103	4,315	1,522	44	8	-	35,504	55,017
Louisiana	15,028	6,779	548	52	-	-	22,407	19,658	1,446	11,778	789	41	25	56,142	78,549
Maine	6,042	5,254	74		-	-	11,370	2,174	345	1,585	44	41	-	15,559	26,930
Massachusetts	3,441	2,177	-		-	-	5,618	41,235	15,034	17,440	290	19	134	79,770	85,388
Minnesota	11,362	15,934	-		-	-	27,296	23,272	9,544	8,424	110	41	-	68,687	95,984
Mississippi	11,233	13,834	148	164	3	-	25,383	9,525	1,383	6,984	200	101	3	43,578	68,961
Montana	6,434	5,960	-		-	-	12,394	939	-	1,155	-	-	-	14,489	26,883
New Mexico	12,402	8,025	-		-	-	20,427	7,283	19	3,880	22	-	-	31,630	52,057
New York	16,909	9,812	479	55	-	-	27,255	56,170	44,449	26,059	1,361	90	74	155,458	182,713
North Carolina	16,309	19,014	1,602	1,002	-	-	37,927	38,261	11,447	10,801	537	126	85	99,184	137,112
North Dakota	3,817	3,943	-		-	-	7,759	1,024	-	799	-	-	-	9,582	17,342
Ohio	24,747	15,428	233	82	-	3	40,493	61,413	14,360	11,439	476	71	33	128,285	168,778
Oregon	11,250	11,354	5	3	-	3	22,615	12,027	3,595	5,884	318	44	11	44,493	67,107
South Dakota	5,366	4,049	27	3	-	-	9,446	1,670	104	616	5	-	-	11,841	21,287
Texas	42,155	45,457	999	323	3	-	88,936	108,123	81,864	55,211	1,175	526	5	335,841	424,778
Utah	8,534	3,838	148	3	-	-	12,523	16,022	635	6,116	110	8	-	35,414	47,937

Table 7 Strategic Highway Network (STRAHNET) length by State, system and location (http://www.fhwa.dot.gov/policyinformation/statistics/2008/)

OCTOBER 2009	Strategic Highway Network (STRAHNET) Length - 2008						TABLE HM-49
	RURAL			URBAN			
STATE	INTERSTATE	NON-INTERSTATE	TOTAL	INTERSTATE	NON-INTERSTATE	TOTAL	GRAND TOTAL
Alabama	539	724	1,263	366	292	658	1,921
Colorado	682	28	710	271	30	301	1,011
Florida	749	227	976	722	261	983	1,959
Idaho	522	58	580	90	-	90	670
Illinois	1,356	-	1,356	826	7	833	2,189
Iowa	628	3	631	153	-	153	784
Kansas	656	3	659	218	15	233	892
Louisiana	535	231	766	371	77	448	1,214
Maine	299	-	299	67	7	74	373
Massachusetts	91	2	93	482	24	506	599
Minnesota	634	173	807	284	29	313	1,120
Mississippi	491	-	491	207	-	207	698
Montana	1,130	209	1,339	62	13	75	1,414
New Mexico	844	413	1,257	156	44	200	1,457
New York	842	9	851	863	19	882	1,733
North Carolina	542	719	1,261	583	315	898	2,159
North Dakota	519	127	646	52	12	64	710
Ohio	724	154	878	850	48	898	1,776
Oregon	555	544	1,099	174	50	224	1,323
South Dakota	602	88	690	77	9	86	776
Tennessee	688	58	746	417	41	458	1,204
Texas	2,058	2,192	4,250	1,176	593	1,769	6,019
Utah	725	276	1,001	211	11	222	1,223

National Highway System: Texas East

Legend:
- Eisenhower Interstate System
- Other NHS Routes
- Non-Interstate STRAHNET Route
- Major STRAHNET Connector
- Intermodal Connector
- Unbuilt NHS Routes
- Other Roads (not on NHS)

- Census Urbanized Areas
- Indian Reservation
- Department of Defense
- National Park Service
- Water

- Airport
- Intercity Bus Terminal
- Ferry Terminal
- Truck/Rail Facility
- Port Terminal
- Multipurpose Passenger Facility
- Truck/Pipeline Terminal
- AMTRAK Station
- Public Transit Station

0   60   120   Miles
0   130   260   Kilometers

Oklahoma

Arkansas

Louisiana

Missouri

FHWA, January 7, 2010

Figure 1 Map of National Highway System – Including STRAHNET Routes (East Texas) [FHWA 2005]

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National Highway System: Texas (West)
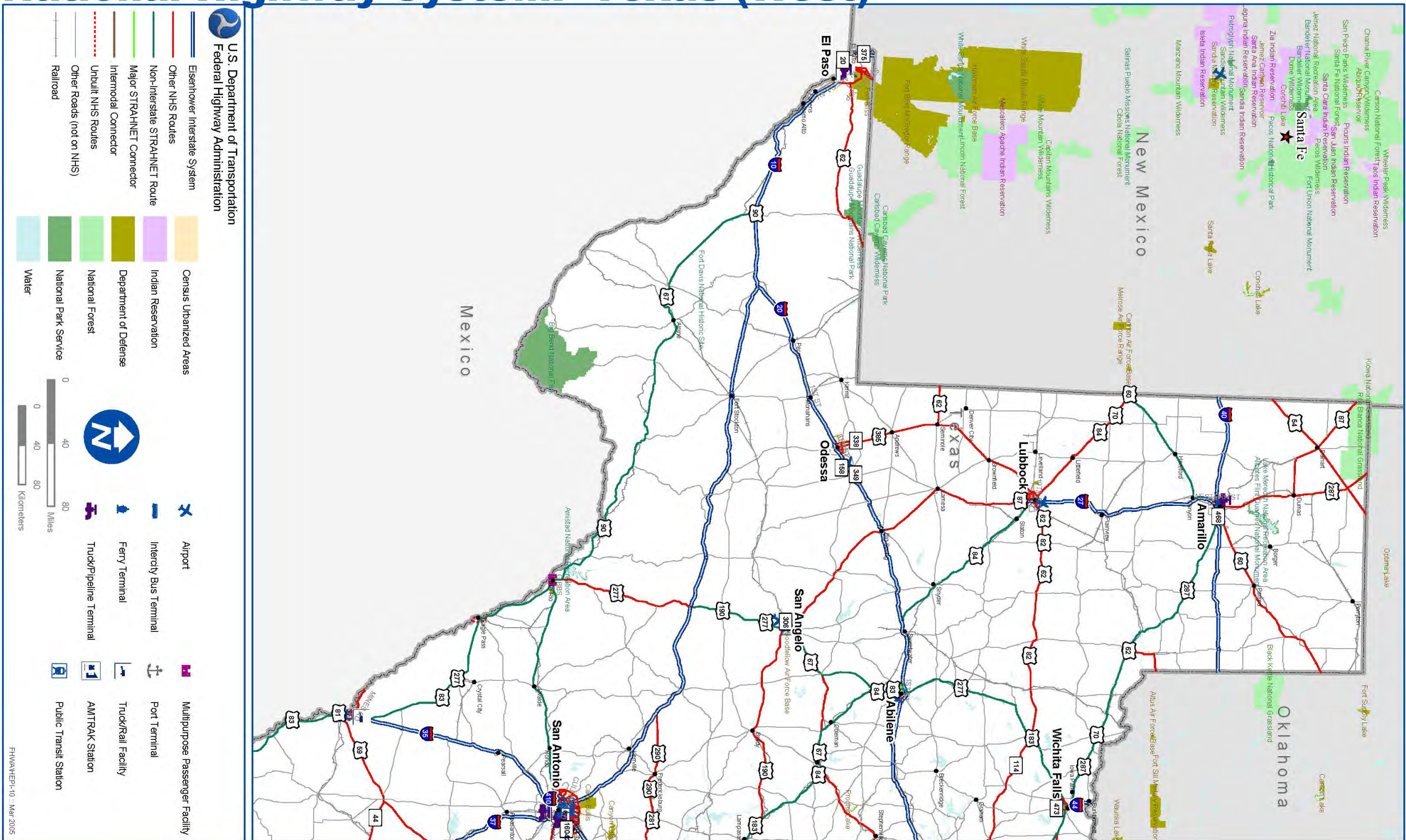
Figure 2 Map of National Highway System – Including STRAHNET Routes (West Texas) [FHWA 2005]

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Introduction

Based on a review of the information provided in Tables 4 – 7 it is apparent that Texas' maintenance budget and pavement network is significantly larger than other states which have implemented or are considering implementing a Multi-Tier Goal System. However, referring to Table 8, it is seen that actually, Texas ranks 9th among these states in terms of the maintenance dollars available per lane-mile. Florida and New York rank 1st and 2nd respectively and have per lane-mile budgets that are 3 times Texas' budget. Each of these states is therefore in a similar financial situation in terms of available funding compared to system size and the need to consider strategies to maintain pavement system conditions with a constrained budget. In this sense, all of these states are Texas peers.

Table 8 Available maintenance dollars per lane mile for MTG States (2008)

AVAILABLE DOLLARS PER LANE MILE ON THE STATE SYSTEM				
STATE	LANE MILES	MAINTENANCE EXPENDITURES (2008)	AVAILABLE DOLLARS PER LANE MILE	RANK
Florida	42,439	854,822,000	20,142	1
New York	38,142	762,793,000	19,999	2
Oregon	18,264	189,553,000	10,379	3
Minnesota	29,266	291,805,000	9,971	4
Illinois	42,150	383,896,000	9,108	5
Maine	18,115	158,397,000	8,744	6
Massachusetts	8,659	62,450,000	7,212	7
Idaho	12,137	87,068,000	7,174	8
Texas	193,188	1,300,886,000	6,734	9
Alabama	28,121	182,085,000	6,475	10
Utah	15,699	97,937,000	6,238	11
Kansas	23,988	137,594,000	5,736	12
Louisiana	38,501	197,794,000	5,137	13
Colorado	22,948	114,242,000	4,978	14
New Mexico	29,237	120,178,000	4,110	15
Iowa	23,036	93,353,000	4,052	16
North Carolina	170,084	623,815,000	3,668	17
Ohio	49,034	163,051,000	3,325	18
Mississippi	27,743	88,990,000	3,208	19
South Dakota	18,071	51,090,000	2,827	20
Montana	24,490	63,688,000	2,601	21
North Dakota	16,986	18,201,000	1,072	22

During the 2030 Committee Study which was completed in 2008, it was determined that although Texas had the largest M&R budget of all 50 states, it ranked 22nd in terms of M&R expenditures per lane mile based on 2006 data as shown in Table 9. [2030 Committee 2008] It is also apparent that the amount available per lane mile has decreased since the 2030 Study was conducted.

Table 9 M&R expenditures per lane mile ranking (2006 data)

State	2006 M&R Expenditures ($ Billions)	State Center-Line Miles	State Lane-Miles	Average Annual M&R Expenditure per Lane-Mile	M&R Expenditure National Rank
Texas	$1.82	79,489	191,530	$9,523	22
Pennsylvania	$1.32	39,843	88,293	$15,044	11
New York	$1.10	15,549	39,267	$27,907	3
Florida	$1.09	12,069	41,914	$25,999	5
Virginia	$1.06	57,481	124,383	$8,548	26
California	$0.82	15,234	50,594	$15,834	10
North Carolina*	$0.69	79,067	168,930	$4,096	45
Illinois	$0.52	16,083	41,990	$11,976	18
Ohio	$0.41	19,266	48,888	$8,484	27
Georgia	$0.21	17,910	47,192	$4,481	43

* Includes both paved and unpaved mileage

Comparing MTG Systems

The study conducted in 2008 by the CST M&P entitled 'Comparison of National Pavement Condition Performance Measures' showed that it is often difficult to make a 1:1 comparison of pavement system conditions between states due to the diversity in pavement condition rating systems. [TxDOT 2008]

Table 10 Comparison of DOT Ride measures and Qualitative Terms

TxDOT			FHWA	Alabama IH	Alabama non-IH	Minnesota
	PSI		IRI (in/mile)			RQI
Very Good	5.0	40	Good 94	Good 94	Good 94	4.1 - 5.0 Very Good
Very Good	4.5	60	Good 94	Good 94	Good 94	4.1 - 5.0 Very Good
Very Good	4.1	80	Good 94	Good 94	Good 94	4.1 - 5.0 Very Good
Very Good	4.0	84	Good 94	Good 94	Good 94	
Good	3.9	85	Good 94	Good 94	Good 94	3.1 - 4.0 Good
Good	3.8	94	Good 94	Good 94	Good 94	3.1 - 4.0 Good
Good	3.7	99	Acceptable 95 - 170	Fair 95 - 119	Fair 95 - 170	3.1 - 4.0 Good
Good	3.5	110	Acceptable 95 - 170	Fair 95 - 119	Fair 95 - 170	3.1 - 4.0 Good
Good	3.3	119	Acceptable 95 - 170	Fair 95 - 119	Fair 95 - 170	3.1 - 4.0 Good
Good	3.2	129	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	3.1 - 4.0 Good
Good	3.2	130	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	3.1 - 4.0 Good
Good	3.1	135	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	3.1 - 4.0 Good
Good	3.0	140	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	3.1 - 4.0 Good
Fair	2.9	145	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	2.1 - 3.0 Fair
Fair	2.6	170	Acceptable 95 - 170	Mediocre 120 - 170	Fair 95 - 170	2.1 - 3.0 Fair
Fair	2.5	177	Unacceptable > 170	Poor > 170	Mediocre 171 - 220	2.1 - 3.0 Fair
Fair	2.5	180	Unacceptable > 170	Poor > 170	Mediocre 171 - 220	2.1 - 3.0 Fair
Fair	2.2	201	Unacceptable > 170	Poor > 170	Mediocre 171 - 220	2.1 - 3.0 Fair
Fair	2.0	220	Unacceptable > 170	Poor > 170	Mediocre 171 - 220	2.1 - 3.0 Fair
Poor	1.9	226	Unacceptable > 170	Poor > 170	Poor > 220	1.1 - 2.0 Poor
Poor	1.5	270	Unacceptable > 170	Poor > 170	Poor > 220	1.1 - 2.0 Poor
Poor	1.0	330	Unacceptable > 170	Poor > 170	Poor > 220	1.1 - 2.0 Poor
Very Poor	0.5	390	Unacceptable > 170	Poor > 170	Poor > 220	0.0 - 1.0 Very Poor
Very Poor	0.0	450	Unacceptable > 170	Poor > 170	Poor > 220	0.0 - 1.0 Very Poor

In a few instances, differences in the definition of qualitative terms such as 'Fair' or better differ between Tier 1 and Tier 2 condition targets as is shown in Table 10 for Alabama's MTG system. This observation emphasizes the need for close evaluation of pavement measures, definitions, goal targets and qualitative terminology is necessary when making comparisons between MTG systems.

a. Condition is based on IRI. Interstate goal is 'Good' or better, non-Interstate is 'Fair' or better. However, definitions for 'Fair' 'Mediocre' and 'Poor' differ between Interstate and Non-Interstate. IH 'Fair' = 95-119; Non-IH 'Fair' = 95-170: IH 'Mediocre' = 120-170; Non-IH 'Mediocre' = 171-220: IH 'Poor' > 170; Non-IH 'Poor' > 220. (Alabama – 5 years)

b. We've had a 2-Tier system in place for 20-years and we are working on a new 4-Tier system which is not yet in place. We use the FHWA March 1989 Highway Functional Classification System to categorize our system. We have one Tier of standards for cracking index (CI) used for IH and Arterials and one Tier of standards for Collectors. IH and Arterials with a CI < 2.5 are deficient; Collectors with CI < 2.0 are deficient. The MTG system has helped improve pavement conditions. In 1993 we had a statewide pavement deficiency rating of 43%. Since implementation of MTG we have been as low as 15% deficient and hover around 20% - however, consider that the deficiency rating would be worse if all roadways were held to the same deficiency standard of Cracking Index = 2.5. (Idaho > 20 years)

To facilitate the review of the DOT Survey results for the purposes of this report, the focus will be to evaluate information and insights that can be gained from the experiences of other DOTs based on implementation and use of an MTG system. No effort will be made to evaluate or assess specific pavement condition measurement systems or qualitative assessments of pavement conditions.

Overview of State DOT MTG Systems

Based on the information in Table 3, there are similarities in the Multi-Tier Goal systems that have been implemented by the 20 State DOTs which completed the Survey. The majority of DOTs created Tiers based on route type or functional classification and in some cases also used speed limit, ADT percentile, and routes identified as heavy truck corridors for categorization purposes. The most common MTG system comprises 2 or 3 Tiers as follows:

Tier 1   Interstate Highways

Tier 2   non-IH NHS System

Tier 3   non-NHS routes

Tier 1 Interstate Highways

Many DOTs indicated that the Interstate Highway system is considered to be the most important transportation system in the state and that the DOT focuses resources on, and has established higher performance targets for the IH system. IH routes and those designed to IH standards are primary economic corridors which carry high ADT and heavy trucks. Current MTG systems do not differentiate between rural and urban IH route segments regarding ADT, truck traffic or other factors.

a. Utah indicated that due to funding constraints, the DOT is considering subdividing the Tier 1 IH system routes into high- and low-truck traffic portions. The low-truck traffic portion would receive no funding for the next two years and would receive only one treatment in the next ten years. This proposal has not yet been implemented and will require Commission approval. (Utah > 10 years)

b. Massachusetts recently raised the performance target from 80% 'Good' or better to 90% 'Good' or better and increased funding by $25 million for IH routes based on discussions with the FHWA. (Massachusetts)

c. Florida developed an MTG system to help maintain the Interstate system, which carries the largest percentage of the network's traffic and the Turnpike system which people pay to drive on at slightly higher condition levels (than the remaining system). (Florida - > 10 years)

d. Implementing an MTG system does focus money where the traffic is and the greatest benefits are…however, that doesn't mean that areas of the state with low traffic get no money. The difference is in terms of project scope; lower volume roadways will get less intensive treatments, like a seal coat, whereas higher volume routes may get an overlay. The cost difference is related to the type of work that is needed; it doesn't mean that lower volume routes get no money. (Kansas > 20 years)

e. The Interstate Rating Committee (IRC) has focused more funds on the IH system which has led to improved conditions - the condition is based on Statewide condition rather than allocating a certain amount of funds per district. (Mississippi – 10 years)

f. A higher performance standard was set for the Interstate System since it is the backbone of the Illinois economy. The DOT Administration made the decision in 2003 to switch to a 2-Tier system which established a goal of 100% Acceptable for IH routes; this was done without consulting the districts -- eventually, however, the districts realized that that a 100% 'Acceptable' or better goal for IH routes was unachievable due to declining funds and considering that the IH is the most expensive system to rehab or reconstruct. The districts advised the DOT Admin of their concerns. (Illinois)

North Carolina is considering implementing central management of the Interstate Highway system. Louisiana and Mississippi have already established Committees that address the Interstate on a statewide basis. Kansas had previously established a special fund to address Interstate Highways and saw an improvement in IH conditions once the MTG system was adopted. North Carolina and Illinois pointed out that although the IH system is a top priority, most of the 'feedback' from the public is related to the condition of the local roadway system. There is not much feedback on the Interstate since most traffic is 'passing through'. Both Illinois and Ohio also pointed out that initially setting the Goal at too high a level for the IH system resulted in accelerated deterioration of lower Tier routes.

a) North Carolina indicated that it's hard to allocate IH funds within a given Division (District) in an effective manner from a statewide basis when you're battling deterioration on your local system (NCDOT has 14 Divisions). For this reason, the DOT is considering developing a separate fund just for the IH which would be managed centrally. Projects selection would be based on best benefits to the State. This might mean that allocations to Divisions would vary in a given funding cycle - one year a Division might get 3 IH projects and another Division no IH projects. (North Carolina – 2 years)

b) Adopting an MTG system didn't really help pick projects more effectively since the Interstate and non-Interstate systems already had two goals and two pots of money. Implementing an MTG system did increase the importance of the IH system although efforts were already underway to improve the IH system even before the 2-Tier system was implemented. Having two goals increased the importance of the Interstate system condition and resulted in better performance. (Kansas > 20 years)

c) The MTG system did not necessarily help improve pavement conditions state wide. The off- IH system routes comprise a high percentage of the total lane miles - a special emphasis on the Interstate system without additional funds resulted in deterioration of non-IH pavements. The non-IH pavements are what the public focuses on; few citizens seem to care about the IH system unless it has to do with snow or ice removal. (Illinois)

d) We worked with one district that was putting their money into the non-principal arterial system but their approach was unbalanced. They were letting their principal arterial system slide to hold the non-principal routes together - we had to meet with them to discuss this strategy - frankly we have to let some non-principle routes deteriorate in order to keep the principal arterial system in acceptable condition. (Minnesota – 10 years)

e) We initially over-reacted and set the threshold too high on Interstates; this resulted in moving too much money from the General System and faster deterioration of the General System which is comprised primarily of 2-lane rural roads. It took the DOT about 7 years to figure out that the thresholds needed to be reset. (Ohio – 12 years)

Tier 2 non-IH NHS routes

It is noted that several DOTs have included Interstate routes in Tier 1 and non-IH NHS routes in Tier 2 with a lower performance target or lower percentage 'Good' or better or 'Fair' or better goal.

The systems that comprise the non-IH NHS system include:

- Other Principal Arterials that provide access between major port, airport or other transportation facility; (Tables 5 and 6; Figures 1 – 2)
- Strategic Highway Network (STRAHNET) routes which are important to US defense policy and provide defense access and emergency response capabilities. Note that STRAHNET includes both IH and non-IH routes (Table 7 and Figures 1 – 2);
- Major Strategic Highway Network Connectors which provide connections between military installations and STRAHNET routes;
- Intermodal Connectors which provide access between intermodal facilities and other NHS routes.

No special designations, targets, or goals have been established for specific components of the NHS system beyond Interstate Highways – in the majority of cases all non-IH NHS routes are combined in Tier 2. North Dakota has assigned lower volume NHS routes to Tiers 3 and 4 based on the intended function of the route. The only exception is Strategic Highway Network (STRAHNET) routes that are also Interstate Highways and therefore contained in Tier 1.

Tables 1 & 2 show the V1.11 and V1.13 decision tree criteria for each Tier. Tier 1 includes all NHS routes and does not differentiate between either high or low ADT, high or low truck traffic or speed limit, as is considered in Tiers 2 – 4. Based on a review of Texas non-IH NHS routes using FY 2009 PMIS data in MapZapper, it is apparent that Tier 1 includes considerable variation in terms of route type (US, SH, FMs and BRs), ADT, posted speed and % trucks. As an example, Tier 1 includes routes such as FM 157K in Ft. Worth with segments carrying greater than 50,000 ADT, 2,700 Truck ADT and a posted speed of 35 – 40 mph and segments of US 87L in the Lubbock District with 1,700 ADT, 500 Truck ADT and a posted speed of 55 mph.

Current System may already be operating according to Tiers.

1. **'All this being said, we generally agreed that barring any miracles in new revenue, the 90% good or better goal is not achievable and we appear to be on an unsustainable course of funding for preventative maintenance goals. One note is that we indirectly have a tier system in place currently. In an overview of PMIS data statewide indicates the interstate system is rated the highest followed by US Highways, State Highways and FM roadways. It is based on roadway classification. So, it may not be an extreme departure to formally designate a Tier system of evaluation. (Page 17)**

Kansas and Minnesota have found that although they use a 2-Tier System, districts have implemented 'tiered' pavement treatment selection processes that are related to route type, functional class, and ADT levels.

a) The 2-Tier System includes Principal Arterials with 70% Good or better / 2% Poor or Very Poor and Non-principal Arterials with 65% Good or better and 3% Poor or Very Poor. This has resulted in a lot of stratification in the Non-principal arterial tier with 500 ADT collectors grouped with 20,000 ADT routes. Districts use non-formalized criteria to further stratify within Tiers based on ADT and other factors. (Minnesota 10 years)

b) Even though additional Tiers have not been implemented, the conditions of Interstate and non-interstate routes follow a 5-Tier stratification when considering route class and traffic hierarchy. This shows that the DOT is proportionally doing the same amount of work on each class of highway but the dollars spent and actions applied (design thickness / surface treatment) is Tiered. Insights of this type led to incorporating functional class in the current PMS to track route conditions, but not actually implementing a 5-Tier System. (Kansas > 20 years)

Figure 3 shows that Kansas route conditions and expenditures follow a 5-Tier stratification although they have implemented a 2-Tier MTG system.
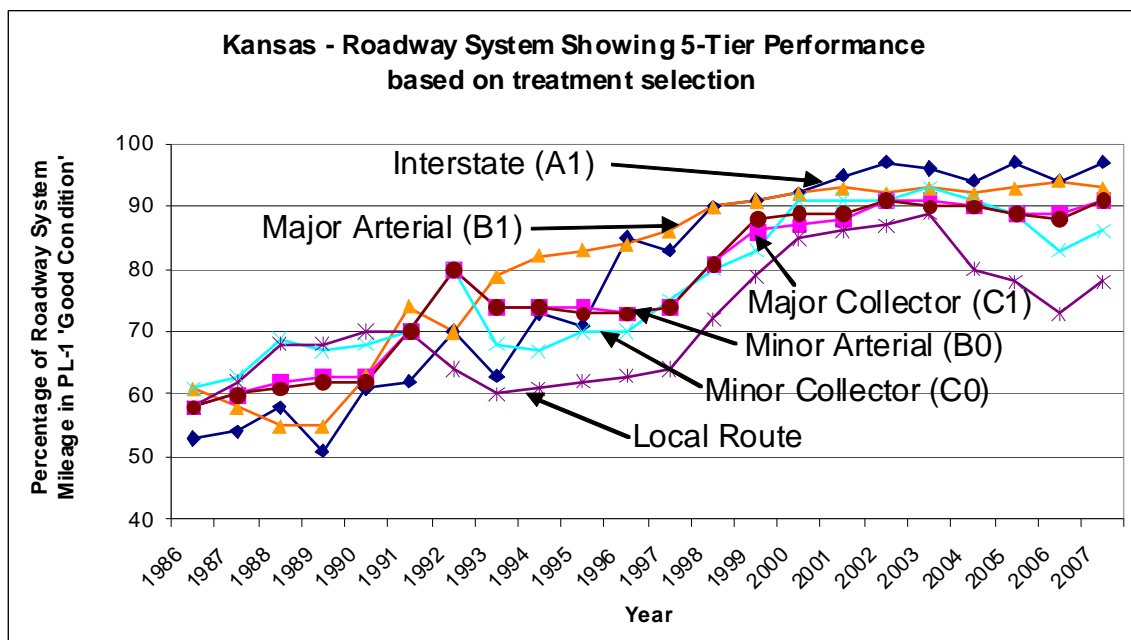
Figure 3 Kansas Roadway System showing 5-Tier performance due to treatment selection processes related to route type

Issues and Concerns

The following Issues and Concerns were identified by the PMC and District Engineers and were first documented in Report #1. Comments from the DOT surveys are listed after each Issue with additional comments from the authors where applicable.

Concerns about Routes with high ADT but low Truck ADT

2. 'Roadways with high ADT but not high truck traffic ADT should be considered for tiers higher than Tier 3.' (Report #1 Page 8)

3. 'Higher ADT Roads that may not be carrying High Truck volumes (700 Truck ADT) need to be considered on an individual basis for higher than Tier 3. Example is a controlled access facility in this Region that has 30,000 ADT but low truck traffic but is a main thorough fair for commuting traffic.' (pages 8 and 15)

MTG Version 1.11 and 1.13 include routes with ≥ 10,000 ADT in Tier 2. A few DOTs indicated that some 'high' ADT routes have been assigned to the wrong Tier based on incorrect functional classification designations or perceived differences between the route's function and route designation. Additional guidance has been issued to assist Districts in considering traffic level and other factors when making project selections rather than applying funds according to Tier goals alone.

a) One of our District Engineers has complained that they have a number of routes that carry high traffic volumes, but are not high priorities since they are included in the Region/District Tier. The MPO in that district has indicated that the DOT should use a VMT based system to classify roads, but this would virtually eliminate all funding to rural districts. (Oregon > 10 years)

b) There are a number of higher volume State secondary routes that carry more traffic than arterials which are not being funded - there is some inconsistency between assigned functional class categories and people's perception of a road's use and route importance to the State. (South Dakota – 3 years)

c) Under the current MTG system, we have State Highways that stay deficient at a Cracking Index (CI) = 2.4 because they have a functional class of Arterial but carry low truck traffic and are posted at a low speed limit. A seal coat would be adequate to seal cracks and provide some improvement in roughness, but it does not improve the CI of the roadway - therefore the roadway remains deficient until the deeper distresses are addressed. Since the roadway has low truck traffic and speed, it likely will

not be programmed for rehab so it remains deficient and lowers the Statewide Score. (Idaho - > 20 years)

Low ADT routes with local economic or military significance

4. 'Roadways with low ADT but having special significance (such as connections to military installations) or special requirements (such as roadways to egg farms) should be considered in a special tier. (Page 8)

    a. In the past we focused on functional class but we found that there is not a 1:1 correlation between functional class and the economic importance of a route. Our MTG system considers functional class, but is more based on economic regions of the state and economic corridors. (Maine)

    b. Truck traffic is increasing on some low volume roads due to grain shipments for ethanol production - this is resulting in pavement deterioration in the immediate area. However, since these are generally low ADT routes, they are not being identified as a priority for inclusion in the STIP. (South Dakota – 3 years)

As previously indicated, the NHS includes STRAHNET and Major Strategic Highway Network Connector routes which specifically serve military installations and provide mobility for defense purposes. All of these routes are contained in V1.11 and V1.13 Tier 1.

    a. Projects are currently selected in each funding category which have the highest benefit / cost ratio. Benefit is defined as the additional pavement performance provided by the treatment multiplied by a traffic factor. Other factors such as Safety, geometrics or highway economic importance are not currently included in the assessment although these are planned for the future. (South Dakota – 3 years)

    b. Opinions vary regarding what level of investment should be made on low volume roads across the state. High ADT roads are a higher priority for funding; however some portion of the available funding should be allocated to the low volume network to maintain some minimum level of conditions or performance targets. (South Dakota – 3 years)

    c. Maine DOT conducted an analysis of the state economy and transportation system which involved public meetings and discussions with the trucking industry. As a result Maine's MTG system is focused on how the transportation system supports 6 economic regions of the state – the study considered that Maine is primarily rural and does not have a large urban center. Maine uses economic regions, traffic levels,

and route type to establish Tiers. Tier 1 comprises IH routes and non-IH routes within each of 5 districts which carry ≥ 80th percentile ADT. Tier 2 comprises non-IH NHS routes in each district which carry ≥ 60th percentile ADT. Tier 3 comprises heavy truck corridors and high traffic routes not included in Tiers 1 and 2. Tier 4 includes all other state routes not contained in the other Tiers. The heavy truck corridors were identified during meetings with the trucking industry and were not selected on the basis of DOT truck counts alone. Based on a recent discussion with the State Pavement Management engineer, modifications to the Tier criteria are still underway. (Maine – MTG under development)

Maine has developed an MTG system which considers the economic importance of routes in 6 regions of the state. Thus, routes that have local economic significance are considered for inclusion in one of four Tiers based on ADT, truck traffic and economic importance. South Dakota is currently planning to include the economic importance of a route in their project selection process.

Safety Considerations

5. **'What will be the Impact on safety when the goal for pavement condition is set at a very low value? As a road gets a lot rougher, vehicles will have to slow down some, but the current rate of vehicle accidents on rural roads is higher. Add the future rougher roads to the higher speeds some will drive anyway plus the higher accident rate and you start getting more killed on Tier 3 roads.' (Pages 10 & 16).**

6. **'Some of the identified issues are safety related to poor quality roads due to allowable moderate to severe rutting on Tier 3 roads causing loss of control, hydroplaning and reduced braking efficiency. The biggest concern is allowing roads to further deteriorate costing more money later to rehabilitate, if we can ever afford it. At least 3 of the department's goals are violated in rural areas with the proposal and 4 of 5 of the goals in suburban and urban areas.' (Page 16).**

Several states responded to the issue of pavement condition and safety considerations. None of these states have determined that implementing a Multi-Tier Goal system had an impact on safety or accidents.

a. We do not agree with the perception that lower functional class roads are less safe than higher functional class roads. Lower class roads receive improvements based on a different rate of deterioration and the improvement may be less expensive than for a higher class roadway; but the work is done according to DOT safety requirements. For example, a seal coat may be done on a lower class road while a higher class road gets a mill and inlay. Both improve friction condition, but the seal coat will be less costly. (Idaho > 20 years)

b. Implementation of an MTG system did not result in any specific safety concerns; actually our fatality rates have been declining so safety was never an issue. (Illinois)

c. There are no Safety impacts due to funding reallocations that we are aware of. Every district is allocated funds specifically for safety issues. (Idaho > 20 years)

d. Regarding Safety and pavement conditions - we would respond that we are putting our money where the greatest exposure is - the highest traffic levels; which is defendable. However, with regard to evaluating variables that are [location specific] we leave decisions about the type of treatments to apply at the local level ---- decisions about safety treatments are not made at the administrative or statewide level. (Kansas - > 20 years)

e. We use the Pavement Condition Rating system to determine conditions of our roads --- the phone starts ringing when PCR drops to about 1.8 - 2.0; we don't anticipate safety concerns when the MTG is implemented. The public knows what to expect (in terms of condition) for a given corridor. (Maine – MTG system under development)

f. Regarding safety, we haven't tried to look at the relationship between pavement condition and accidents. We have a separate program that considers accidents and causes. (Ohio – 12 years)

Two news releases from Minnesota State Senators indicated concern over shifting funds from rural to urban districts and possible impacts on safety. However, the Minnesota DOT made no comments regarding impacts of the MTG system on safety or accident rates.

a) News release from Minnesota Senator Gary Kubly denouncing the fact that MnDOT shifted money from rural to urban districts - notes that shifting money put safety improvements for rural roads on hold in order to make the ledger books look right. (Minnesota – 10 years)

b) News release from Senator Jim Vickerman denouncing the fact that MnDOT shifted money from rural to urban districts - notes that shifting money put safety improvements for rural roads including Hwy 60 in a holding pattern - referred to this as not a Republican or a Democrat issue but a "fairness issue." (Minnesota – 10 years)

Setting Goals at 'Fair' or better Conditions

7. 'Current Goals are all based on "good" or better condition. Do we set some Tiers at 'Fair' or better or even based on distress instead of condition? (page 8)

8. **'Consider percent of 'Fair' for Tier 3 rather than percent 'Good' or better? Include a percent 'Good' or better and a percent 'Fair'. (pages 10 & 16 – This Issue combined with Safety Issue on Page 16)**

9. **I like % fair for Tier 3 roads instead of good. Lower, more even standards as opposed to extremes of good vs. poor. (Page 17)**

10. **We feel that we are pushing Tier 3 roads shown in Scenarios 4A and 4B too low, down to near 25% Good or Better. Perhaps Tier 1 should be 70% "Good" or better, OR 80% "Fair" and this could raise Tier 3 up some. As we all have discussed, maybe we should consider only two Tier levels for the state. (Page 13)**

   a. The threshold for the General System was raised from Pavement Condition Rating (PCR) > 55 to PCR > 60 - The goal for each system is 90% 'Fair' or better which also relates to a 10% 'Poor' or very poor goal. The targets for the Priority Network are > 65 PCR and > 60 PCR on the Urban Network. (Ohio – 12 years)

   b. Condition is based on IRI. Interstate goal is 'Good' or better, non-Interstate is 'Fair' or better. However, definitions for 'Fair' 'Mediocre' and 'Poor' differ between Interstate and Non-Interstate. IH 'Fair' = 95-119; Non-IH 'Fair' = 95-170: IH 'Mediocre' = 120-170; Non-IH 'Mediocre' = 171-220: IH 'Poor' > 170; Non-IH 'Poor' > 220. (Alabama – 5 years)

Ohio DOT has established a 90% 'Fair' or better for each system with different performance targets for each. As is stated, establishing a 'Fair' or better Goal also, by default, establishes a 'Poor or very Poor' goal. Thus, 80% 'Fair' or better for Tier 1 would also establish a 20% 'Poor or Very Poor' Goal for Tier 1. Alabama established a 'Good' or better goal for the Interstate System and a 'Fair' or better Goal for the non-Interstate routes. However, as mentioned previously, the definition of 'Good' and 'Fair' is not the same for Interstates and non-Interstate routes which could result in a two-fold difference in Tier 1 and Tier 2 pavement conditions.

Tying Goals to Funding

11. **'I believe our Goal has to be tied to funding and that a tier system of management is probably the correct method for the situation. I would hope that the tier 3 pavements would be able to have enough minimum goal that they can remain reasonably safe and that they will not be "lost completely' so that they can hopefully be improved without a complete rebuild if resources become available and which would allow a raising of the goal. As far as really liking such a drastic reduction in goals, I do not; however, we can accomplish no more than resources and best practices allow. (Pages 10 & 16).**

a. An MTG system has been implemented, but funding is not tiered and project selection is not weighted toward Tiers with higher goals. (Colorado – 16 years)

b. Implementing an MTG system did impact funding allocations - rural areas with more lower class highways received less funding on a per mile basis. (Oregon - > 10 years)

c. Funding allocations are according to Tiers or Categories, not by Region. (South Dakota – 3 years)

d. The MTG System was developed to assist in determining funding needs and developing logical funding splits for various funding categories to maintain minimum conditions and goals. (South Dakota – 3 years)

e. Our rural districts do a good job with less money - there are some exceptions as mentioned, but rural district conditions are in balance with urban districts. (Ohio – 12 years)

Several DOTs indicated that implementation of an MTG system with funding tied to Tiers did result in lower funding for rural routes. Although some states indicated that lower funding led to worsening conditions for lower Tier routes, this does not occur in every case. Ohio and Montana pointed out that lower funding for rural routes meant that Districts were challenged to develop treatment strategies to address the types of traffic and local conditions associated with low volume roads.

12. **'Establish a minimum amount of funding for a District? Absolutely, yes. If not some rural districts would get almost nothing.' (Page 16).**

Several states indicated that funding equity is considered in the pavement funding allocation formula. One state was direct in stating that when their MTG system was first implemented, funding allocations were based on meeting goals in light of statewide needs and pavement preservation practices. There were no constraints placed on the funding formula to ensure that districts received a specific amount of money – this first iteration of the MTG system led to improvement of statewide pavement conditions for 5 years. However, the issue of equity in funding was introduced and incorporated in the 2nd iteration of the MTG system and the funding allocation formula – this led to constraints on the project selection process that prevented an optimum combination of projects to continue improving statewide pavement conditions. During the 2nd iteration of the MTG system, statewide pavement conditions leveled out. The 3rd iteration of the MTG system devolved into funding allocation and project selection based on local public and political interests. Pavement conditions have since declined.

a. The MTG system has more to do with how a Division (District) uses funds rather than how funds are allocated to Divisions. As mentioned the Funding allocation formula considers Equity among Divisions. (North Carolina – 2 years)

b. We have a Capital Project Selection process that also addresses regional equity when selecting projects. This process specifically addresses heavy rehab projects; traffic is taken into account, but the traffic weighting factor is an 'S' curve so that above a certain level increases in traffic don't continue to accrue benefit. Regional location is also considered to ensure equity in project selection and regional funding distribution. (Kansas > 20 years)

States have pointed out that district and statewide pavement condition is also affected by the use of pavement funds for non-pavement related activities.

a. The problem with a decentralized system comes down to the fact that part of the funding allocation formula is pavement condition - so districts with poor condition get more money; however there are no guidelines or restrictions on how the money is spent. A district may get a 30% increase in funds because of poor pavement conditions but may elect to use the money on a widening project, to build a new bridge or to straighten out curves (Safety); or other project that the District or their local legislator and constituency thinks is a higher priority. This causes problems between districts because districts who are doing a good job managing the system and putting the money on the pavement know that these other districts are building projects that don't address pavements but they still receive the money. We can differentiate between districts that have poor conditions due to lack of funds and those that have poor pavements due to lack of good management - we track how much money a district gets over time and how their pavement conditions change.

b. The MTG system was implemented to help us understand the condition of each component of our network and to help in allocating funds to districts which had the worst conditions. Although the idea was to use the MTG system to help us allocate funds, this is one of the weaknesses of our organizational structure - we are decentralized and how money is spent to address a problem is made by the district ---- it is not managed centrally.

c. We do have problems with regions using pavement funds for non-pavement projects. For example a Region may decide to use all of its allocation to do big bridges for two or three years; then switch over and use all of its money to do pavement work and let all of their small bridges go untreated for two or three years. There are also local public and political factors that affect these decisions.

13. **'Every district has to have a good PM program. Based on the need for PM, it would probably be wise to establish a minimum amount of funding for each district. Rehab funding could then be based on distress scores.' (Pages 14 & 18)**

Several DOTs indicated that implementation of an MTG system helped pavement managers focus on and understand the different components of the network and lead to improved pavement management practices. Utah indicated that improved management practices lead to legislative approval of a highway funding increase.

Other DOTs pointed out that implementing an MTG system and related pavement preservation practices moved them from a 'worst first' organization to an organization that considered a 'mix of fixes' that were in line with the system needs.

a. Implementation of MTG did impact funding allocations - districts that primarily manage General System roads got less money. This meant that they had to craft treatments to address their roadways and needs - these needs will be different than for urban areas or the Interstate. (Ohio – 12 years)

b. We first implemented Multi-Tier Goals based on a report 'Good Roads Cost Less' which showed that allowing roads to deteriorate costs more money in the end - this report was updated a few years ago by Deighton Associates. This report was very helpful to the DOT in obtaining additional funds to keep our roads in good condition. The MTG System and the concept that good roads cost less to maintain is supported by DOT management and the Commission - there is also buy-in by the Legislature. (Utah – 10 years)

c. Other factors that helped implementation of the MTG system: 1) the head of our DOT at that time was a major champion of pavement preservation; he understood it and took steps to develop a designated Pavement Preservation fund. 2) We developed a memorandum of understanding with the FHWA regarding use of Pavement Preservation Practices in selecting projects and choosing treatments. This helped move us from a 'worst first' to a 'mix of fixes' organization. (Montana – 10 years)

d. Another main reason for implementing MTG was the local funding crunch on top of a National recession. However, the MTG was also implemented to help local engineers and maintenance people focus more attention on higher type facilities. It's easy to fall into the mode where you are mainly treating local roadways since this is where you'll receive most citizen complaints. (North Carolina – 2 years)

e. Funding constraints and the realization that a 'worst first' approach was being used to select projects led to the development of the MTG system. The MTG system was developed to support selecting the right projects to perform at the right time to preserve the system - it was realized that not all roads needed to perform at the same level. (North Dakota – 7 years)

However, DOTs still needed to address concerns among regional managers and maintenance workers who were not accustomed to allowing lower Tier routes deteriorate so that funds could be made available for higher Tier routes.

a. Some of our maintenance workers don't understand why they have to let roads deteriorate - they realize that it will cost more to bring the road back up to standard. But if we are talking about a low volume route, we have to face these kinds of decisions because [these funds are needed] for higher priority statewide and freight routes. (Oregon - > 10 years)

b. The Regional Maintenance managers do not like the new MTG system although the DOT Administration has given buy in. They don't like the idea that they won't be able to maintain certain roads at the same level as they have in the past - they won't have the same flexibility to put money where they want to which means they will need to spend it on some roads and let others decline. There is Regional competition and Regional Managers are concerned that their system condition is changing.

DOTs also pointed out that funding allocation also considered factors such as poor local material sources and a desire to maintain contractor competitiveness in all regions of the state.

a. Some districts have poor material sources and this shows up in their pavement conditions and deterioration rates - one district in particular has bad gravel - they need to look at whether they are going to continue placing band aid fixes or whether they are going to tackle this problem and develop treatments that work - we have set up a budget account marked for problem areas like this. (Ohio – 12 years)

b. There is a desire to allocate funding across the state to ensure that contractors remain viable in all regions.

c. Adopting an MTG system didn't really help pick projects more effectively since the Interstate and non-Interstate systems already had two goals and two pots of money. Even if we adopted the 5 Tier system, likely the projects selected would not be different. The main difference is the project work that is conducted - that is, the scope of the response. The type of work that is conducted is already happening according to a 5-Tier system. (Kansas > 20 years)

Are the Legislature, Commission, Administration, Districts, and Public ready for MTG System?

14. '**Since moving from a single-tier system to multi-tier system is a shift of the resource allocation philosophy from the traditional lane-mile based approach to a utilization based approach, are the Legislature, the Commission and the Administration, the Districts and the general public ready for such a shift?' (Page 7)**

a. The statewide pavement deficiency percentage is one of the most scrutinized statistics provided by the DOT to the Legislature. (Idaho – 20 years)

b. Reporting pavement conditions using the MTG system is now mandated by the State Legislature, the Transportation Commission, the Legislative Finance Committee and the Department of Finance and Administration. (New Mexico - > 20 years)

c. The legislature has been very positive in endorsing the MTG and route classification system. (North Dakota – 7 years)

d. We don't' get much feedback from the Legislature - most feedback comes from MPOs. (Ohio – 12 years)

e. The DOT needs more revenue; however, DOT leadership must demonstrate and re-gain credibility before asking for a gas tax increase. A 19 cent increase proposal failed in 2008. (Massachusetts)

f. When we first implemented an MTG system we set the 72 'Good' or better and / 5% 'Poor and Very Poor – not to exceed' goals and learned a lot about how the goals compared to actual conditions at the regional and state wide levels. In preparation for the 2nd Highway Program we approached the Public and asked what their expectations were on IH versus non-IH routes. The public expected IH routes and routes built to IH standards to be smoother than other routes. Based on this we set different goals for these higher type routes. (Kansas - > 20 years)

15. **'When I presented to our supervisors I tied it in with the Kansas DOT Road Rallies attempting to obtain public opinion on what is acceptable and not acceptable. In Texas I am unaware of previous attempts to obtain public opinion on acceptability standards for various classifications of roadways to validate our decisions for improvements. Road Rallies are one way to qualify data to validate that we are doing what Texans find acceptable. The bad part, as I see it, is it will take years to gather a statistically valid sampling of data to make any firm decisions that could affect our policies. Kansas DOT has been doing this for around 10 years.' (Pages 10 & 17)**

a. We got feedback from both the Legislature and the public during the period when the 2-Tier System was in use, but I can't say that is was strictly due to the 2-Tier system. We were also dealing with financial constraints which caused concerns in the DOT, Legislature and with the public....that makes the water a little muddy regarding impacts of the MTG system on public opinion. (Illinois)

b. The Transportation Commission reviewed and approved the MTG Goals. The DOT Administration - especially the Chief Engineer (retired now) was totally invested in the concept of performance management and the MTG system. The Chief Engineer did a great job marketing the MTG idea to the State Legislature and the Public at citizen group meetings. DOT Technical staff was definitely involved in developing the MTG system. NCDOT county maintenance engineers were involved as was the FHWA. (North Carolina – 2 years)

c. The Legislature mandated that a system be implemented, but did not specify the type of system or what the goals should be. The DOT Administration, Technical Staff developed the goals; the MPOs, Counties, Municipalities and Industry vetted our goals. FHWA advised on our goals but weren't actively involved in setting goals. Universities were involved in evaluating our goals - weren't involved in setting the goals. (Ohio – 12 years)

DOT interaction with the Public regarding MTG Goals

a. Unexpectedly the public actually recommended lowering the classification of some roadways listed in the State Highway Classification System and indicated that they didn't need to perform at the level indicated. (North Dakota – 6 years)

b. We get feedback from the Public when a roadway treatment deteriorates faster than expected. We have gotten some feedback from the Public on our Goals. (Ohio – 12 years)

c. We thought that the Public might react negatively if we used numbers instead of categories for our upper goals. For example, if the average condition of the IH system was 68 that would be 'Desirable' based on our rating system, but the public tends to think about numbers in terms of the grading system in school since that is what they are most familiar with so a 68 would sound like the IH system got a 'D'. (Montana – 10 years)

d. Another issue regarding setting goals is the Public has a difficult time relating to what 90% 'Good' or better means on a statewide basis. We used Road Rallies to take people out on roadways of different types and asked questions to get feedback from the Public about their expectations.....you've got to come at the question from a different angle to get good, useful feedback. We set up roadway circuits in 4 to 6 areas of the state and provided the public with rating sheets which listed various items to be rated on a scale from 1 to 5. The scale related to the Public's perception if the DOT was maintaining a specific item above, below, or at the right level for the type of roadway.

A '3' meant that the DOT was maintaining the item (say mowing) at the right level, '4' or '5' was above expectations and '2' or '1' was below expectations. We asked them to rate roadway conditions, shoulder type and width, striping, ride, signing etc. (Kansas > 20 years)

e. We used a professional company to help us manage Public meetings [to obtain input on proposed Goals] - there has been a significant effort to bring the Public into this process. (Maine – MTG system under development)

f. There is a Legislative body that addresses transportation needs in the state (we don't have a Commission); they have been involved in the MTG development effort. The DOT Administration, Technical staff, the Public and the Trucking Industry have been involved as well as the FHWA. (Maine – MTG system under development)

g. The concept of project scope is also tied back to Public expectations…the Public doesn't expect the same level of performance on a low volume rural road as on an Interstate Highway…therefore the scope of work and the types of treatments you'd consider are different for these two systems. The funding levels are derived from the scopes of work and projects that are considered. (Kansas > 20 years)

h. Regions (Districts) and the Public prefer reconstruction projects compared to resurfacing projects due to the long intervals between subsequent treatments. The tendency therefore is for the region to increase the scope of a project to include geometric realignment and other concerns once a project is programmed. However, less money will be available for reconstruction in the future. (South Dakota – 2 years)

i. The DOT is decentralized regarding how funds are handled by the Districts. We did get some negative feedback from the districts when the MTG system was implemented since some districts had their allocation reduced. We set our goals based on analysis of historical performance and market research to find out what was acceptable to the Public. (Minnesota – 10 years)

j. The Legislature endorsed the HPCS (MTG) concept in 2005. The DOT Administration was involved in development and strategic direction; DOT Technical staff was involved in development. The Public was involved in numerous meetings around the state; Dept. of Commerce - Tribes; Counties, Municipalities; MPOs; Agriculture industry were involved at the Public meetings. FHWA reviewed the draft HPCS MTG system and supported. (North Dakota – 6 years)

k. We have had numerous public meetings to obtain feedback from citizens on expectations about conditions on key routes in our State. We have also met with the trucking industry to determine which routes they think are important to maintain as primary freight routes - we want to keep these routes in satisfactory condition. We develop reports and conduct corridor analysis to determine which routes are most important to the State's economy. (Maine – MTG under development)

Does the current 'Single-Tier' system meet TxDOT pavement management needs?

16. Is such a shift [to a Tiered System] even necessary? (Page 7)

a. The MTG system did definitely help improve pavement conditions when it was first implemented; however, in later versions of the MTG system, there has not been an impact. (Montana – 10 years)

b. The goal sometimes is to maintain conditions or balance conditions of pavements with other assets such as bridges or conditions such as safety or mobility. (New York)

c. Due to funding constraints the best I can say is that the MTG system has helped hold the line - otherwise we'd be seeing a decline in conditions. (North Carolina – 2 years)

d. Statewide conditions have improved since MTG system was implemented - however it took awhile before our districts began looking at statewide conditions in addition to their own district. (Ohio – 12 years)

e. The MTG system has not necessarily helped improve pavement conditions - but it has help manage the decline in condition in light of constrained budgets. (Oregon - > 10 years)

f. All project funding decisions are made on a statewide basis - pavement conditions are not compared between districts. It is too early to tell if statewide pavement conditions have improved due to implementation of MTG system. (South Dakota – 3 years)

g. Prior to the loss in funding and higher construction costs the MTG system was helping improve overall pavement conditions statewide. However, some regions experienced a decline in conditions while others experienced an increase. (Utah – 10 years)

h. We aimed for a statewide deficiency rating of 15% and achieved this goal in 2001. (Idaho - > 20 years)

i.   The MTG goals were not achievable in the short term due to declining revenues. (Illinois)

j.   The DOT has subdivided the state into 7 rural and 1 Metro Area Transportation Partnerships (ATP). Of these 8 ATPs ATPs 2 and 3 met or nearly met all of their performance targets in 2009 ATP 4 met only the Principal Arterial RQI > 70% target and ATP 8 met the Non-PA < 2% Poor Target. All other targets were not achieved, in some cases by a large margin. (Minnesota – 10 years)

k.   Based on the DOT 2009 Pavement Condition Report, 96% of our State's four major systems was in Fair or better condition. (Montana – 10 years)

l.   We've only had the goals in place 2 years so it's hard to tell whether they will be achievable especially due to the funding crunch - we are holding the line right now. (North Carolina – 2 years)

m.   We have not been able to meet all of the HPCS (MTG) system goals. We have met certain IRI goals, but we are still in the process of refining the Goal requirements. We plan to have more Public meetings this summer to gauge Public response to these proposed changes and how close we are meeting their expectations. (North Dakota – 6 years)

n.   There are regional differences in condition – it's hard to achieve the same Multi-tier Goal across all regions with limited funds. For example, imagine an urban district with 90 miles of Interstate and 10 miles of local routes compared to a rural district with 10 miles of Interstate and 90 miles of local routes. They are going to have different condition targets. (Oregon - > 10 years)

o.   There is a perception that level of maintenance is not consistent across the state. There is more emphasis on pavement resurfacing and reconstruction than preventive maintenance. (South Dakota – 3 years)

Establishing Lower Goal Bounds

17. **'Should the lower goal be set at 1, 3, and 5 percent for Tier 1, Tier 2, and Tier 3, respectively or should they be 3, 5, and 7 percent instead? Please note that every one percent increase in the lower goal adds $390 to $780 million of eventual reconstruction costs to the statewide pavement needs estimate.'**

a.   Our first MTG system divided the network into 3 Tiers: Principal Arterials - 70% 'Good' or better / 2% 'Poor or Very Poor'; Minor Arterials 65% 'Good' or better / 3% 'Poor or Very Poor'; and Collectors 50% 'Good' or better and 5% 'Poor or Very Poor'. However, after tracking how districts were applying funds we saw that some districts

with low lane miles in the Collector Tier could meet the goal with only one or two projects - while other districts had to spend a large portion of their allocation in the Collector Tier. This led to a 2-Tier System. (Minnesota – 10 years)

b. Previously we only set lower level goals to achieve less than a certain percentage of 'Poor and Very Poor' pavements in each Region; but this led to a 'worst first' approach to treating pavements - we found that you get what you measure….[or get results in relation to the goals or guidance you set.] (New York)

c. The upper level goal has been achievable however the lower level goal has not been met on our non-IH arterials or the primary system. Due to reduced revenues and the change in how our system is managed, conditions are starting to decline. (Montana – 10 years)

d. Initially we had a 3-Tier System IH, Non-IH NHS and primary highway system - each had an upper and lower goal. We didn't want to use actual numbers for the upper bound goals due to potential negative public feedback. We used: 'Superior' 80-100, 'Desirable' 60-79, 'Undesirable' 40-59 and 'Unsatisfactory' 1 - 39. We set our targets as IH Average IRI 'Desirable' or 'Superior' with < 5% 'Undesirable' or lower. Non-IH NHS Average IRI = 'Desirable' or 'Superior' with less than 5% 'Undesirable' or lower and Primary highway Average IRI = 'Desirable' or 'Superior' with less than 5% 'Undesirable' or lower. (Montana – 10 years)

18. **'For What it's worth, PMIS uses both approaches in its optimization program. "Benefit" is simply the expected gain in condition over time. "Cost" is the treatment cost annualized over the expected life of the treatment. The "benefit-cost" ratio is adjusted for mileage (lane miles) and utilization (log VMT) to produce a final "Cost Effectiveness Ratio" used for ranking projects. (Page 14)**

a. The current condition of the DOT network provides pavement managers with multiple options on all type of categories, with limited funds the projects that provide best return on investment are picked - however, this is often more political than model based. (Colorado – 16 years)

b. The MTG system hasn't really helped managers pick projects more effectively, the system just results in the IH and Turnpike systems being resurfaced more often. (Florida - > 10 years)

c. The current 2-Tiered system does help pavement managers pick projects for programming due to deficiencies; however, there are a number of other factors considered including congestion needs, bridge

needs, expansion etc. Pavement deficiency is not the only factor considered when programming a project. (Idaho > 20 years)

d. The MTG system did help improve project selection since we were focused on projects rather than filling up a funding allocation. Also the MTG system provided for better consistency statewide and improved executive decision making. (Illinois)

e. We anticipate that the 3-fold method that includes PMS models, data on system conditions and evaluation of data and model results by experienced engineers will help us spend funds more effectively to support maintaining economic viability. (Maine – MTG system under development)

f. Project selection includes factors such as Traffic (ADT); project scope; Benefit/Cost ratio; Funding equity across districts --- to an extent; if multiple projects are indicated along the same route in a given district, these would be staged so that funding would be allocated more equitably between districts. Funding necessary to maintain statewide conditions is determined at the network level --- this is seen as a separate function than actually selecting projects. (Massachusetts)

g. The MTG system itself didn't help managers pick projects - it was the project selection process which was more affected by the agreement we had with FHWA. (Montana – 10 years)

h. The MTG system impacts how projects are selected, but local managers are under pressure to pick projects due to "factors that are hard to model" [such as local political pressure]. (New York)

i. The MTG system has helped districts pick projects more effectively - they know that bad decisions will become apparent as we track conditions over time. The MTG system has helped people become more accountable for their decisions. (Ohio – 12 years)

j. MTG Goals have helped steer the DOT to pick projects on higher priority routes which benefits all state residents and are also routes where most of the freight is carried. (Oregon - > 10 years)

k. The MTG system did not help in selecting projects but does help better explain how / why funding splits are made to each funding category. (South Dakota – 3 years)

l. Projects are currently selected in each funding category which have the highest benefit / cost ratio. Benefit is defined as the additional pavement performance provided by the treatment multiplied by a traffic factor. Other factors such as Safety, geometrics or highway economic importance are currently not included in the assessment although these are planned for the future. (South Dakota – 3 years)

m. When the new MTG system is implemented funds will likely shift between regions again. The Regions understand the current Goals and understand the process - the MTG system helps Pavement Management office work with the Regions to develop candidate lists of projects. (Utah – 10 years)

n. The new MTG system will be more useful in developing candidate project lists because there will be a better link between visual distress and road scores. (Utah – 10 years)

o. The Resurfacing Program deals with improvements to the structural condition of the existing network. The program provides for resurfacing, rehab, minor reconstruction, milling and recycling. These actions are meant to preserve the structural integrity of the pavement. Major construction or reconstruction projects are not included in the Resurfacing program. The program objective is to ensure that the 80% meets Standards State Statute is met. (Florida – 10 years)

p. For roadways which are deficient in Ride only, the District may request an exception to fix only the ride deficient portions and will not be required to resurface the entire roadway. (Florida – 10 years)

q. The MTG system has helped improve pavement management practices and the deficiency rating tool is helpful to the districts in developing the pavement project program. (Idaho > 20 years)

r. We have a Capital Project Selection process that also addresses regional equity when selecting projects. This process specifically addresses heavy rehab projects; traffic is taken into account, but the traffic weighting factor is an 'S' curve so that above a certain level increases in traffic don't continue to accrue benefit. Regional location is also considered to ensure equity in project selection and regional funding distribution. (Kansas > 20 years)

s. The DOT plans to move from a prioritization system to an optimization system. Plans are to buy off-the-shelf software which can recommend treatments statewide based on predicted pavement condition deterioration - optimization would be based on 'best bang for the buck'. We'd like to have a system that can tell us how much we would need to spend to get a 4-lane roadway up to a PCR of 70. We'd also like to consider remaining service life since the Legislature understands time and money - this may be easier to explain from a financial / audit standpoint. (Mississippi – 10 years)

System Management - Accountability and Incentives

19. **"If we match funding to percentage of "Good" or better goals (4A and 4B), we as managers, administrators need to ensure there are expectations/incentives to exceed the goals. (Page 13)**

   a. Funding allocation was done centrally and then distributed to the 5 Commission Districts. The districts chose how to use the funds; however, they have to justify any changes to the PMS project list if it changes how the funds are used. If a district wants to use $10 million for a major rehab that was originally allocated for pavement preservation on the IH system we would work with them to determine what the consequences would be. Also districts could not use pavement funds for non-pavement related activities. There was a much higher level of accountability during our first MTG goal system. (Montana – 10 years)

   b. The DOT is decentralized regarding how funds are handled by the Districts. We did get some negative feedback from the districts when the MTG system was implemented since some districts had their allocation reduced. We set our goals based on analysis of historical performance and market research to find out what was acceptable to the Public. (Minnesota – 10 years)

   c. We use Statewide averages to determine if Goals are met or not. We do not hold individual District Managers accountable for achieving a target goal due to the constrained financial situation we are in. There is no specific emphasis on comparing one district's performance to another district although we do publish each district's performance in the annual Pavement Condition Score Card. Goals are not included on a District Manager's performance plan.

   d. We also needed to figure out what portion of system condition was due to poor treatment decisions and what portion was due to funding balance - in some cases it was both lack of funds and poor decisions - it takes time to iron out the system and get these individual pieces fitted together. (Ohio – 12 years)

   e. Our current MTG system helps us do follow up on poor decisions when selecting treatments or treatment programs. Our District Managers have a Pavement Condition Goal on their Performance Plan and their pay raises are tied to achieving / exceeding these goals. (Ohio – 12 years)

   f. There are enormous difficulties dealing with coalition groups in our major urban areas. The groups are politically very strong and don't trust the DOT to manage portions of the System which should be part of the DOT system. This includes bridges and portions of the roadway network. (Massachusetts)

g. Our current plan is to achieve the MTG goals within 5 years; however I don't think we've got the money to do it. Kansas DOT has a centralized process for allocating funding and evaluating / selecting projects. This eliminates districts spending pavement money on non-pavement projects. (Minnesota – 10 years)

h. Our DOT conducted a telephone survey to determine resident's satisfaction with the Transportation System. Residents were also asked about perceived moderate or severe problems. 50% of residents said that congestion was the biggest concern, followed by the number and condition of rest areas, timely resolution of safety issues (40%) and Vehicle damage from maintenance or construction activities (39%). The lowest level of concern was expressed regarding adequate roadway signs (20%); Road Maintenance impacts on air quality (27%) and too many driveways and approaches (29%). (Minnesota – 10 years)

i. One of our urban District Managers indicated that he discusses the MTG system when he receives a public inquiry or complaint. He explains the process for selecting projects and why we can't apply the same level of treatments to all roadways. Some roadways will receive patching to keep them safe and serviceable until additional funds come available to take them off the backlog list. (Oregon - > 10 years)

j. Regional managers do have Regional Pavement Condition Goals on their performance plans and the Pavement Management Engineer works with the Regional Managers very closely regarding how their system is performing. (Utah – 10 years)

20. **"Mileage-based versus utilization-based allocations. PMIS data suggests that Districts are primarily using a lane-mile based approach to improve condition with limited funding. This approach does have some value: it protects the most mileage from the risk of deterioration, which protects the state from having to spend much larger amounts of (limited) money to rebuild mileage. The lane miles were built for a reason – they were built to be used --- so there is some "utilization" benefit gained from treating lane miles. A strictly utilization-based approach runs the risk of spending all of the money on a very small amount of high-cost mileage, while exposing the large portion of the network to the risk of deterioration and eventual loss." (Page 14)**

a. We performed a 20-year analysis of needs categorized into a) Reconstruction; b) Rehabilitation; and c) Resurfacing. We then re-ran the analysis with the available funds for year 1 and dedicated funds for each category; the pavement conditions for years 2 - 20 were projected and the budget category split determined. This led to a final best mix of fixes through an iterative process that resulted in the best distribution of funds and resulting pavement conditions. This provided a much superior approach than 'worst first'. Pavement conditions

showed a dramatic increase the first 5 years this method was used. (Montana – 10 years)

b. Previously we only set lower level goals to achieve less than a certain percentage of Poor and Very Poor pavements in each Region; but this led to a 'worst first' approach to treating pavements - we found that you get what you measure….[or get results in relation to the goals or guidance you set.] (New York)

c. The system we used prior to the MTG system was basically a 'snap shot in time' of system conditions based on Pavement Condition Rating, Present Serviceability Index and skid. Each of these 3 criteria was assigned a weight and the sections prioritized on a 'worst first' basis. The prioritized list based on 'worst first' was then evaluated based on engineering judgment and other factors to ensure equity. The earlier system was not based on achieving goals. Our old system could not be used to develop a multi-year plan which was our goal based on a study of our processes. Our old system could not be used to predict future conditions nor could the system tie our 12 districts together in order to evaluate statewide needs along with district needs. We also needed to hold our decision makers more accountable. (Ohio – 10 years)

d. Currently 80% of IH Routes are at 3.0 PSI or above and 70% of all other routes are 2.8 PSI or above. The PSI is Pavement Serviceability Rating on a scale from 0-5 which includes Ride, Rut and Distress - if any one measure falls below the target for the two tiers then that route mileage is not included in the 'at or above meets goal percentage'. (Massachusetts)

e. We tweak the goals occasionally. We are working toward an 'equilibrium state' where the Interstate and Turnpike systems are 90% meets standards and the arterial system in each district is 77% meets standards. This would result in meeting the statewide goal of 80% meets standards. (Florida – 10 years)

f. We use a 3-Tier system which includes IH routes, 4-lane (non-IH) and 2-lane routes. (Mississippi – 10 years)

g. Our MTG system has gone through several changes since first implemented: First iteration was NHS and Non-NHS; then Priority Corridors, then geographic regions. Currently there are three Tiers: IH, Non-IH NHS, and non-NHS systems. (New York)

h. The Multi-tier goals were established for three Policy Systems - The Priority Network which includes the IH system and routes designed to IH standards; The Urban System which includes roadways within municipalities > 5000 population and the General System which primarily consists of rural 2-lane roadways. (Ohio – 12 years)

i. Utah is in the process of revising its MTG system—in the past a 3-Tier System was used including Interstate routes 90% Good or better based on IRI; Arterials 70% or Better, and Collectors 50% or Better. (Utah 10 years)

j. There wasn't a huge difference between the goals set for the two Tiers. The entire state was 90% Acceptable or better and the Interstate was 100% Acceptable or better. This means that the pavement conditions off the IH system weren't drastically different. Most of our IH mileage is in rural districts -- in our urban districts congestion is a bigger issue than pavement condition. (Illinois)

k. We have 3 Tiers which include the Statewide Tier: IH ≥ 85% Good (PCR ≥ 93. In 2009 IH at 80.5% Good. Regional Tier which includes the Primary System and NC Routes - Target is ≥ 80% 'Good' condition. In 2009 Primary System was at 65.5% Good. Local Tier - These are Secondary Roads (SR) Routes - Target is ≥ 75% 'Good' Condition. In 2009 SR was at 68.5% 'Good' or better. (North Carolina – 2 years)

l. MTG was implemented 2 years ago and the Goals have been tweaked since then - it's an iterative process. We set the goals too close together for the different Tiers at first - we needed to spread the goals out so that we'd have clearer targets to differentiate expected conditions for the different systems. (North Carolina – 2 years)

Considering Ride – Public Perception and Funding computations

21. **'Do we de-emphasize ride in the funding computation? Yes.' (Pages 14 & 16)**

22. **'Ok to de-emphasize ride in formula. I did this long ago and concentrated on distress.' (Page 17)**

23. **'We agree that we should……..de-emphasize ride in the funding computations.' (Page 17)**

Information provided by both the Kansas and Missouri Road Rallies showed that smoothness was ranked lower than pavement surface condition on the IH and below pavement surface condition, lane and shoulder width on primary arterials, and below pavement surface condition, lane and shoulder width and signage on collectors.
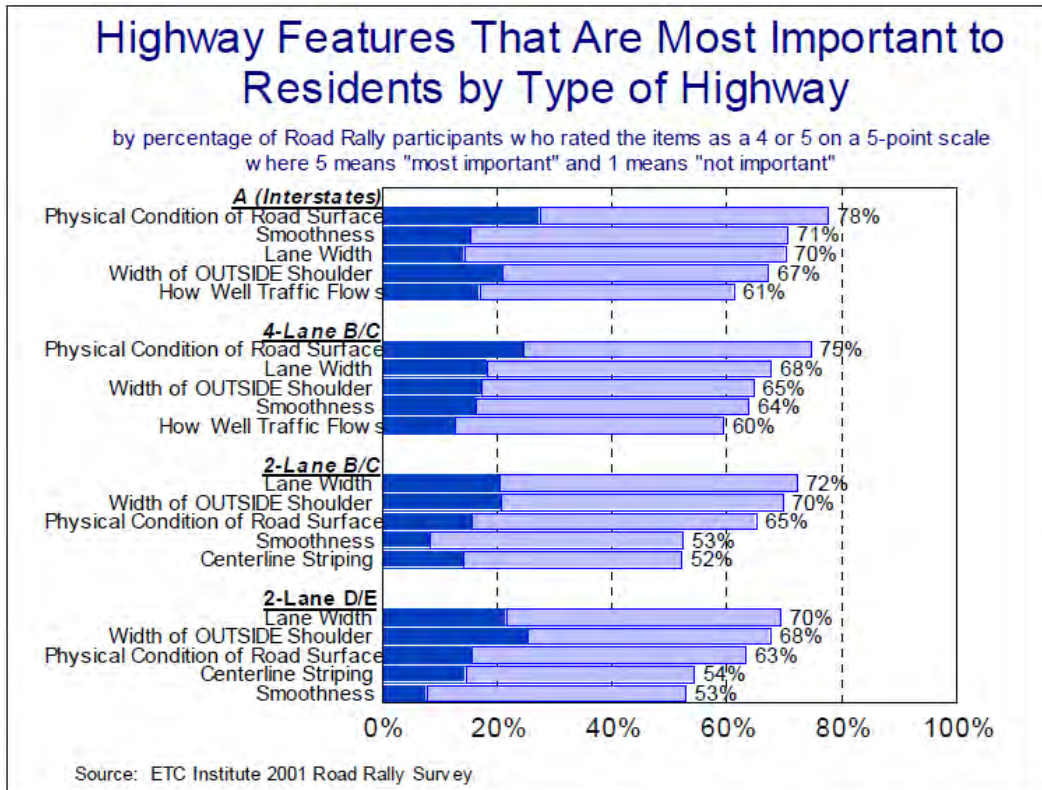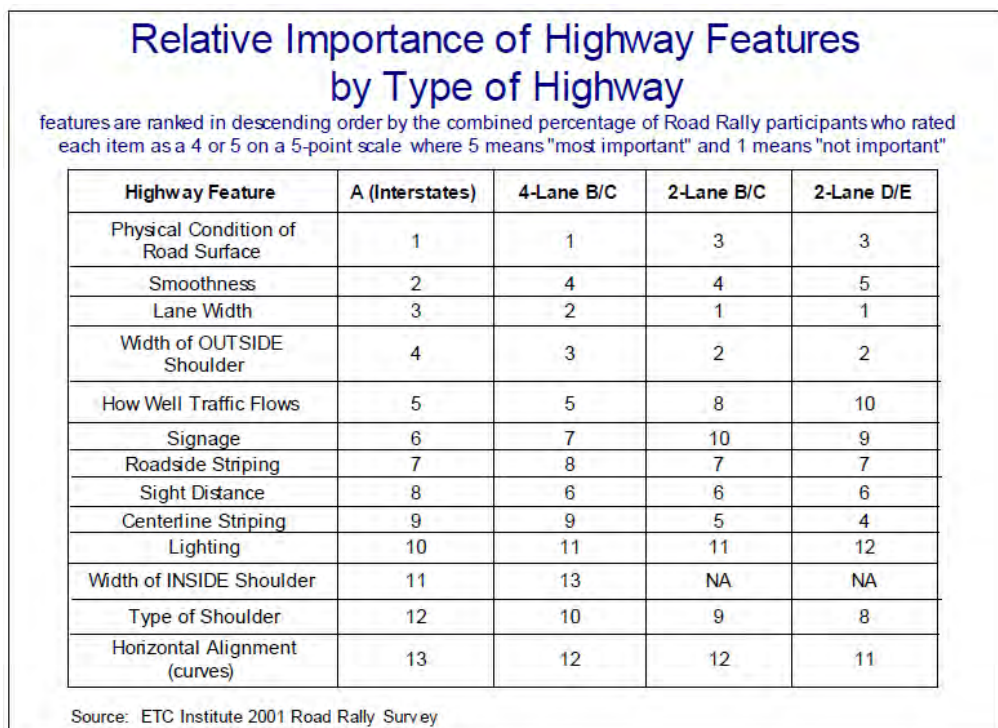
Figure 5 Kansas Road Rally Summary Results

Highway Feature	A (Interstates)	4-Lane B/C	2-Lane B/C	2-Lane D/E
Physical Condition of Road Surface	1	1	3	3
Smoothness	2	4	4	5
Lane Width	3	2	1	1
Width of OUTSIDE Shoulder	4	3	2	2
How Well Traffic Flows	5	5	8	10
Signage	6	7	10	9
Roadside Striping	7	8	7	7
Sight Distance	8	6	6	6
Centerline Striping	9	9	5	4
Lighting	10	11	11	12
Width of INSIDE Shoulder	11	13	NA	NA
Type of Shoulder	12	10	9	8
Horizontal Alignment (curves)	13	12	12	11

Source: ETC Institute 2001 Road Rally Survey

Figure 6 Kansas Road Rally Results – Rankings
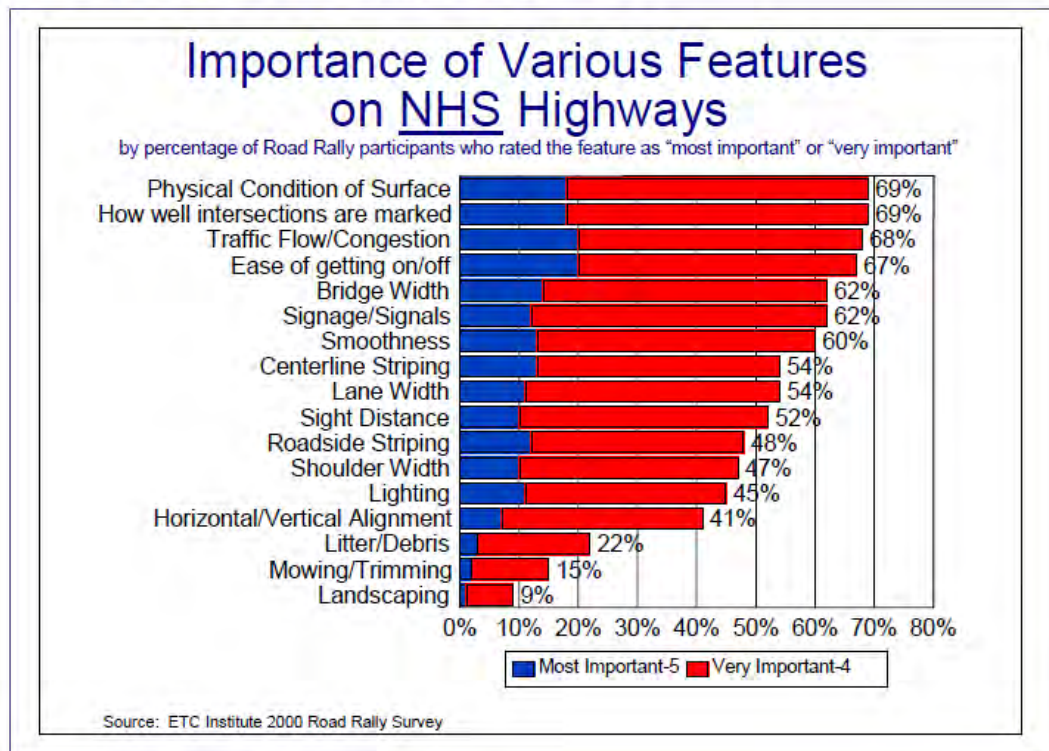
Figure 7 Missouri Road Rally Feature Ratings [Rahn 2010]

FHWA Design Standards

24. 'Last, once there is a Tier system in place, TxDOT needs to look very hard at the level of design standards that we are rehabilitating roadways. If there is not enough funds for the state, TxDOT needs to work with FHWA and see how we can lower Interstate design standards so that all possible money can be put to the pavements and not be spent on appurtenances if not absolutely necessary (4R vs. 3R etc.) (Pages 9 & 15)

Several states have involved the FHWA in the MTG process at the beginning either in vetting goals or in some cases participating in the goal development process. Some states also include the FHWA on a committee that reviews projects and funding allocations for IH projects.

a. We have an Interstate Rating Committee (IRC) composed of personnel from Pavement Management, construction, maintenance, the districts, and FHWA. For the 4-lane and 2-lane routes, PMS generates a project list. (Louisiana – 6 years)

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b. There is a Legislative body that addresses transportation needs in the state (we don't have a Commission); they have been involved in the MTG development effort. The DOT Administration, Technical staff, the Public and the Trucking Industry have been involved as well as the FHWA. (Maine – MTG system under development)

c. The MTG system itself didn't help managers pick projects - it was the project selection process which was more affected by the agreement we had with FHWA. (Montana – 10 years)

Local Government

25. **"Ironically, I have discussed this concept with two County Judges and they completely understand our funding dilemma and said 'there is only so much you can do with limited funds.' I believe counties are facing similar challenges on their systems." (Page 17)**

Two DOTs indicated that counties were considering or had implemented pavement data collection methods and MTG systems modeled on the DOT system. Recent testimony given by Jim Allison, general counsel for the County Judges and Commissioner's Association of Texas points out that county road funds are insufficient and that counties have not had an increase in gas tax revenues since 1951.

a. Counties are starting to think about implementing a similar system to our HPCS (MTG) system in consideration of limited funds. (North Dakota – 6 years)

b. Testimony given before the Joint House Committees on Transportation and Agriculture and Livestock, May 18, 2010. Jim Allison, general counsel for the County Judges and Commissioners' Association of Texas, said the county road system receives $7.3 million annually from the state gas tax and this amount has remained unchanged since 1951. County property taxes primarily fund county roads and are an insufficient source of funding. Mr. Allison said additional state funding is necessary for county roads. He recommended ending Fund 6 diversions, indexing of fuel taxes, raising fuel taxes by 10 cents, and allowing local option elections for county transportation needs.

c. Counties and Municipalities have shown a lot of interest in our MTG goals - we work very closely with counties in particular who have adopted our data format, goals and management techniques. We get negative feedback from a county when there is lack of coordination on projects and there is an obvious change in pavement conditions at the county line. (Ohio – 12 years)

26. '**How often will tier maps (and therefore formula distribution) be updated? With growing area and industry (esp. drilling), road can go from tier 3 to tier 2 quickly. Will need $$$ to upgrade to handle increased loading. (Pages 8 & 17)**

The Project Monitoring Committee may want to consider how the MTG system will be managed once implemented. Does the same group make future decisions about changes to route designations? How often will these decisions be made?

    a. Implementation of the MTG system had an impact on funding allocations - but changes in allocations are more related to the funding allocation formula. Based on our experiences, we are planning to review and revise the funding formula on a 5-year cycle as needed. (Minnesota – 10 years)

Observations and Summary

The Project Director indicated that some of the information gained through the DOT Surveys will be evaluated as part of the TxDOT MTG development effort while other items are longer-term 'parking lot items'. The following lists summarize observations for short- and long-term consideration by TxDOT.

Short-term

    1. Although Texas has the largest roadway network and pavement maintenance budget, we rank in the middle of states with MTG systems in terms of dollars available per lane mile. This suggests that in terms of financial constraints all of the states surveyed are our 'peers'.

    2. The majority of State DOTs have included IH routes in Tier 1 and non-IH NHS routes in Tier 2. Currently V1.11 and V1.13 includes all NHS routes in Tier 1. This comprises over 49,500 lane miles of pavement with a large stratification of ADT, Truck ADT and speed limits. Further consideration will be given regarding whether all NHS routes should be retained in Tier 1.

        Should special designations, goals or condition targets be established for individual portions of the NHS network beyond those for Interstate Highways? (i.e. Non-IH Principal Arterials serving major transportation hubs; Strategic Highway Network (STRAHNET); Major Strategic Highway Network connectors; and Intermodal Connectors)

    3. Routes serving military installations including NHS STRAHNET (Strategic Highway Network) and Major Strategic Highway Network

Connectors are currently contained in V1.11 and V1.13, Tier 1. Concern had been expressed by PMC / District Engineers that routes serving military installations should be above Tier 3. Should these routes remain in Tier 1 or are they candidates for Tier 2?

4. Other DOT MTG systems do not differentiate between rural and urban IH routes nor do they separate the IH into different Tiers. Due to financial constraints one state is considering the possibility of splitting IH routes into high and low truck traffic portions. The low truck traffic IH routes would potentially receive less funding. Should consideration be given to sub-dividing the IH system based on ADT, or truck ADT?

5. Maine has conducted an extensive study of the state's economic regions and has developed Tiers that support the 6 regions that were identified. The Maine DOT held meetings with the trucking industry to help identify primary trucking corridors. V1.11 and V1.13 differentiates identifies 'high' truck traffic corridors as having 700 Truck ADT per day or greater. These routes are contained in Tier 2. Additional assessment of the local economic importance of low ADT and low Truck ADT routes may be required to ensure that 'egg routes' receive adequate funding. Referencing item 6, how will consideration of these individual routes be handled in the future?

6. Strong DOT leadership is necessary to develop and implement a Multi-Tier Goal system. Continued strong leadership is even more important to ensure that the MTG strategies are reviewed and updated as needed in response to changing economic conditions and as information is gained about the impacts of the MTG system compared with actual performance. This suggests that a committee or Technical Team may be necessary to provide leadership in monitoring the operation of the MTG system, determining when routes should be moved to a different Tier and to determine when the funding allocation formula should be reviewed.

7. Some state DOTs with decentralized organizational structures expressed concern regarding use of pavement funding for non-pavement related items and the impact on statewide condition scores. No solutions were discussed – is this a topic for the PMC?

8. States that have established 'Fair' or better goals for selected Tiers indicated that this approach, by default' sets a 'Poor or Very Poor' goal for those Tiers. Close attention is needed to ensure balance between upper and lower bound goals if a 'Fair' or better goal is established.

9. The results of Road Rallies conducted in Kansas and Missouri showed that pavement surface condition, not ride, was the most important feature for higher type roadways. The relative importance of ride decreased on lower type routes ranking below lane width, shoulder type and striping. Some DEs have suggested de-emphasizing ride in the funding allocation equation - the Department may want to consider a similar (Road Rally) exercise to establish motorist's expectations in Texas.

10. Kansas and Minnesota pointed out that although they operate a 2-Tier MTG system, districts have implemented non-formalized criteria established that impact treatment selection and funding allocations among route functional classes. This has resulted in a 5-Tier stratification of route conditions that follows the functional classification – the stratification is attributed to pavement management practices. Should TxDOT consider publishing guidance regarding treatment prioritization, treatment categories, or related information in conjunction with implementation of the MTG system?

11. One state pointed out that over time they have been able to monitor pavement performance and funding allocations to districts such that it is possible to determine when lower pavement conditions are due to under-allocation of funds and when conditions are due to inappropriate pavement management practices. However, this type of insight takes time to develop --- should TxDOT consider developing a methodology to assist in assessing performance trends to identify impacts of reduced funding allocations or other factors that affect district pavement performance once the MTG system is implemented?

12. Regarding accountability, some state DOTs include pavement condition goal targets on Regional Manager's performance plans and tie pay raises to performance. Other DOTs reported that Regional Managers do not have condition goals on their performance plans due to constrained financial conditions.

Long-term (parking lot items)

13. Some states have implemented, or are considering central management of the IH System. It was pointed out that the IH system is the most expensive in terms of project costs and that often districts found it difficult to allow the local system to deteriorate in preference for high dollar rehab projects on the IH system. This was particularly true since citizen complaints are typically related to local routes rather than the Interstate. Would central management of the IH system benefit Texas?

14. One state indicated that their funding allocation formula considers statewide contractor viability. Should contractor viability and maintaining contractor competitiveness statewide be considered in the funding allocation formula?

15. Ohio indicated that some districts have poor local material sources and that a separate fund is established to work with districts that have poor conditions due to materials. However, it was also pointed out that although rural districts received lower funding after the MTG system was implemented, on the whole, rural district conditions are comparable to urban conditions due to appropriate treatment type selections that are matched to route type and needs.

16. Several states pointed out that the MTG system is an iterative process and goals, condition targets, and condition measures can change over time in response to financial conditions, new technologies and lessons learned. It is important to consider how to ensure historical PMIS trends can be related to MTG trends once the system is implemented.

17. Several DOTs indicated that once an MTG system was in place the performance of the DOT related to the established goals was of great interest to the Legislature. Some DOTs pointed out that establishing goals and demonstrating good management practices were instrumental in maintaining credibility with the legislature and obtaining future funding increases. At least two DOTs indicated that MTG goals were mandated / became state law. Considering that it has been stated that the MTG process is iterative, how can TxDOT manage the possibility that the Legislature might mandate MTG goals or establish goals as state law?

18. Several states pointed out that the MTG system was not directly responsible for improving project selection. The MTG system did help pavement managers prioritize and allocate funds; however additional project selection tools were developed that helped districts consider benefit / cost ratio based on various factors when selecting projects.

19. Ohio and other states have indicated that they have a close working relationship with counties. Recent testimony by Jim Allison (general counsel for the County Judges and Commissioner's Association) indicated that counties are also experiencing financial constraints. Should TxDOT take the initiative to provide guidance on MTG system development and implementation with counties and other local governments?

Bibliography

TxDOT Multi-Tier Pavement Management Workgroup 'Multi-Tier Pavement Condition Goals: Issues and Concerns – Interim Report #1 April, 2010

TxDOT Multi-Tier Pavement Management Workgroup 'Three Tier System – Version 1.11 FY 2010' Map and supporting information prepared by the CST-Materials and Pavements Section – Pavements and Materials System Branch. April 28, 2010

TxDOT Multi-Tier Pavement Management Workgroup 'Three Tier System – Version 1.13 FY 2010' Map and supporting information prepared by the CST-Materials and Pavements Section – Pavements and Materials System Branch. April 28, 2010

FHWA 'The National Highway System – Where is the NHS?' Maps of the NHS for each state. East Texas and West Texas. March, 2005
Available on-line May 23, 2010
http://www.fhwa.dot.gov/planning/nhs//

FHWA Policy Information Website – 'Statistics 2008'
available on-line May 23, 2010
http://www.fhwa.dot.gov/policyinformation/statistics/2008/

2030 Committee 'Texas Transportation Needs Report' February, 2009
Available on-line May 23, 2010
http://texas2030committee.tamu.edu/

TxDOT Construction Division Materials and Pavements Section
'Comparison of National Pavement Condition Performance Measures'
July 22, 2008

Kansas Department of Transportation 'Kansas Long Range Transportation Plan – Appendix C2 KDOT 2001 Road Rally Summary' December 2002
Available on-line May 24, 2010
http://www.ksdot.org/burtransplan/burovr/longtp/cltp.asp

Peter Rahn, Director Missouri DOT 'Using Performance Measures to Establish Accountability' presentation TRB Session 126 Strategies for Moving Toward a Performance-Based Organization' 89th Annual TRB Meeting, Washington DC. January 10, 2010

Multi-Tier
Pavement Condition Goals

White Paper

Prepared by
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Construction Division, Materials and Pavements Section
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February 12, 2010

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Multi-Tier Pavement Condition Goals

DESCRIPTION:

TxDOT maintains 194,000 lane miles of pavement which is the largest State maintained highway system in the U.S. The current statewide pavement condition goal, set by the Texas Transportation Commission in 2002, is to achieve 90 percent of State-maintained lane miles in "Good" or better condition by 2012. This is a "one size fits all" goal: high-traffic metro Interstates are treated the same as low-traffic rural FM roads.

Funding for pavement preservation (routine maintenance, preventive maintenance, and rehabilitation) is becoming increasingly limited. Available pavement preservation funds have been reduced by: Federal rescissions; construction cost inflation; reduced fuel tax revenue receipts (and projected receipts) due to reduced travel and increased vehicle fuel efficiency; debt service; and increased competition to address mobility, bridge, and safety issues.

During the August, 2009 Commission meeting, it was noted that the TRENDS revenue assessment computer program predicted pavement funding allocations from FY 2010 to FY 2030 that are well below the 2030 Committee's pavement needs estimate to achieve and maintain 80 percent 'Good' or better pavement Conditions. Based on this observation, TxDOT Administration requested an analysis of predicted future pavement Condition Scores using the same methodology and assumptions as was used in the 2030 Pavement Needs study, but based on the current and future projected funding allocations.

The analysis showed that the 90% 'Good' or better goal cannot be achieved and system conditions will deteriorate to unacceptable levels as shown in Figure 1.
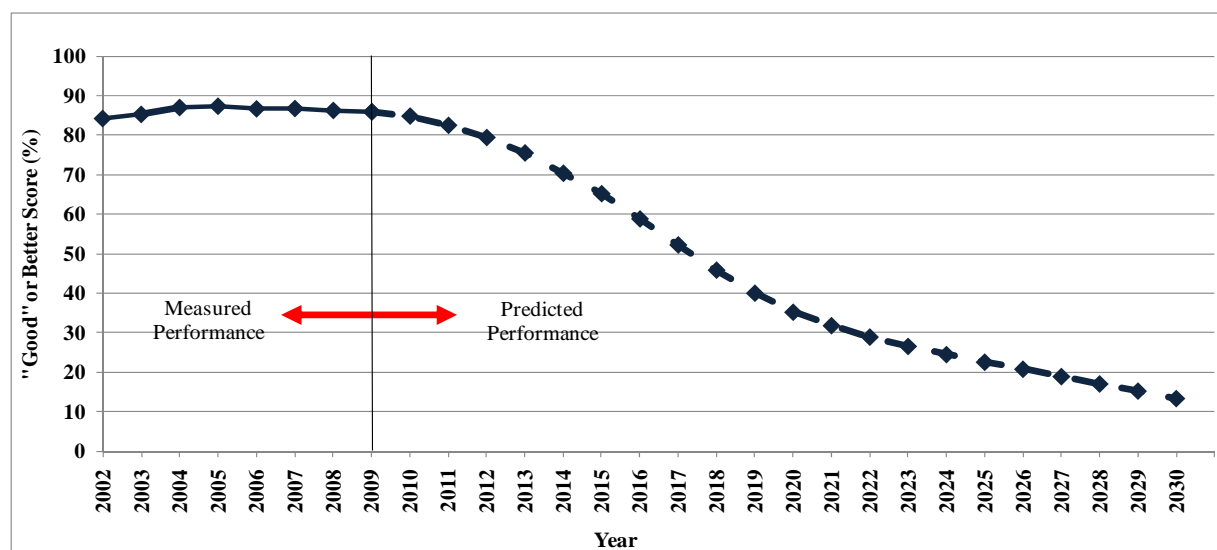
Figure 1. Predicted Pavement Performance Trend for FY 2009-2030
[Center for Transportation Research (CTR), Zhang et al 2009]

In response to this finding, the Administration directed TxDOT personnel and University researchers to investigate alternate pavement condition goal systems and a funding allocation formula that preserves the State pavement network under a constrained budget. In addition, the group was directed to assess potential risks and consequences associated with these goals.

Multi-Tier Pavement Condition Goals

ISSUES:

The investigators are exploring several questions.

- What are the most effective strategies to preserve the system and provide the highest achievable pavement conditions for the greatest number of Texans?

- How do we manage risk as pavement system conditions deteriorate due to limited pavement preservation funding?

- What are the consequences in terms of road user costs and other factors of allowing portions of the state network to deteriorate?

- How should the Category 1 Pavement funding allocation formula change?

- How are other State DOTs facing the challenges of a constrained budget?

The Approach

A survey of other State DOT pavement condition goal systems, first conducted in July, 2008 and updated in January, 2010, indicates that at least 20 DOTs have used multi-tier pavement condition goals for the past 10 – 20 years. Additional State DOTs are currently considering a multi-tier goal approach in view of limited resources. Each 'Tier' includes a portion of the highway network with pavement condition goals that are in line with the importance of the Tier to the overall Statewide Transportation System. Discussions with other DOT Administrators and pavement managers have identified several benefits to the multi-tier management approach:

<u>Ohio</u>: *Statewide (pavement) conditions have improved since multi-tiered goals were implemented. Multi-tiered goals did impact regional funding distributions; this meant that districts that primarily managed (rural roads) had to craft solutions to address their roadways and needs which are different than in urban areas or on the Interstate.*

<u>Mississippi</u>: *We've had a 3-tier system in place for 10 years. Multi-tier Goals have helped direct funds based on statewide needs rather than specific districts.*

<u>Kansas</u>: *We set 85/3 on the Interstate and 80/5 on non-Interstate. The first number is the percentage 'Good' or better goal, the second number is percentage 'Poor' or 'Very Poor' goal (not to exceed). Setting different Goals for the IH and non-IH routes definitely resulted in the improvement of our IH system condition and better performance. Higher goals raised the importance of the IH system.*

<u>Florida</u>: *Multi-tiered Goals have helped keep the Interstate and turnpike systems in better condition. However, we do not allow other portions of our arterial system to deteriorate. We maintain goals for each Tier as well as a Statewide standard to achieve 80% Good or better conditions based on Florida Statute.*

Multi-Tier Pavement Condition Goals

In conjunction with the DOT survey, an analysis is underway to evaluate the TxDOT pavement system using a multi-tier pavement condition goal approach. A preliminary assessment of the TxDOT highway network was conducted based on different Tier configurations with associated lane miles; truck traffic levels; vehicle miles traveled and other factors.

DESIRED RESULTS:

Based on this preliminary assessment, a proposed three-Tier system was developed as shown in Table 1. It is proposed to set goal percentages for 'Good' or better conditions and goal percentages (not to exceed) for 'Poor' and very poor conditions for each Tier.

Table 1. Preliminary Proposed Three-Tier System with Tier Descriptions and Statistics.

Category	Description	Lane Miles	Percentages of...		
			Lane Miles	**VMT**	**Truck VMT**
Tier 1	High-traffic major corridors (such as IH and US)	47,106.6	24.22	64.68	70.40
Tier 2	Intermediate-traffic routes, including state and local corridors important to the economy	30,463.2	15.67	18.07	15.01
Tier 3	Low-traffic routes (mainly FM, but some SH and US).	116,890.6	60.11	17.25	14.58

Scenarios Analyzed So Far

The Center for Transportation Research has analyzed five Goal Scenarios identified by the TxDOT Project Monitoring Committee. The five Scenarios include different % 'Good' or better goals for the 3 Tiers. Please note that there is no longer a statewide goal for percentage of lane miles in 'Good' or better condition. Table 2 shows the goals for the five Scenarios.

Table 2. Five Potential Goal Scenarios.

	Current (2009)	Scenario 1	Scenario 2	Scenario 3	Scenario 4 A (with current UTP Funding)	Scenario 4 B (with current UTP Funding)
Tier 1	85.69/ 2.72	90/1*	90/1*	80/1*	70/1*	80/1*
Tier 2	80.99/ 3.85	90/3*	80/3*	70/3*	70/3*	50/3*
Tier 3	87.31/ 1.74	90/5*	70/5*	50/5*	28/5*	25/5*

Table 3. Estimated M&R Needs Based on the Five Potential Goal Scenarios.

	Current (2009)	Scenario 1	Scenario 2	Scenario 3	Scenario 4 A (with current UTP Funding)	Scenario 4 B (with current UTP Funding)
Tier 1	85.69/ 2.72	$11.02	$10.88	$8.46	$6.28	$8.46
Tier 2	80.99/ 3.85	$4.61	$3.76	$3.11	$2.85	$1.89
Tier 3	87.31/ 1.74	$25.28	$14.79	$9.01	$2.28	$1.06
Total	85.94/ 2.30	$40.90	$29.43	$20.58	$11.41	$11.41

Table 3 shows the estimated needs (in Billions of dollars) to achieve and maintain each of the five Table 2 Scenarios over the next 10 years. These estimates only address preservation of the existing highway system and do not include treatment costs for added capacity, mobility lane miles that might be constructed between FY 2010 and FY 2020.

Multi-Tier Pavement Condition Goals

In addition, these costs do not reflect vehicle operating cost increases that will occur due to lower pavement condition goals for Scenarios 2 and 3. Based on an analyses conducted for TxDOT Administration, the increase in vehicle operating costs exceeds the reduction in M&R needs. There are no cost savings for either TxDOT or taxpayers by allowing the system to deteriorate.

FURTHER ACTIONS:

Additional analyses are planned to evaluate other Scenarios and to determine the percentages of lane miles in the 'Good' or better and 'Poor' or 'Very Poor' categories using different funding allocations.

Additional work is also underway to review the Category 1 Funding allocation formula and to determine changes that may be needed to ensure funding is allocated statewide in the most effective manner.

It is anticipated that funding allocations may change from district to district in order to achieve statewide Condition Goals and to ensure that the IH System and principal arterials important to the region and the state are maintained in a manner acceptable to Texas' motorists and to meet freight movement needs. This work will consider safety as a key priority and will consider providing funding which allows districts to craft treatment solutions that meet local needs.

OTHER:

The Administration will be prepared to present preliminary findings on the following topics to the Commission at the February 24, 2010 workshop:

- Proposed Multi-tier Pavement Condition Goal Scenarios and associated needs estimates;
- Projected 'Good' or better and 'Poor' or 'Very Poor' percentages for each Scenario;
- A preliminary new Category 1 Funding Allocation formula process which incorporates the multi-tier pavement condition goal approach;
- Evaluate risks and consequences associated with each multi-tier goal Scenario.

Agenda for Initial for Multi-tier Pavement Management Workgroup
15 March 2010

- Initial meeting and definition of issues -- March

- Work previously done and presentation to the Commission on 24 February 2010

- Definition of Issues and concerns

- Assignments

- Next Meeting Date

Funding by Category (2010-2035)

Category	2010-2020 UTP Scenario B	2021-2035 MTP Forecast	2010-2035 Combined Total
1 – Preservation	$10.616	$11.630	$22.246
2 - Metro Mobility	$2.020	$0.000	$2.020
3 - Urban Mobility	$0.401	$0.000	$0.401
4 - Statewide Mobility	$0.056	$0.000	$0.056
5 - CMAQ	$1.246	$2.230	$3.476
6 - Bridge	$2.813	$3.750	$6.563
7 - STP Metro Mob/Rehab	$2.106	$3.140	$5.246
8 - STP Safety (HES)	$1.444	$1.950	$3.394
9 - STP Enhancement	$0.676	$0.900	$1.576
10 - Supplemental Trans. Projects	$0.768	$0.490	$1.258
11 - District Disc.	$0.728	$0.940	$1.668
12 - Strategic Priority	$0.176	$0.000	$0.176
TOTAL	$23.050	$25.030	$48.080

Pavement Condition Topic Discussed Previously (November 2009)
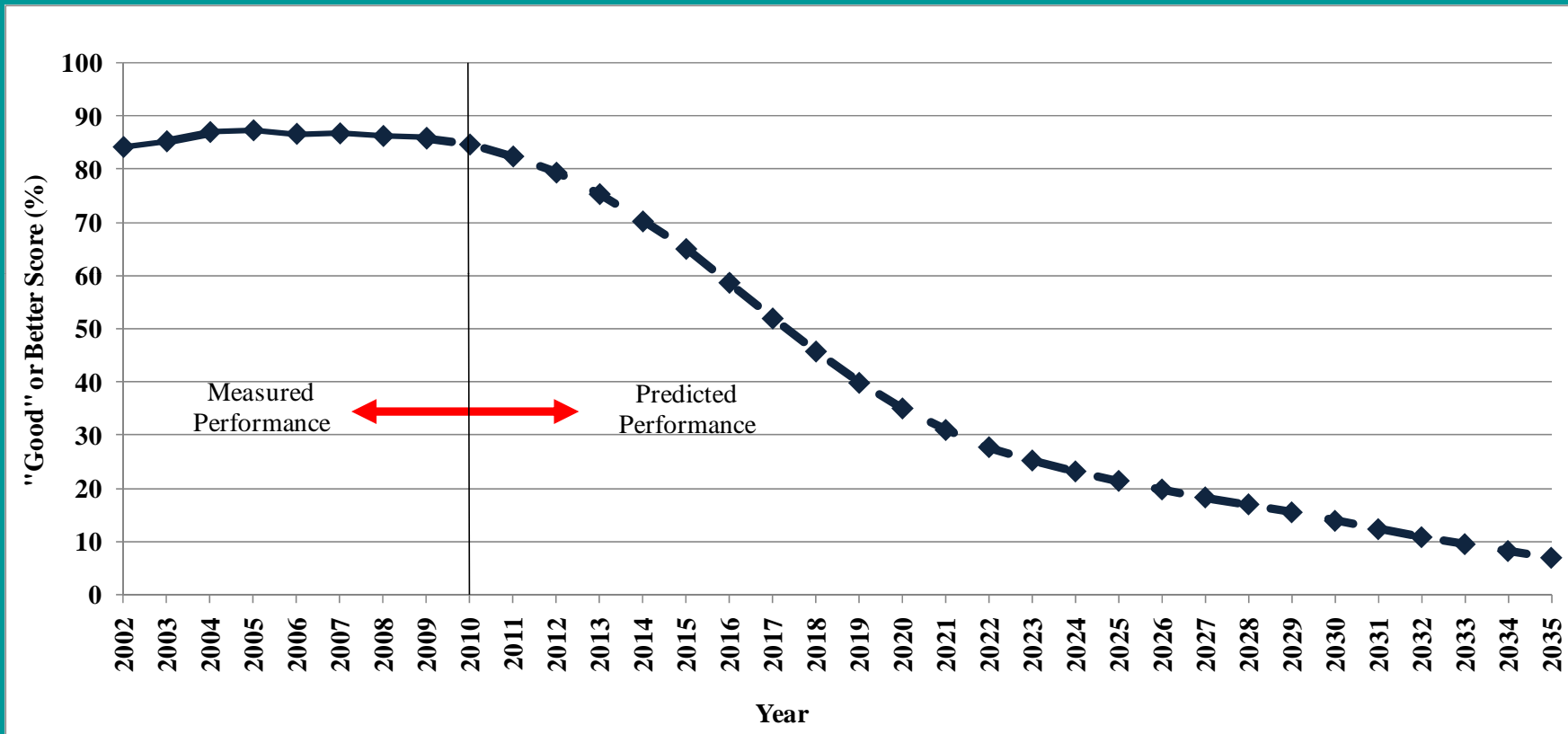
Projected Percentage of Lane Miles in "Good" or Better Condition (FY 2010 – 2035)

Best Practices and Additional Funding that Should Help Pavement Condition Scores

- Prop 12 and 14 bonds, ARRA FUNDS

- DE's management practices
    - PEER review

- 4 year pavement management plan

- "Pennies to Pavement" (concentrating funding on pavements instead of other areas)

- Cost saving initiatives
    - 89 cost saving measures developed with the AGC – including alternate material, bidding, increased use of RAP, RAS, etc.

State DOT Multi-Tier Goal Survey

Status

All 50 states were asked a 13 Question Survey

At least 20 DOTs Use Multi-Tier Goals

Several other DOTs are Currently Considering Multi-Tier Goals for the First Time.

Aspects in Common...

Financial Constraints

Min/Max Goals

Focus on Statewide Priorities Instead of on Geographic Distribution

Establish Public/Legal Expectations

Preliminary Proposed Three-Tier System with Tier Descriptions and Statistics

Category	Description	Lane Miles	Percentages of…		
			Lane Miles	VMT	Truck VMT
Tier 1	High-traffic major corridors (such as IH and US)	47,106.6	24.22	64.68	70.40
Tier 2	Intermediate-traffic routes, including state and local corridors important to the economy	30,463.2	15.67	18.07	15.01
Tier 3	Low-traffic routes (mainly FM, but some SH and US)	116,890.6	60.11	17.25	14.58

Proposed Three-Tier System
Version 1.6 - FY 2009

**Tier 2 Includes
Truck ADT 700 and Above**

Version 1.6-FY 2009
— Tier 1 - Primary
— Tier 2 - Intermediate
— Tier 3 - Secondary
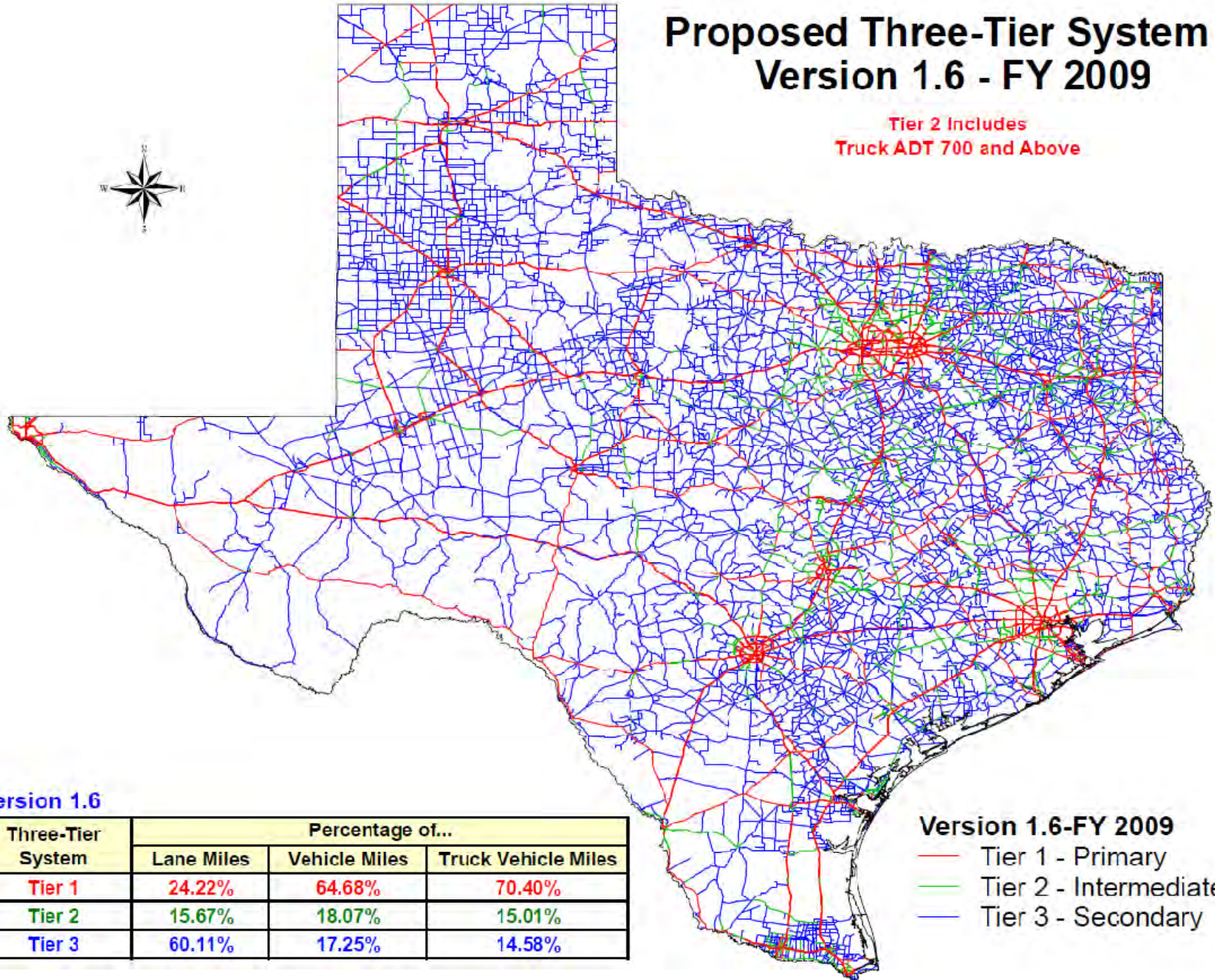
Version 1.6

Three-Tier System	Percentage of...		
	Lane Miles	Vehicle Miles	Truck Vehicle Miles
Tier 1	24.22%	64.68%	70.40%
Tier 2	15.67%	18.07%	15.01%
Tier 3	60.11%	17.25%	14.58%

DFW Area
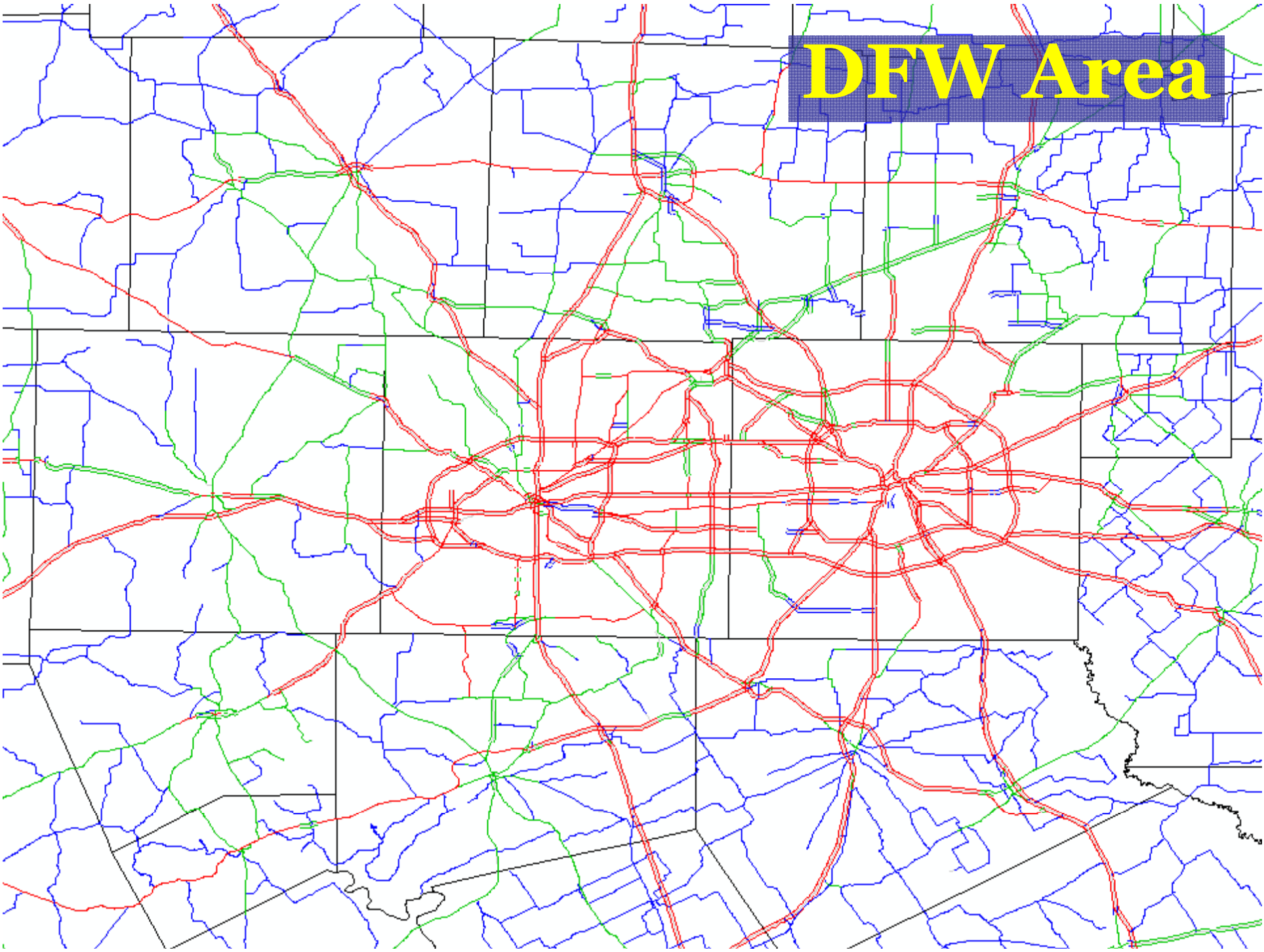
Houston Area
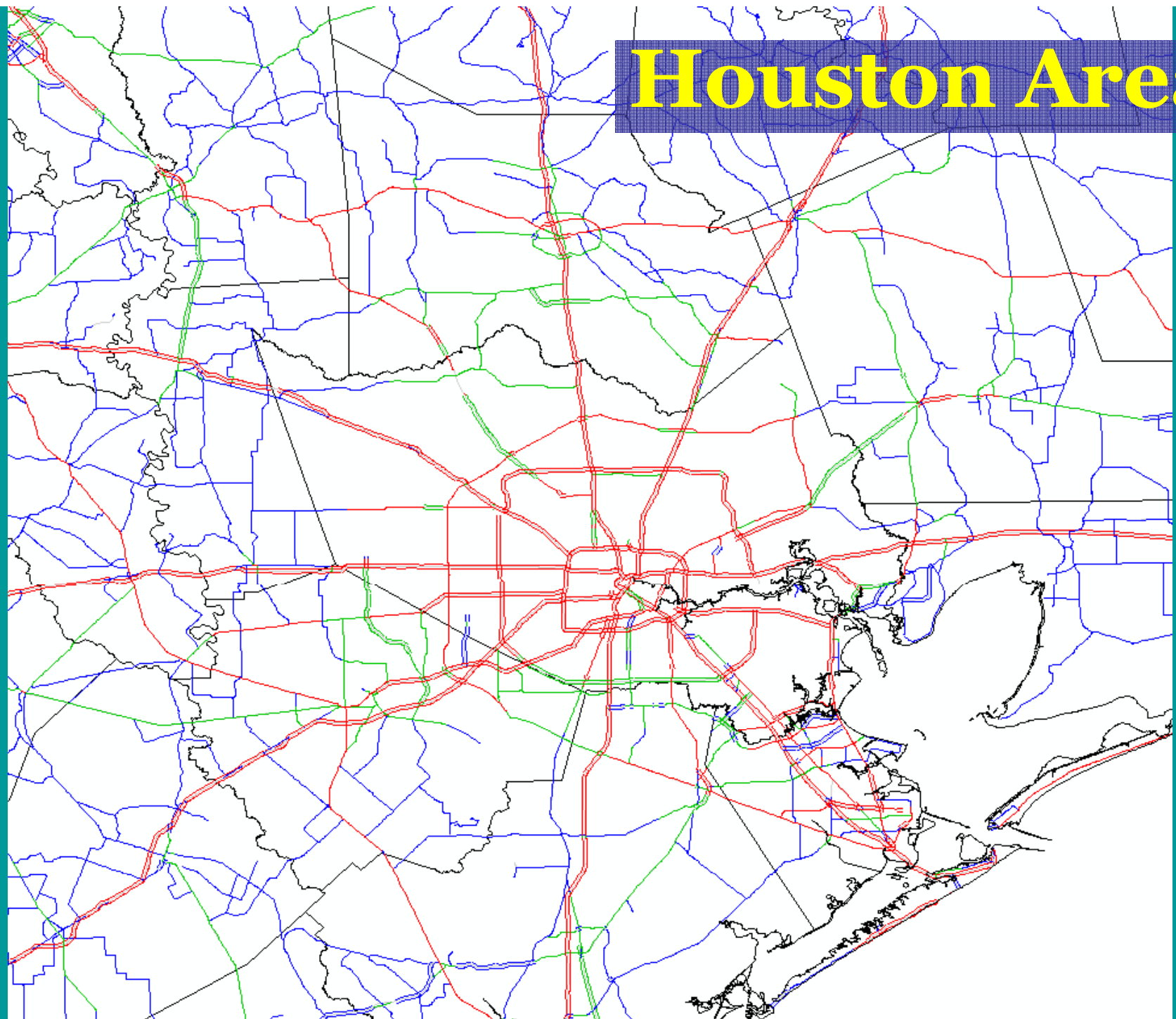
San Antonio & Austin Area

El Paso Area
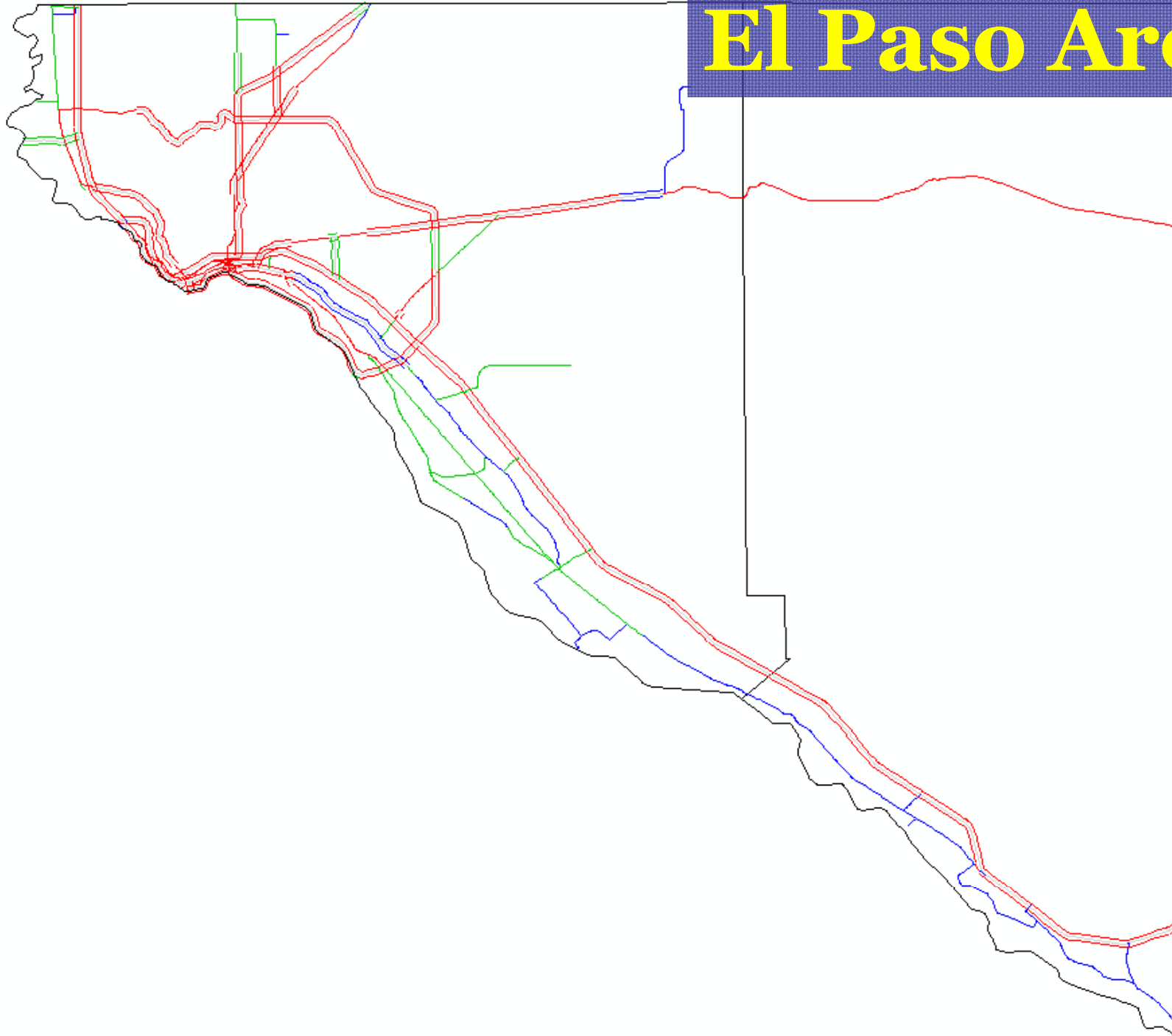
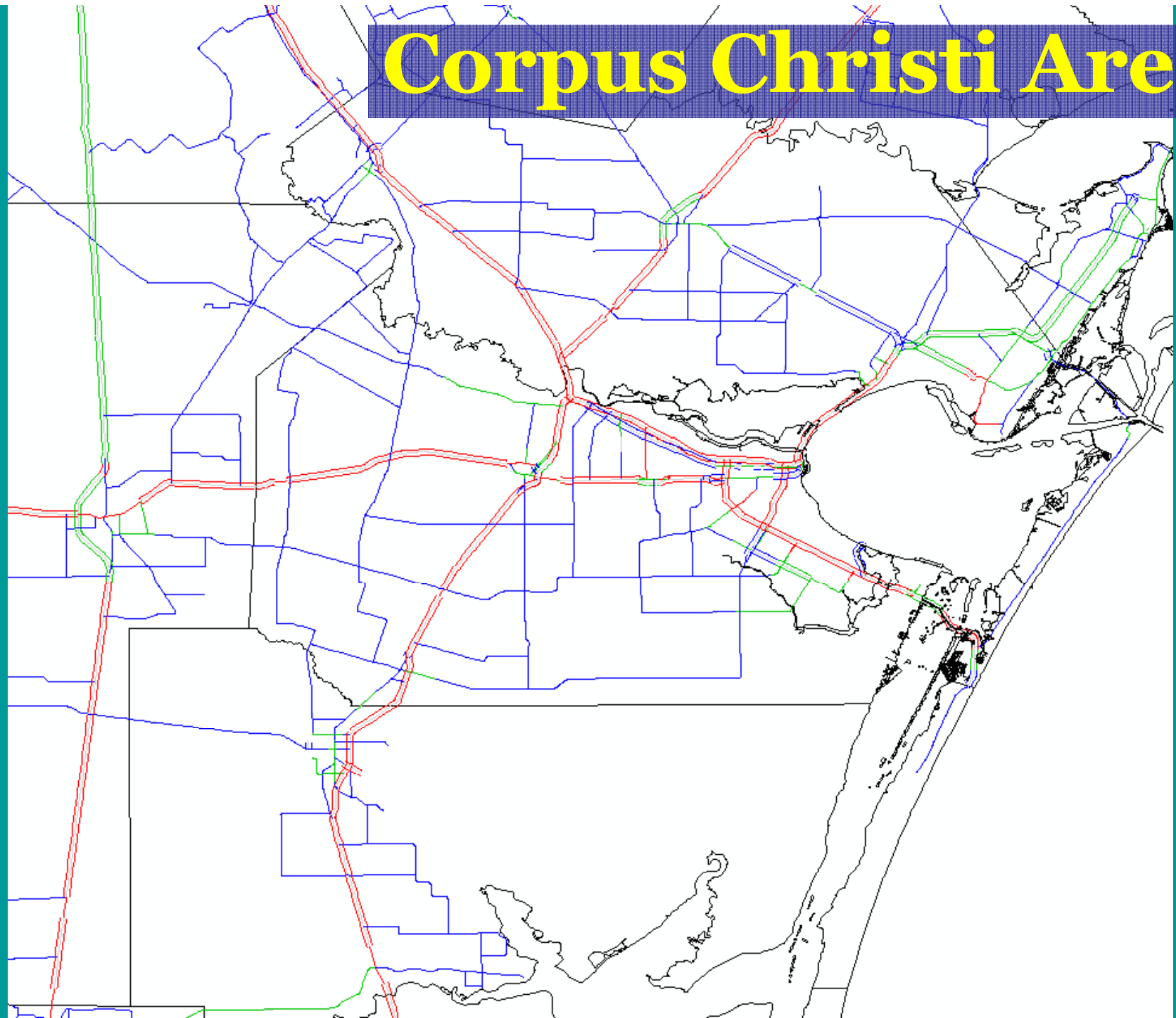Beaumont, Port Arthur, & Orange Area
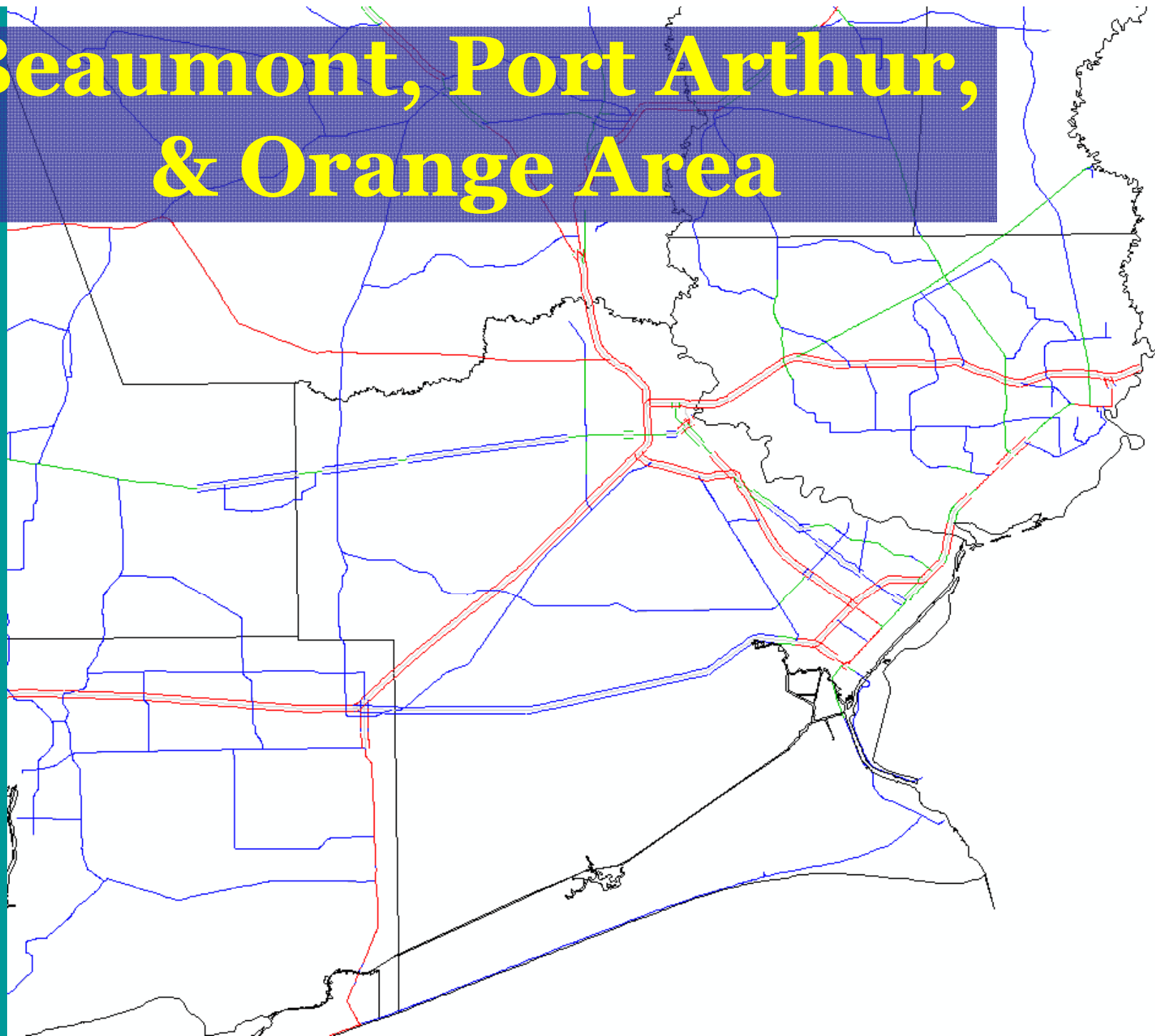
Tyler Area
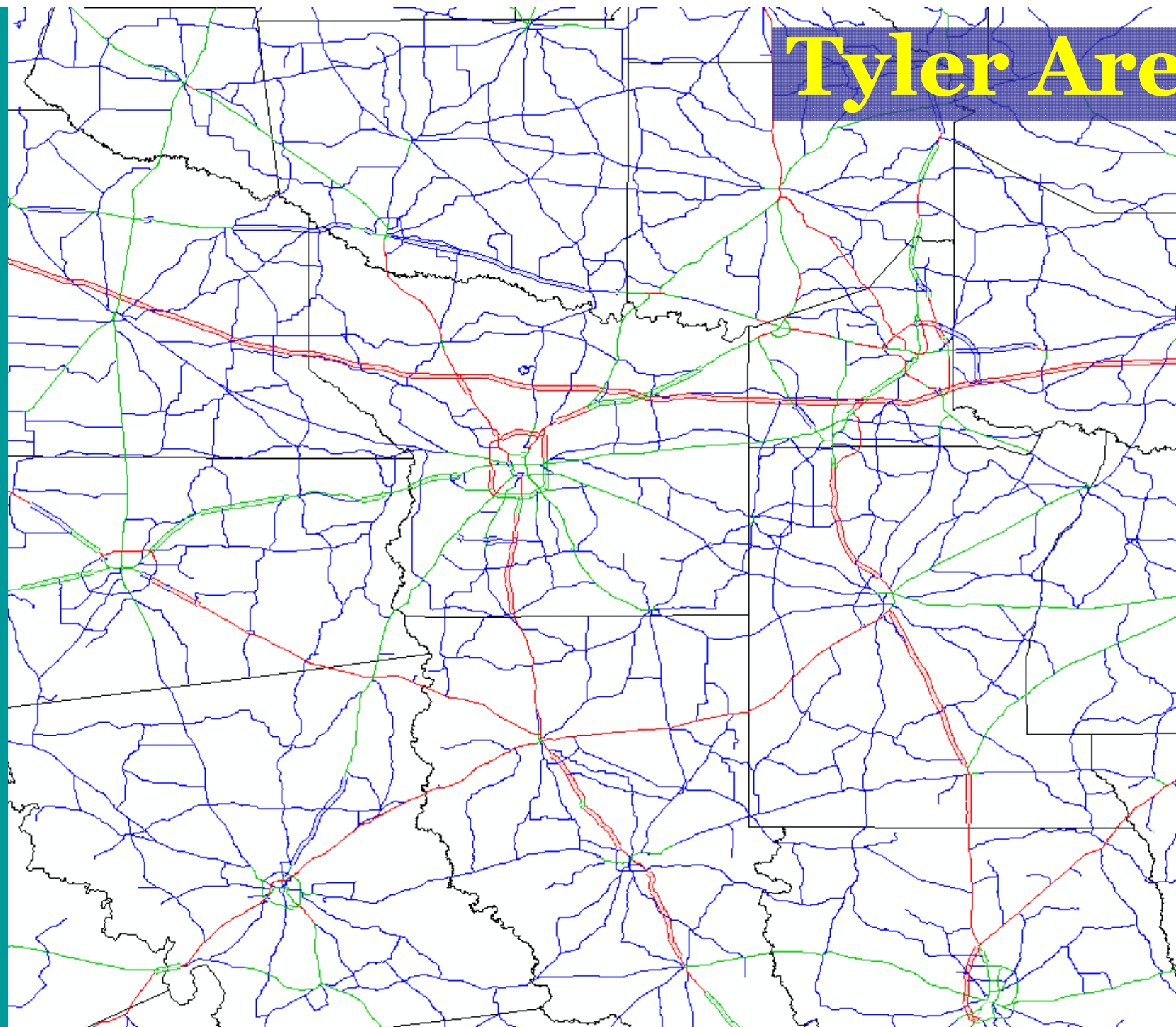
Lubbock Area
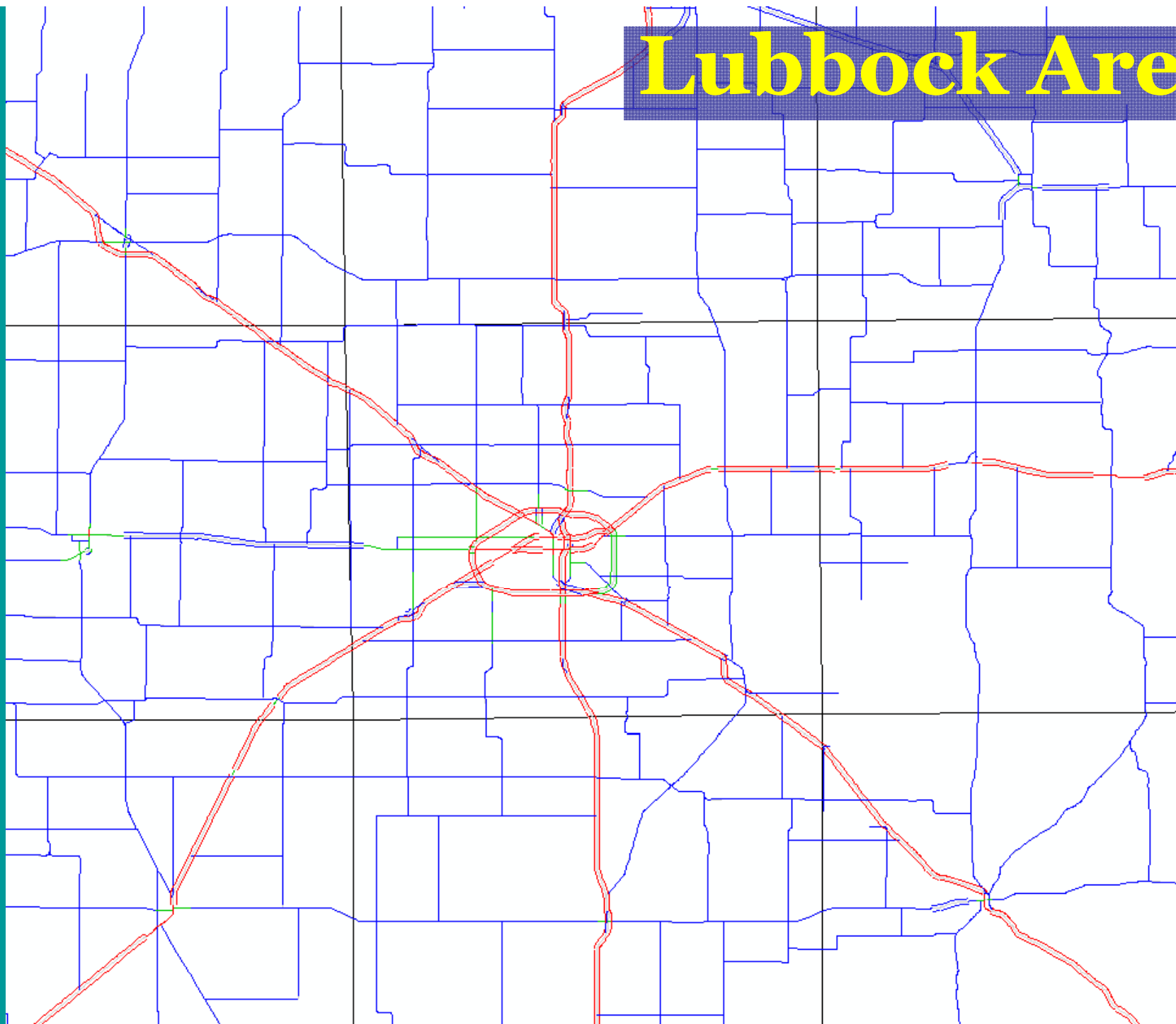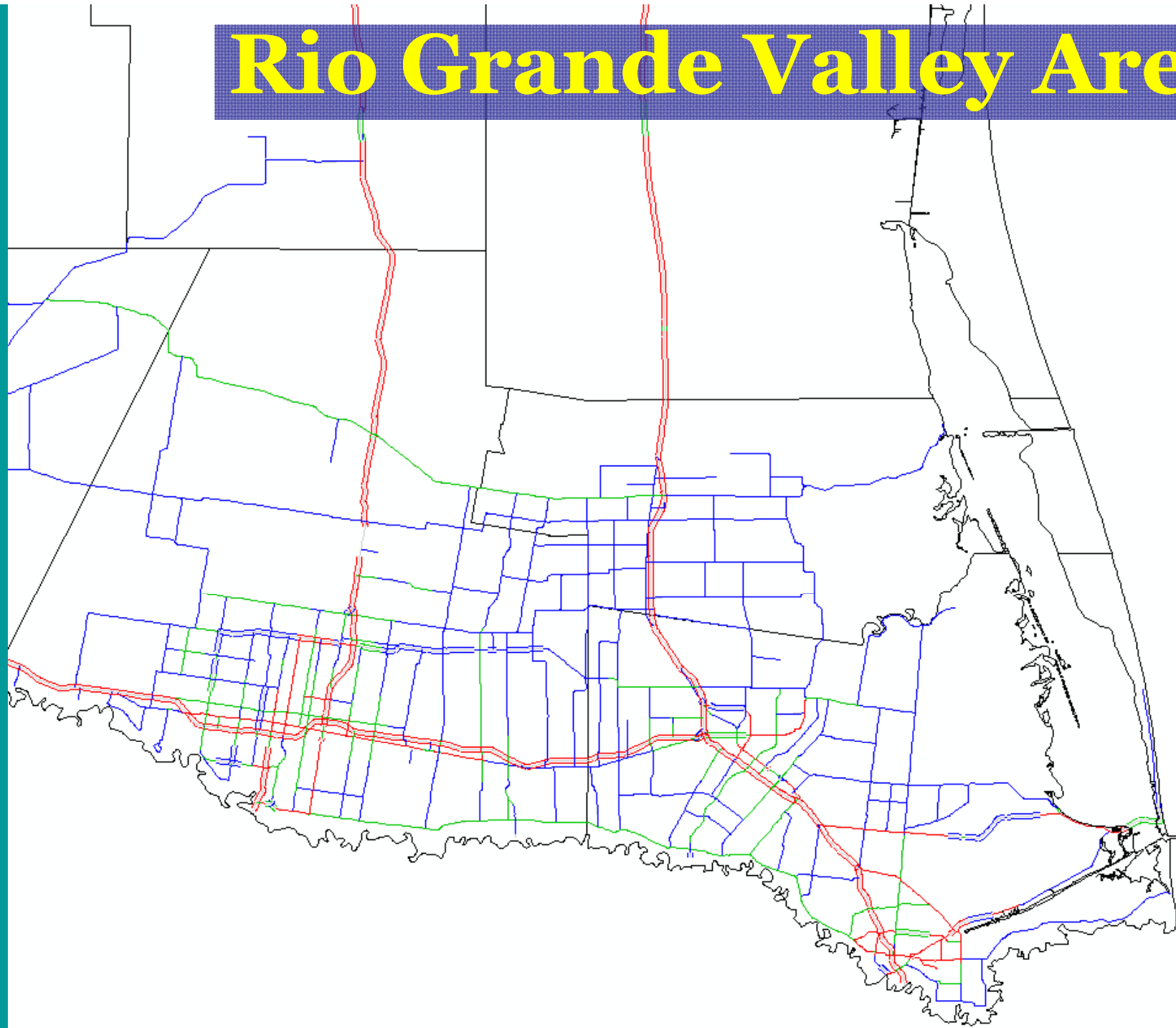
Midland & Odessa Area
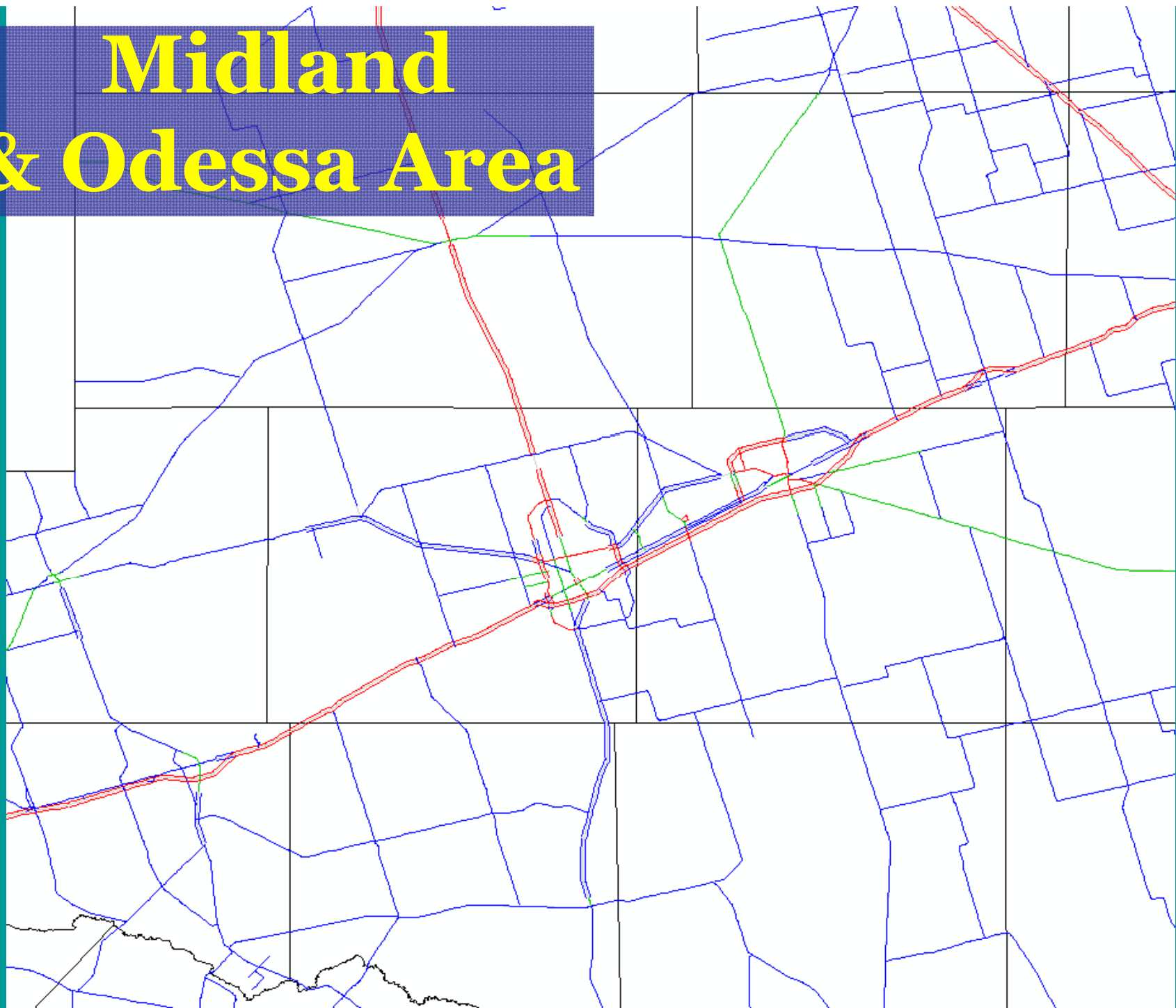
San Angelo & Abilene Area
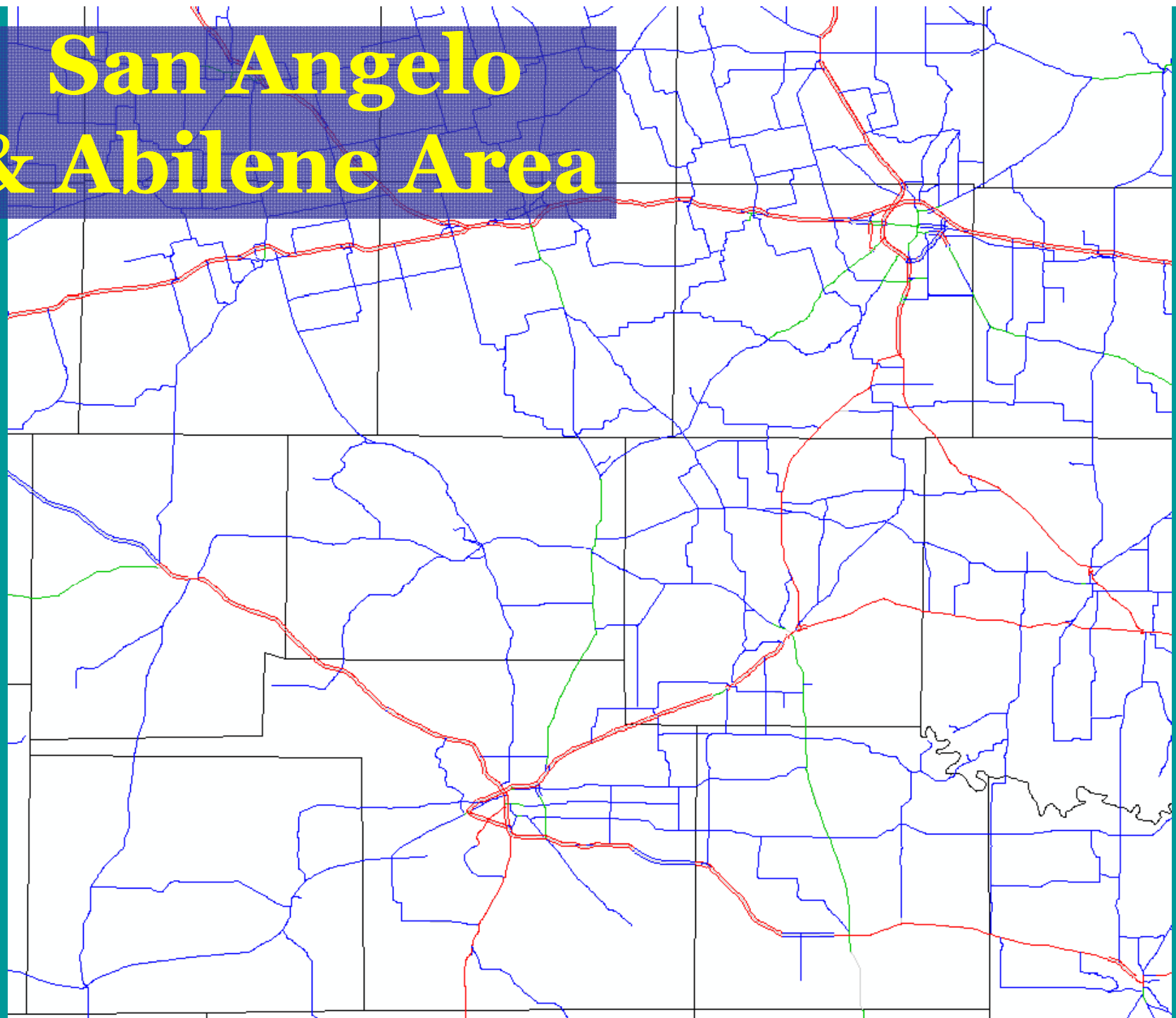
Corpus Christi Area

Rio Grande Valley Area

Current System Condition and Potential Scenarios Utilizing a Three Tier System

Condition Goal Scenarios
Percentage of Lane Miles in "Good" or Better Condition

	Current (2009)	Scenario 1	Scenario 2	Scenario 3	Scenario 4 A (with current UTP Funding)	Scenario 4 B (with current UTP Funding)
Tier 1	85.69/ 2.72	90/1*	90/1*	80/1*	70/1*	80/1*
Tier 2	80.99/ 3.85	90/3*	80/3*	70/3*	70/3*	50/3*
Tier 3	87.31/ 1.74	90/5*	70/5*	50/5*	28/5*	25/5*

*   1st number is percentage 'Good' or better (to exceed).
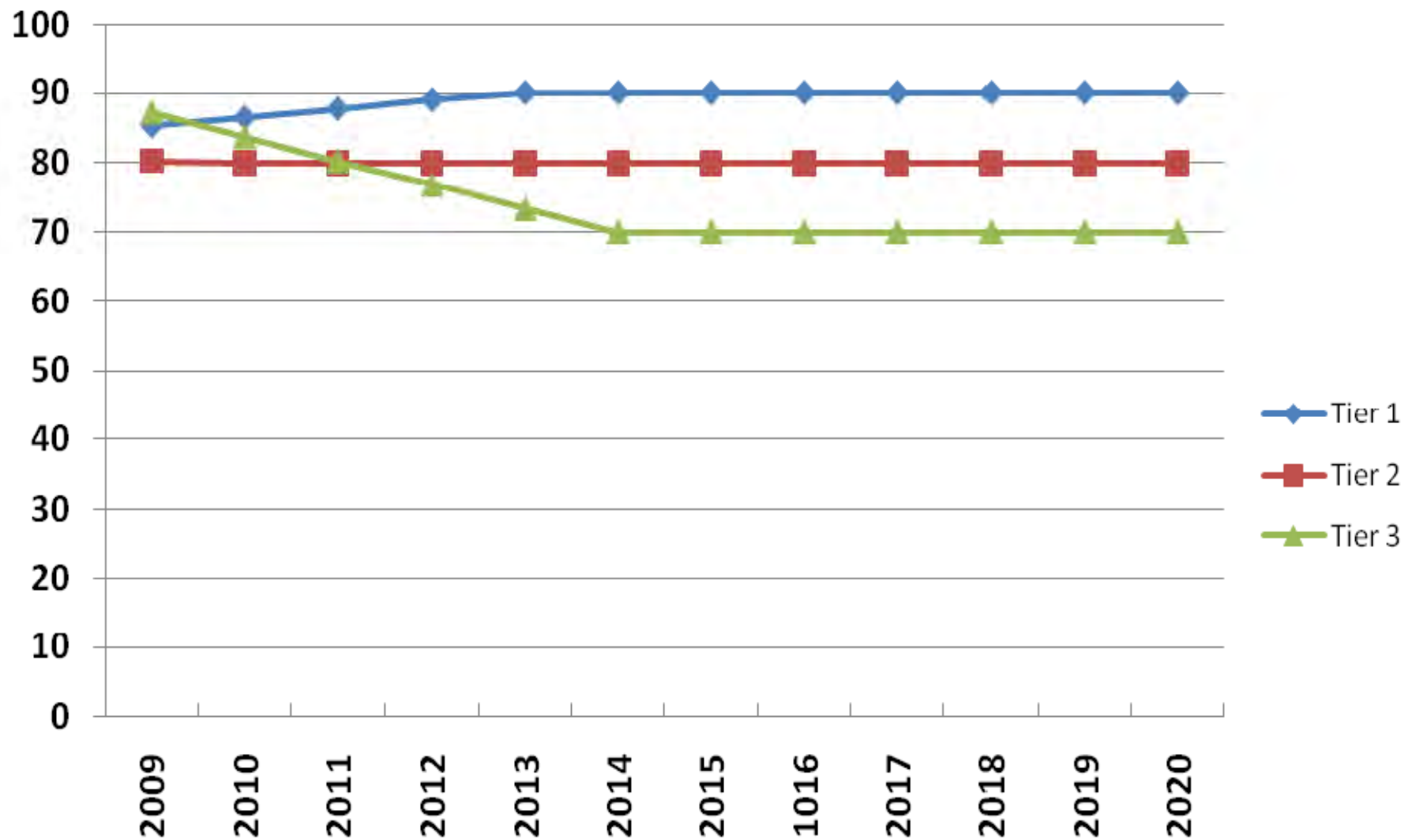   2nd number is percentage 'Very Poor' (not to exceed).

Estimated M&R Needs
(FY 2010 – 2020 in 2008 Dollars)

|	Current (2009)	Scenario 1 90/90/90	Scenario 2 90/80/70	Scenario 3 80/70/50	Scenario 4 A 70/70/28	Scenario 4 B 80/50/25
Tier 1	85.69/ 2.72	$11.02	$10.88	$8.46	$6.28	$8.46
Tier 2	80.99/ 3.85	$4.61	$3.76	$3.11	$2.85	$1.89
Tier 3	87.31/ 1.74	$25.28	$14.79	$9.01	$2.28	$1.06
Total	85.94/ 2.30	$40.90	$29.43	$20.58	$11.41	$11.41

Annual Goals for Scenario #3
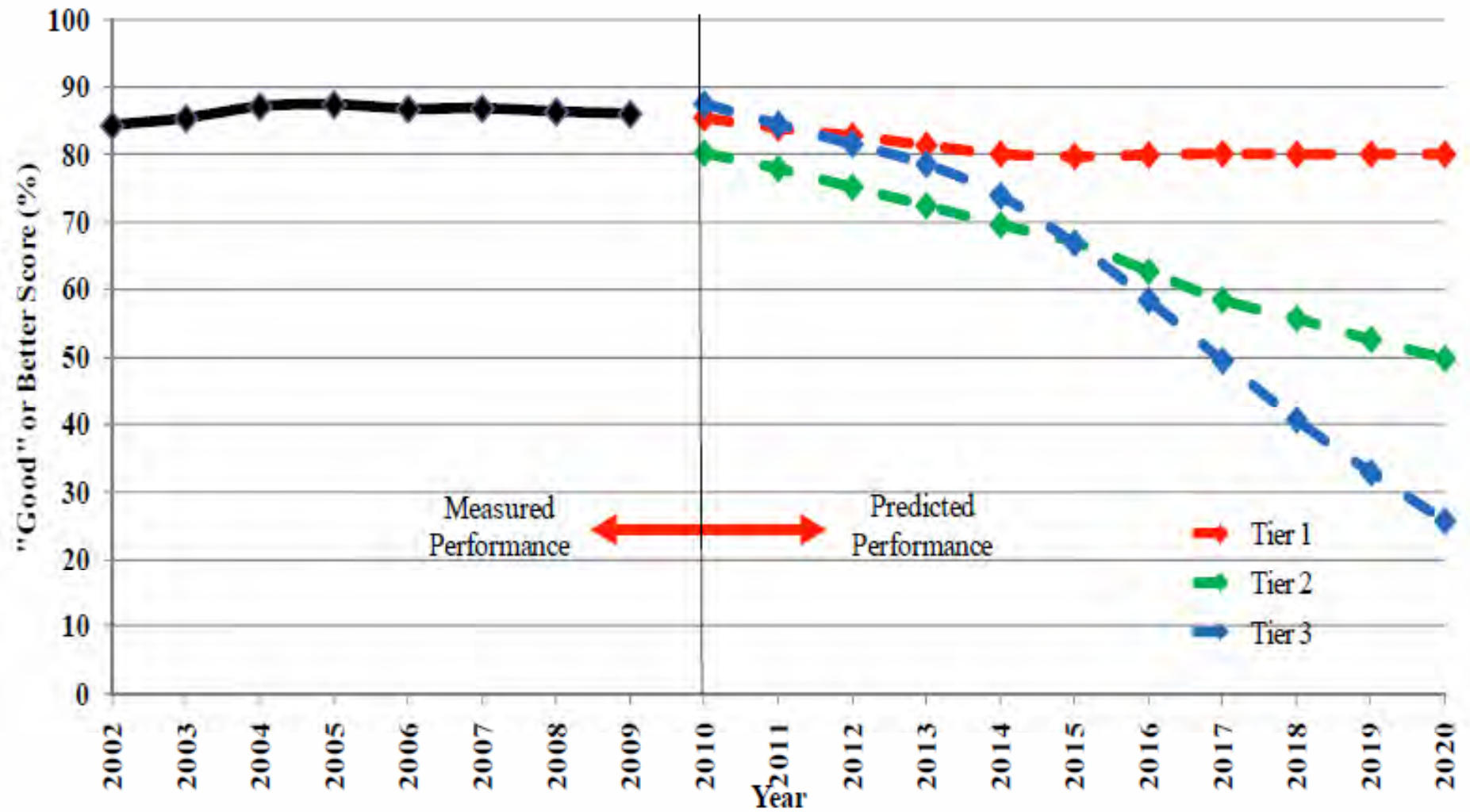## 80 % (Tier 1), 70 % (Tier 2), 50 % (Tier 3)
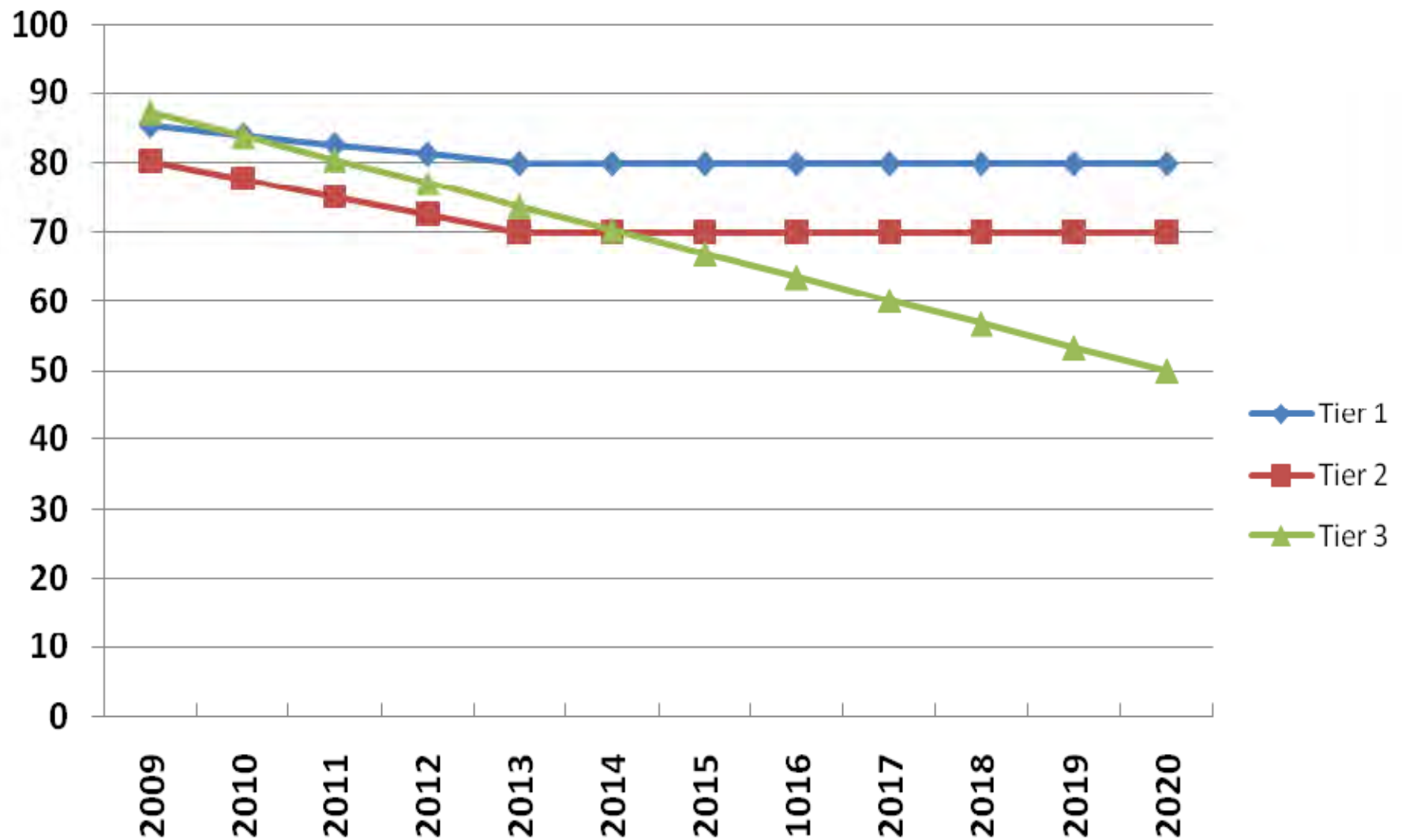
Scenario 4 A

55% of CAT 1 funds for Tier 1, 25% of CAT 1 funds for Tier 2, and 20% of CAT 1 funds for Tier 3
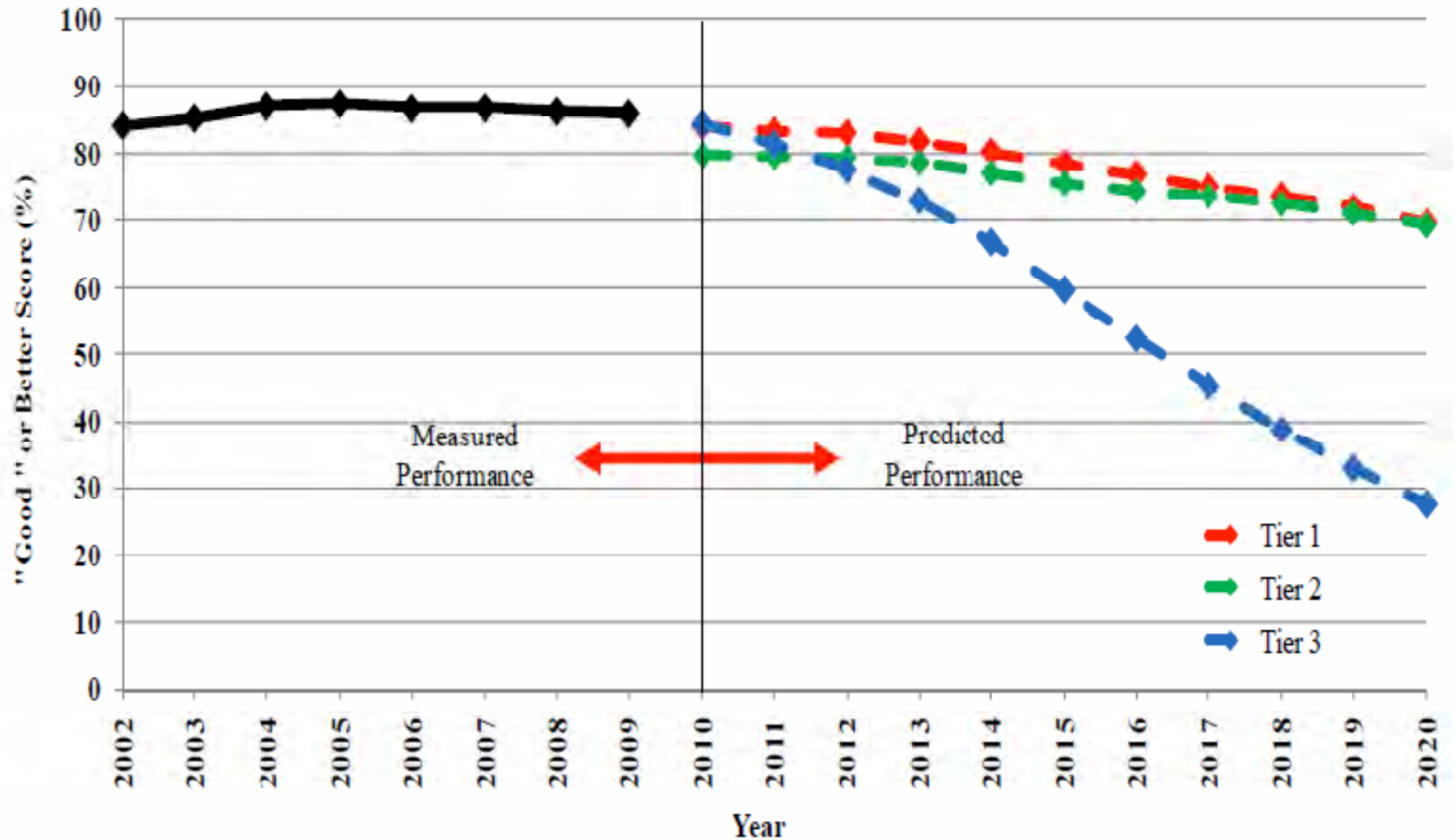
Scenario 4 B

Using current available UTP Pavements Allocation ($11.41B) and held Tier 1 to 80% "Good or Better" how far would the rest of the System Slip

FY 2010 Estimated Maintenance & Rehabilitation Needs, by District
(In Constant 2008 $)

District	Current Maintenance & Rehabilitation Funding Distribution	Scenario 4 A		Scenario 4 B	
Abilene	$288,374,263	$158,591,100	↓	$234,160,200	↓
Amarillo	$571,682,575	$185,869,400		$321,633,400	
Atlanta	$241,667,837	$274,527,600		$291,571,200	
Austin	$562,468,689	$839,182,200		$740,852,500	
Beaumont	$370,673,818	$433,818,400		$362,187,400	
Brownwood	$104,960,626	$99,735,800		$153,300,200	
Bryan	$417,004,285	$321,488,600		$351,464,500	
Childress	$114,381,228	$41,755,800		$85,290,400	
Corpus Christi	$573,913,809	$349,029,900		$356,081,400	
Dallas	$1,314,431,955	$1,595,531,000	↑	$1,463,025,700	↑
El Paso	$308,016,853	$265,831,200		$301,926,000	
Fort Worth	$782,062,983	$932,308,400		$891,748,700	
Houston	$1,328,638,658	$1,893,578,400	↑	$1,800,055,400	↑
Laredo	$288,888,474	$167,267,300		$254,377,500	
Lubbock	$515,321,555	$187,685,800	↓	$295,384,600	↓
Lufkin	$199,546,800	$272,371,800		$277,087,700	
Odessa	$278,351,301	$172,885,100		$243,784,000	
Paris	$328,719,207	$267,578,100		$228,625,700	
Pharr	$360,243,801	$548,389,800	↑	$488,887,000	↑
San Angelo	$141,692,234	$95,353,900		$167,405,800	
San Antonio	$869,331,252	$940,390,400		$928,659,600	
Tyler	$377,286,412	$535,169,000		$420,702,100	
Waco	$426,085,354	$391,116,700	--	$318,003,100	--
Wichita Falls	$240,190,735	$149,449,900		$182,106,400	
Yoakum	$406,065,296	$288,289,100		$255,444,500	
STATEWIDE	$11,410,000,000	$11,407,194,700		$11,413,765,000	

Current Category 1 Allocation

Current Rehab Portion:

• **Based on Lane Miles with Deep Distress, VMT, ESAL-Miles, and Distress Score below 70.**

Current Preventive Maintenance (PM) Portion:

• **Based on Estimated Seat Coat Lane Miles (ADT 1 to 9,999), Estimated Thin Overlay Lane Miles (ADT 10,000 or more), Distress Score 70-89, and Bridge Deck Area.**

Ideas for Different Formulas for Each Tier

Tier 1 – Rehab Almost Totally
(Use low Condition Score, Deep Distress, Trucks?)

Tier 2 – Mainly Rehab, Some PM
(Note that Tier 2 is in the worst condition.)

Tier 3 – PM Almost Totally
(Low funding but can do lots of mileage.)

Questions:

- **Do we need an overall goal for statewide (Tiers 1-3)?**
- **No more than 2-5% below a specific target ?**

Questions We Face and Definition of Issues and Concerns

- What are the most effective strategies to preserve the system and provide the highest achievable pavement conditions for the greatest number of Texans?

- How do we manage risk as pavement system conditions deteriorate due to limited pavement preservation funding?

- What are the consequences in terms of road user costs and other factors of allowing portions of the state network to deteriorate?

- How should the Category 1 Pavement funding allocation formula change?

- How are other State DOTs facing the challenges of a constrained budget?

Where Do We Go from Here?

- **Interim Report #1 - identification of issues and concerns -- April**

- **Interim Report #2 - in-depth analysis of other states' experiences and lessons learned -- May**

- **Interim Report #3 - development of a minimum of 3 reasonable scenarios for consideration and discussion -- July**

- **Final Report - Conclusions and Recommendations -- August**

- **Anticipate interaction with the Commission in July and September**

- **Also anticipate interaction with the Texas Transportation Plan effort and leverage that effort to gain wider input. Wayne Dennis is asked to serve on the workgroup to facilitate this interaction.**

Wrapping Up

- **Assignments**

- **Next meeting date**

Discussion???