TEXAS DEPARTMENT OF TRANSPORTATION

Condition of Texas Pavements

PMIS Annual Report FY 2004-2007

Condition of Texas Pavements

Pavement Management Information System (PMIS)
Annual Report FY 2004-2007

Prepared by
Texas Department of Transportation
Construction Division, Materials and Pavements Section

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What's New in This Report?

- "Deep Distress Score" tables, charts, and maps were added to Chapters 1 through 5. "Deep Distress Score" is a subset of the PMIS Distress Score, and only includes distress types believed to indicate sub-surface structural rehabilitation needs.
- Chapter 6 maintenance level of service definitions for Shallow Rutting and Deep Rutting were changed to treat 1 percent the same as 0 percent.
- Chapter 8 needs estimate treatment ACP705 was changed to trigger preventive maintenance treatment for Deep Rutting greater than 1 percent (instead of greater than 0 percent).

Also of Interest in This Report...

- The PMIS sample for visual distress, ride quality, and rutting increased to 100 percent in fiscal year 2001.
- The definitions for Shallow Rutting and Deep Rutting were changed in fiscal year 2001.
- Bar charts and maps have been added for International Roughness Index (IRI), a measurement that is used in construction specifications for as-built ride quality.
- Chapter 2 maps contain insets of the urban areas with Interstate loops.
- Chapters 3, 4, and 5 include pictures of pavement distress types for ease of reference.
- Chapter 3 ACP distress maps show the average rating for each distress type.
- Chapter 7 contains expanded information about the Texas Transportation Commission's statewide pavement condition goal, including data storage percentages and prioritized lists of the distress types and ride quality items most needing to be improved.
- Chapter 9 contains statewide county and district boundary maps, along with lists of county and district names.

How Data Was Analyzed In This Report...

- Data analyzed in this report was obtained from all PMIS sections, mainlane roadbeds, Condition Scores greater than 0, excluding sections under construction. This analysis was consistent for the entire report except for the following portions of Chapter 7:
- UTP Category 1 pages were based on all PMIS sections, mainlanes and frontage roads, Distress Score or Ride Score greater than 0 (where applicable), excluding sections under construction.
- FHWA NHS ride quality tables were based on NHS sections, mainlanes only, with IRI left and right wheelpath greater than 0.

Cover Photo:
IH 35 in Temple, Waco District
Photo by Stan Williams, TxDOT.

Executive Summary

This report describes the condition of Texas pavements in Fiscal Year 2007 and during the four-year FY 2004-2007 period, based on analysis of Pavement Management Information System (PMIS) distress ratings and ride quality measurements. The report includes the major highway systems (IH, US, SH, and FM) and pavement types (ACP, CRCP, and JCP), along with maintenance level of service information, pavement-related performance measures, and estimates of preventive maintenance and rehabilitation needs.

"Distress" refers to various types of surface deterioration (such as ruts, cracks, potholes/failures, and patches). "Ride quality" refers to the smoothness of the pavement surface. "Condition" is a mathematical combination of the "distress" and "ride quality" data that describes the average person's perception of pavement quality.

The overall condition of Texas pavements got slightly worse in FY 2007 mainly because of increased distress on asphalt pavements. Overall pavement distress got worse, but overall ride quality improved. A prolonged drought that began in mid-FY 2005 and lasted through all of FY 2006, rising material costs, increased competition for limited construction materials, and increased oilfield development traffic contributed to the decline in statewide pavement condition.

Although overall pavement condition declined, the statewide pavement condition goal percentage of lane miles in "Good" or better condition increased from 86.69 percent in FY 2006 to 86.76 percent in FY 2007.

Pavement condition and distress trends were mixed, but ride quality improved for each of the four major highway systems (IH, US, SH, and FM) in FY 2007. IH and SH routes improved in all categories – condition, distress, and ride. US highways improved in distress and ride, but the improvements were all very small, and were not enough to keep the overall condition from getting worse. FM roads improved in ride quality, but got worse in condition and distress.

ACP condition and distress got worse, but ride quality improved in FY 2007. CRCP condition and distress improved, but ride quality got worse. JCP condition and ride quality improved, but distress got very slightly worse.

"Deep" distress types in PMIS suggest the need for sub-surface rehabilitation to restore structural strength. The following "deep" distress types got worse in FY 2007: Deep Rutting, Failures, and Longitudinal Cracking for ACP, and Slabs with Longitudinal Cracks for JCP. No "deep" distress types got worse on CRCP.

The overall "Combined" level of service maintained on Texas flexible (ACP) pavements got worse in FY 2007, despite an improved level of service for Alligator Cracking. "Low-traffic" and "Medium-traffic" mileage got worse, while "High-traffic" level of service did not change.

Condition trends in this report are based on average PMIS Scores, weighted by lane miles. They are not the same as the percentage "good" or better trends shown in the *Status of Statewide Pavement Condition Goal*, *FY 2004-2007 – Full Version* report.

History of Changes Affecting PMIS Data and Scores (FY 1993-2002)

FY 1993: PMIS begins (uses 0.5-mile sections, 100 percent IH sample, 50 percent non-IH sample); first estimates of statewide pavement needs (lane miles and dollars).

FY 1996: First automated rut measurements. PMIS Shallow Rutting and Deep Rutting values increased because the automated equipments was able to "see" ruts that raters missed. **Increased Shallow Rutting and Deep Rutting values; lowered Distress Scores and Condition Scores.**

FY 1997: Automated rut measurements much higher than FY 1996 because of "old" acoustic sensors that had been used in the previous year (sensors replaced every year afterwards because of this problem). Also, beginning of ride quality equipment conversion to laser profiler (IRI) that was completed in FY 1999.
Increased Shallow Rutting and Deep Rutting values; lowered Distress Scores. Conversion to laser profiler lowered Ride Scores. Mixed effect on Condition Scores.

FY 1998: Second third of ride quality equipment converted to laser profiler (IRI).
Lowered Ride Scores and Condition Scores.

FY 1999: Remainder of ride quality equipment converted to laser profiler (IRI).
Lowered Ride Scores and Condition Scores.

FY 2000: CRCP Spalled Cracks definition changed to count only large spalled cracks (3-inch instead of 1-inch); Distress Score weighting factors ("utility values") changed from percentage spalled to number per mile.
Definition change increased Distress Scores and Condition Scores. Weighting factor change decreased Distress Scores and Condition Scores. Mixed effect on Distress Scores and Condition Scores overall.

FY 2001: Switch to distress ratings done by contractors; sample increased to 100 percent of all mileage; rutting definitions changed (Shallow Rutting changed from ½-1 inch to ¼-½ inch, Deep Rutting changed from 1-3 inch to ½-1 inch; Severe Rutting added as 1-2 inch; Failure Rutting added as greater than 3-inch; rut gap left from 2-3 inch); Texas Transportation Commission proposes statewide pavement condition goal (90 percent "Good" or better in ten years).
Minimal effect on PMIS distress data, Distress Scores, and Condition Scores.

FY 2002: Rut gap closed, Failure Rutting changed from greater than 3-inch to greater than 2-inch; Two- and ten-year district goals established to meet Texas Transportation Commission's statewide pavement condition goal.
Affected Failure Rutting results, but they are not used in PMIS Score definitions, so no effect on Distress Scores or Condition Scores.

History of Changes Affecting PMIS Data and Scores (FY 2003-2007)

FY 2006: Changed Rutbar dynamic calibration procedure to produce truer "zero" rut depths on concrete at highway speeds, but then subtracted 0.1 inches from each rut depth measurement to reduce effects of signal noise.
Mixed effect on Shallow Rutting and Deep Rutting; minimal effect on Distress Scores and Condition Scores. Calibration procedure produced large increases in Shallow Rutting and Deep Rutting, but subtraction of 0.1 inches from rut depth measurements more or less cancelled out the calibration procedure increases.

Description of FY 2006-2007 Rutbar Changes

Two changes to the Rutbar equipment affected PMIS Rutting measurements for FY 2006-2007:

1) Change in Rutbar Dynamic Calibration Procedure

TxDOT changed the calibration procedure for its Rutbar equipment in FY 2006 to provide truer "zero" rut depths on concrete pavements. In previous years, the Rutbar was "statically" calibrated to provide "zero" rut depths on a known flat surface while not moving. The Rutbar was then driven on a group of flexible pavement test sections in the Austin area and "dynamically" calibrated. During PMIS data collection, the dynamic calibration would be adjusted on an as-needed basis when the operator believed that the rut measurements did not look reasonable, based on field observations.

In FY 2006, TxDOT kept the "static" calibration procedure but changed the dynamic calibration procedure by measuring rut depths on concrete pavements in the Austin area. These concrete pavements were assumed to have no rutting. Each Rutbar was subjectively adjusted to produce "near zero" rut depths on the concrete sections before being approved for PMIS data collection.

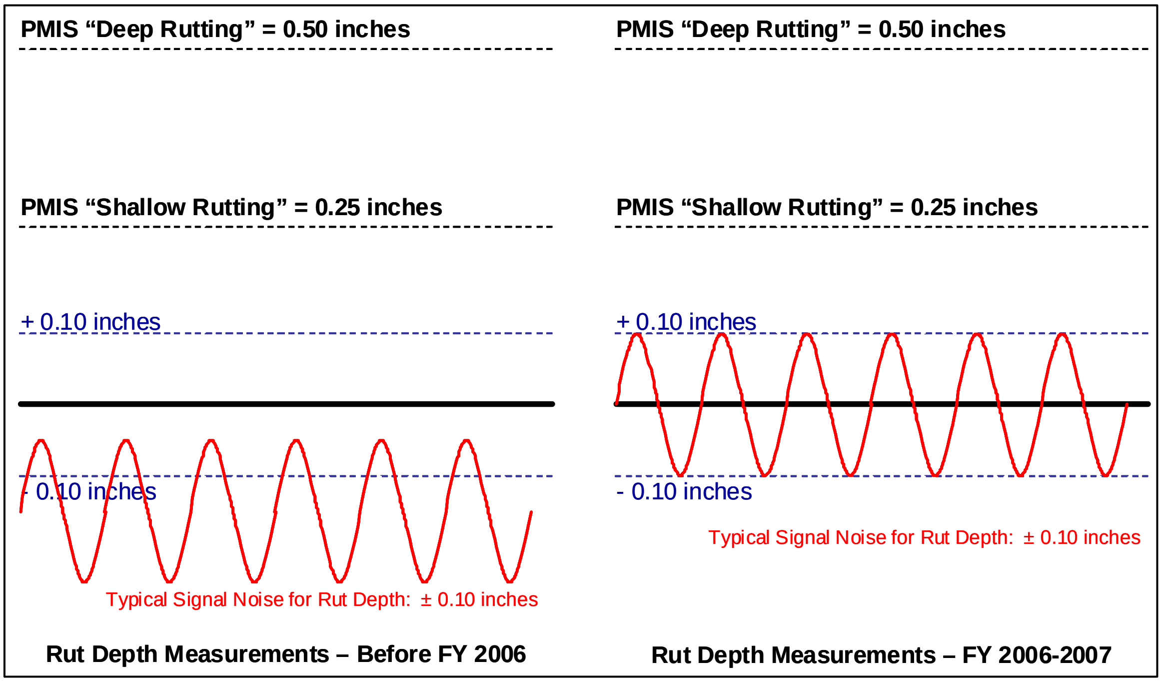
2) Adjustment of Rut Depth Measurements

The new dynamic calibration procedure took out most of the subjective adjustment of the Rutbars, but it made the PMIS rut data results much more sensitive to signal noise. This produced large increases in Shallow Rutting and Deep Rutting, especially on coarse-textured seal coats.

"Signal noise" refers to the typical variability of the Rutbar instrument due to characteristics of the electronic equipment used in the measurement and the way in which signal return strength and scatter can be affected by environmental and road conditions. For the TxDOT Rutbars, the instrument is an ultrasonic sensor that "fires" sound waves down to the pavement surface and measures the length of time for the sound waves to return to the sensor – the longer the time, the deeper the "rut." The new procedure raised the typical ±0.1-inch variability of the Rutbar ultrasonic sensor much closer to the range of Shallow Rutting. For example, a "true" 0.15-inch rut depth could be reported as anywhere from 0.05 inches ("No Rutting") to 0.25 inches ("Shallow Rutting") just because of typical sensor variability. Before FY 2006, this variability was not as noticeable because it was usually suppressed by the subjective dynamic calibration adjustments.

In a similar fashion, the new dynamic calibration change caused some Shallow Rutting to be reported as Deep Rutting. For example, a “true” 0.45-inch “Shallow Rut” could be reported as anywhere from 0.35 inches (“Shallow Rutting”) to 0.55 inches (“Deep Rutting”) because of typical sensor variability.

The following diagrams show the relationship between typical ±0.1-inch “signal noise” and PMIS Rutting. It takes 0.25 inches to produce a “Shallow Rut” in PMIS, but in FY 2006 nearly 0.1 inches of that — 38 percent — could be signal noise. Before FY 2006, signal noise was basically eliminated from showing up in the Shallow Rut category at all.



The FY 2006 changes caused large increases in Rutting reported in PMIS for FY 2006. Shallow Rutting increased from 33.96 percent in FY 2005 to 58.32 percent in FY 2006. Deep Rutting increased from 7.97 percent in FY 2005 to 24.18 percent in FY 2006. The Deep Rutting increase caused a large drop in “Rutting” and “Combined” maintenance level of service, and also caused a $239 million increase in preventive maintenance treatments to repair Deep Rutting.

Review of the FY 2006 rut depth measurements suggested that the new dynamic calibration procedure produced rut depths approximately 0.1 inches deeper than they would have been under the previous procedure. As a result, TxDOT decided to “adjust” the FY 2006 rut depth measurements by -0.1 inches statewide and then recalculate the percentages of Shallow Rutting and Deep Rutting for PMIS. These “adjusted” rut data are in the PMIS database and are shown in this report for FY 2006 **and** FY 2007 rut data.

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Chapter 1 Overall Pavement Condition

TxDOT measures ride quality and rates pavement distress on all of the State-maintained highway network each year. The ride quality measurements and distress ratings are then stored in the Pavement Management Information System (PMIS) database, which (among other things) calculates a series of three scores: Condition Score, Distress Score, and Ride Score.

Condition Score, which combines ride and distress, ranges from 1 (worst condition) to 100 (best condition). Distress Score ranges from 1 (most distress) to 100 (least distress). Ride Score ranges from 0.1 (roughest) to 5.0 (smoothest).

These PMIS scores can be used to describe the current condition of Texas pavements, to document trends in condition from year to year, and to estimate the total funding needs for pavement repair (preventive maintenance and rehabilitation).

PMIS also contains International Roughness Index (IRI) measurements. IRI is a value that many states and other countries use to describe the amount of roughness measured in a given length of pavement. PMIS contains IRI measurements in units of inches (of roughness) per mile that typically range from 1 (smoothest) to approximately 950 (roughest). IRI is similar to, but is not exactly the same as, the PMIS Ride Score, and is used as a roughness specification for pavement construction in Texas. This report includes IRI tables, figures, and maps for use by readers who are familiar with it.

Additional information about PMIS Scores and how they are calculated may be found in *PMIS Score Equations and Utility Factors*. Specific information about calculation of the PMIS Condition Score may be found in *Overview of Calculation of PMIS Condition Score*. These documents are available from the Construction Division, Materials and Pavements Section.

Average PMIS Scores

Figure 1.1 shows average PMIS Scores (Condition, Distress, and Ride) statewide from fiscal years (FY) 2004 through 2007. Average pavement condition and distress decreased, but ride quality increased in FY 2007.

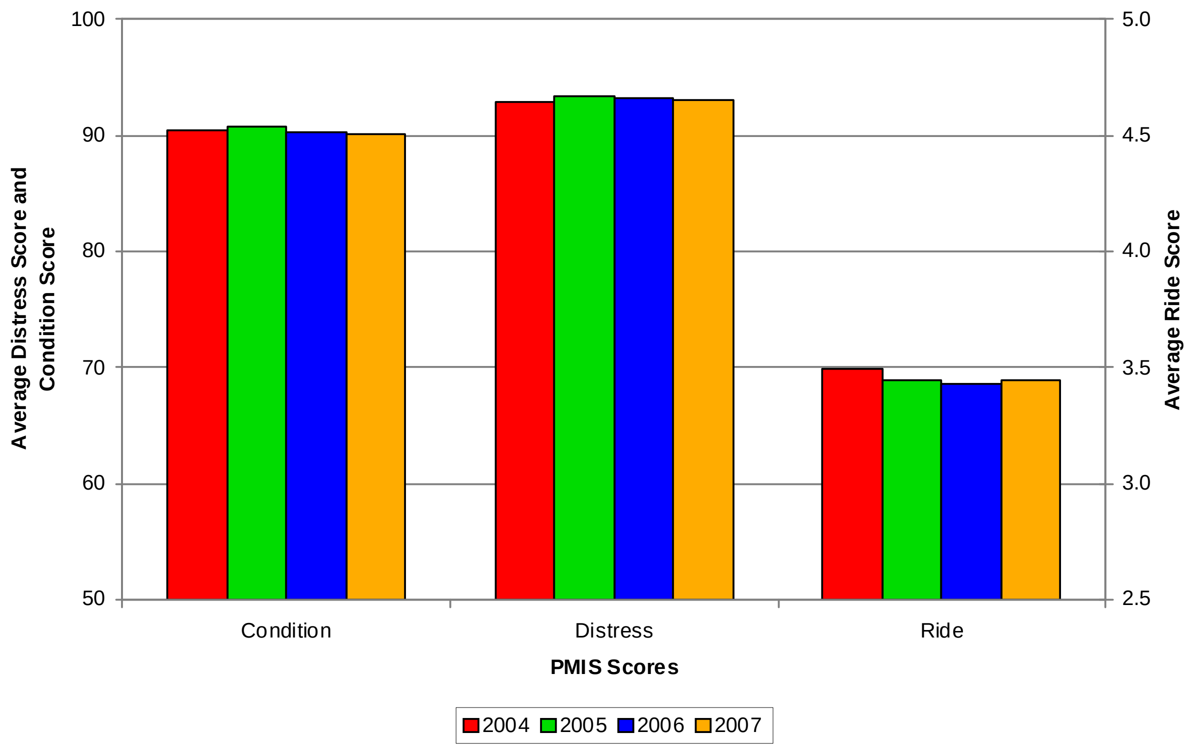


Figure 1.1 — Average PMIS Scores (with Ride), FY 2004-2007.

Figure 1.2 shows average PMIS Scores (Condition, Distress, and IRI) statewide from fiscal years (FY) 2004 through 2007. As mentioned earlier, average pavement condition and distress decreased in FY 2007. Average IRI also decreased in FY 2007, but that shows decreased pavement roughness.

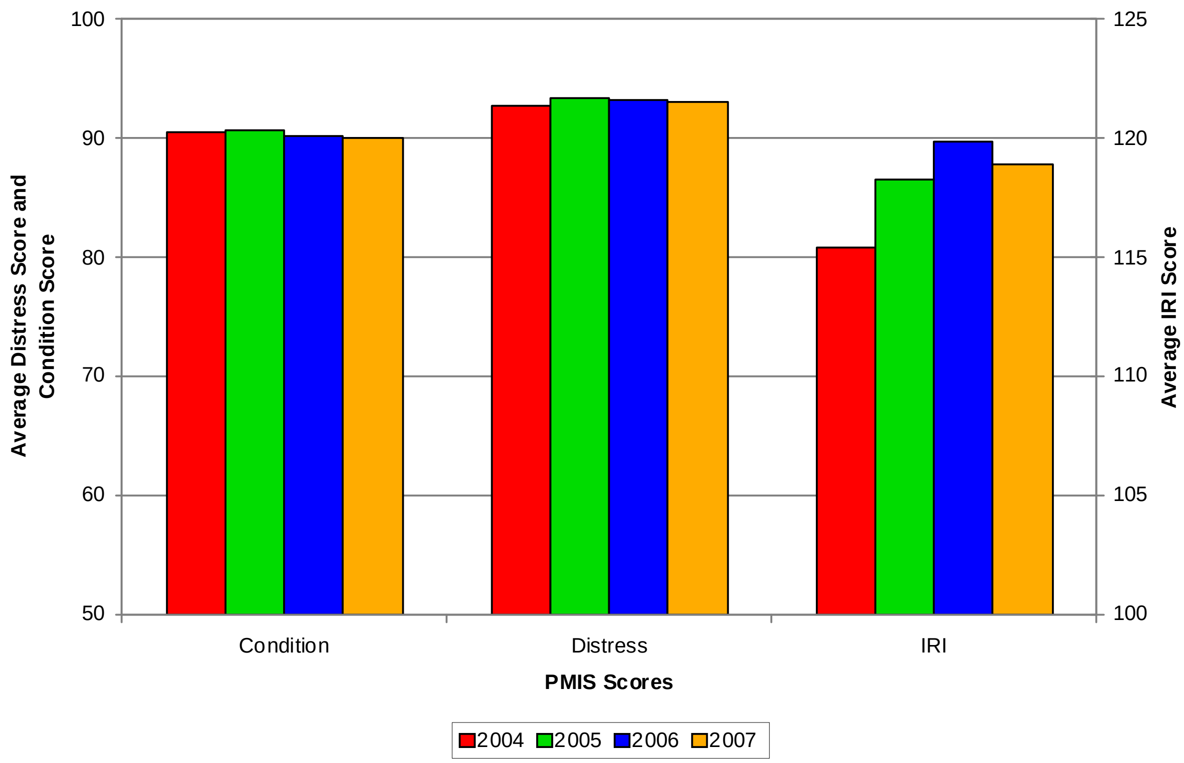


Figure 1.2 — Average PMIS Scores (with IRI), FY 2004-2007.

PMIS Condition Score Classes

The PMIS Condition Score combines ride quality measurements (“Ride Score”) and pavement distress ratings (“Distress Score) into a single description of overall pavement condition. The values range from 1 (worst condition) to 100 (best condition).

For the purposes of this report, PMIS Condition Score values have been grouped into descriptive classes, as shown below:

Table 1.1 — PMIS Condition Score Classes.

Condition Score	Description
90-100	Very Good
70-89	Good
50-69	Fair
35-49	Poor
1-34	Very Poor

NOTE: The Condition Score is a combination of ride quality and pavement distress, adjusted for traffic and speed. It is not weighted by regional factors such as climate and material properties, and it does not describe the load-carrying structural capacity of the subsurface pavement layers.

When interpreting PMIS Condition Scores, it should be noted that traffic and speed limit are included in the calculated score values. A road with high traffic (based on Average Daily Traffic) or high speed (based on Speed Limit) must have less distress and smoother ride to give the same PMIS Condition Score as a road with lower traffic or lower speed. Although this tends to give lower Condition Scores in urban and metropolitan areas, it also provides advance warning of pavement problems in high-traffic, high-speed, areas where scheduling treatments might be more difficult.

Additional information about the PMIS Condition Score may be found in *PMIS Score Equations and Utility Factors* and *Overview of Calculation of PMIS Condition Score*. These documents are available from the Construction Division, Materials and Pavements Section.

Figure 1.3 shows the statewide distribution of Condition Score classes for fiscal years 2004 through 2007. The Condition Score is a combination of ride quality measurements and distress ratings, adjusted for traffic and speed.

72.80 percent of the mainlane mileage was in “Very Good” condition in FY 2007.

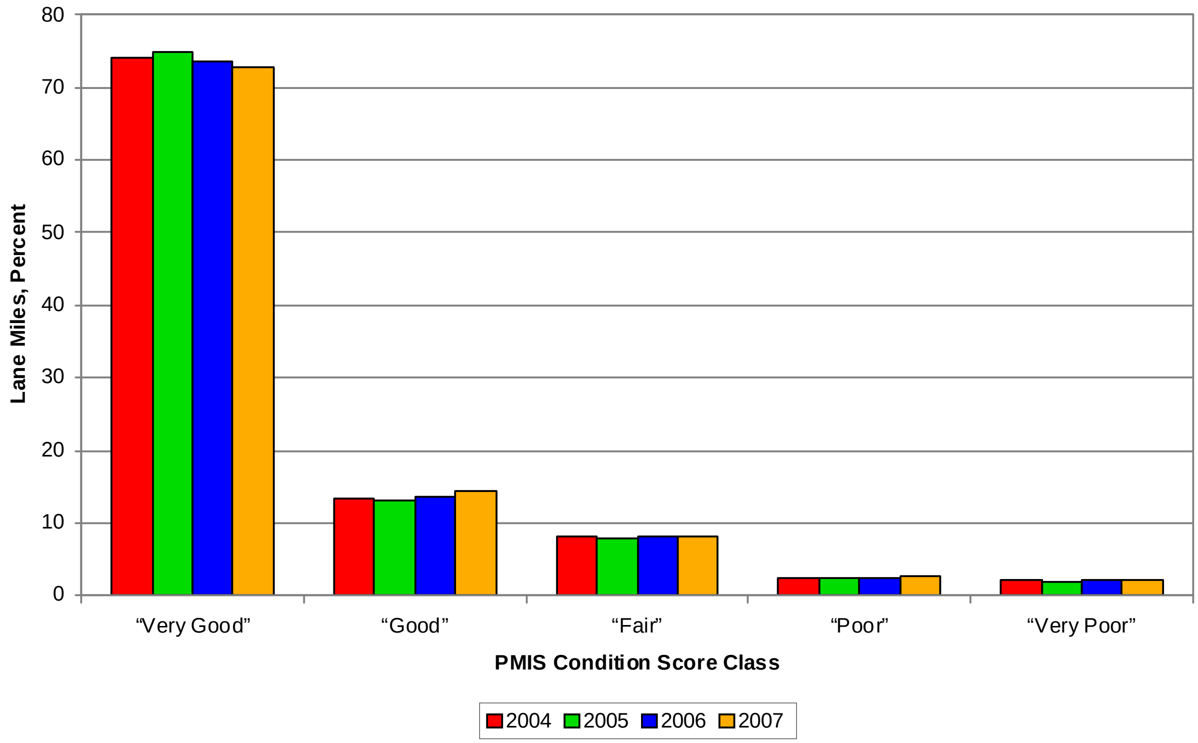


Figure 1.3 — Condition Score Classes, FY 2004-2007.

The Condition Score Classes show that:

- “Very Good” mileage decreased (from 73.60% in 2006 to 72.80% in 2007)
- “Good” mileage increased (from 13.62% in 2006 to 14.45% in 2007)
- “Fair” mileage decreased (from 8.21% in 2006 to 8.16% in 2007)
- “Poor” mileage increased (from 2.50% in 2006 to 2.53% in 2007)
- “Very Poor” mileage decreased (from 2.07% in 2006 to 2.06% in 2007).

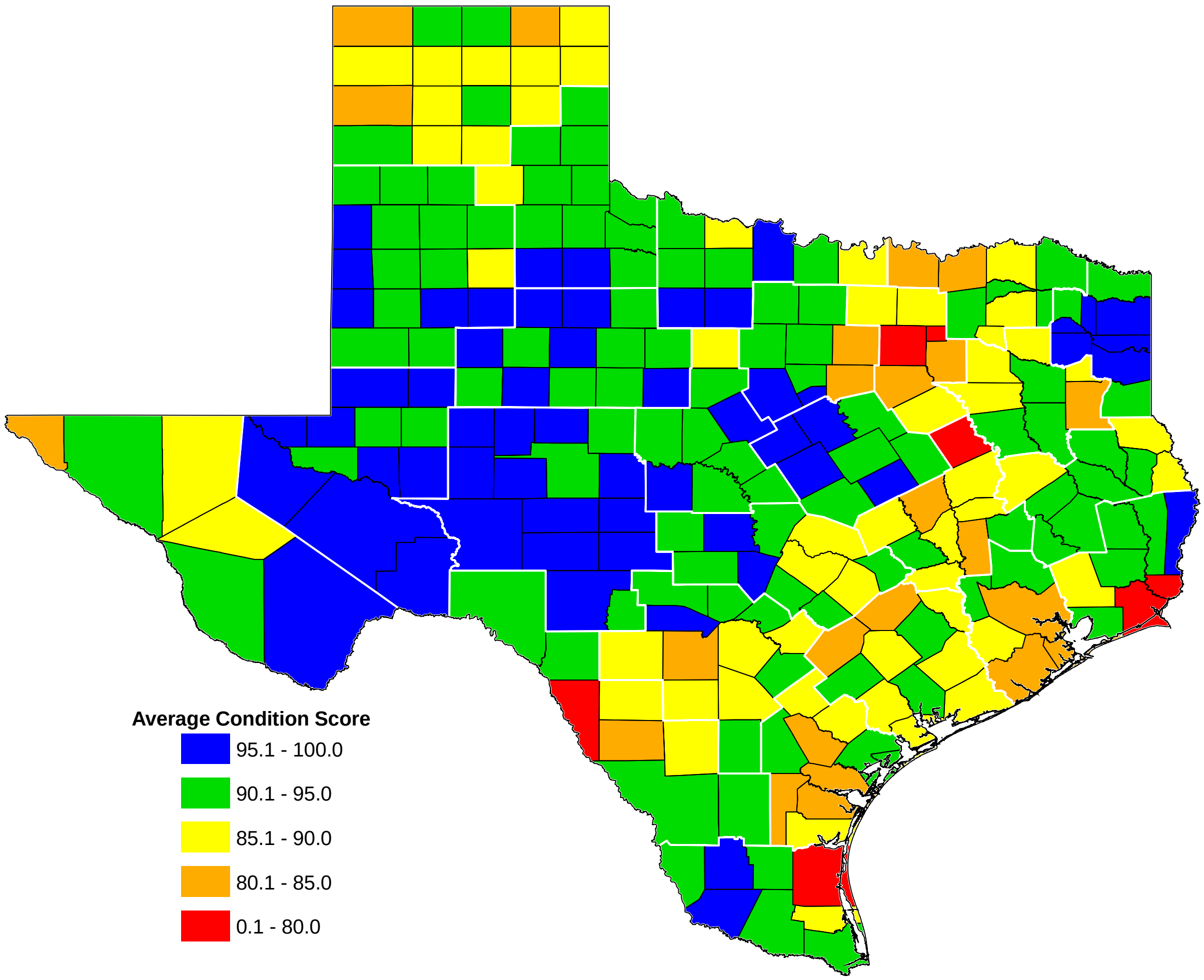
TxDOT's Pavement Management Information System (PMIS) began operation in fiscal year 1993. It replaced TxDOT's Pavement Evaluation System (PES) which began in fiscal year 1983.

Condition Score Maps, FY 2006-2007

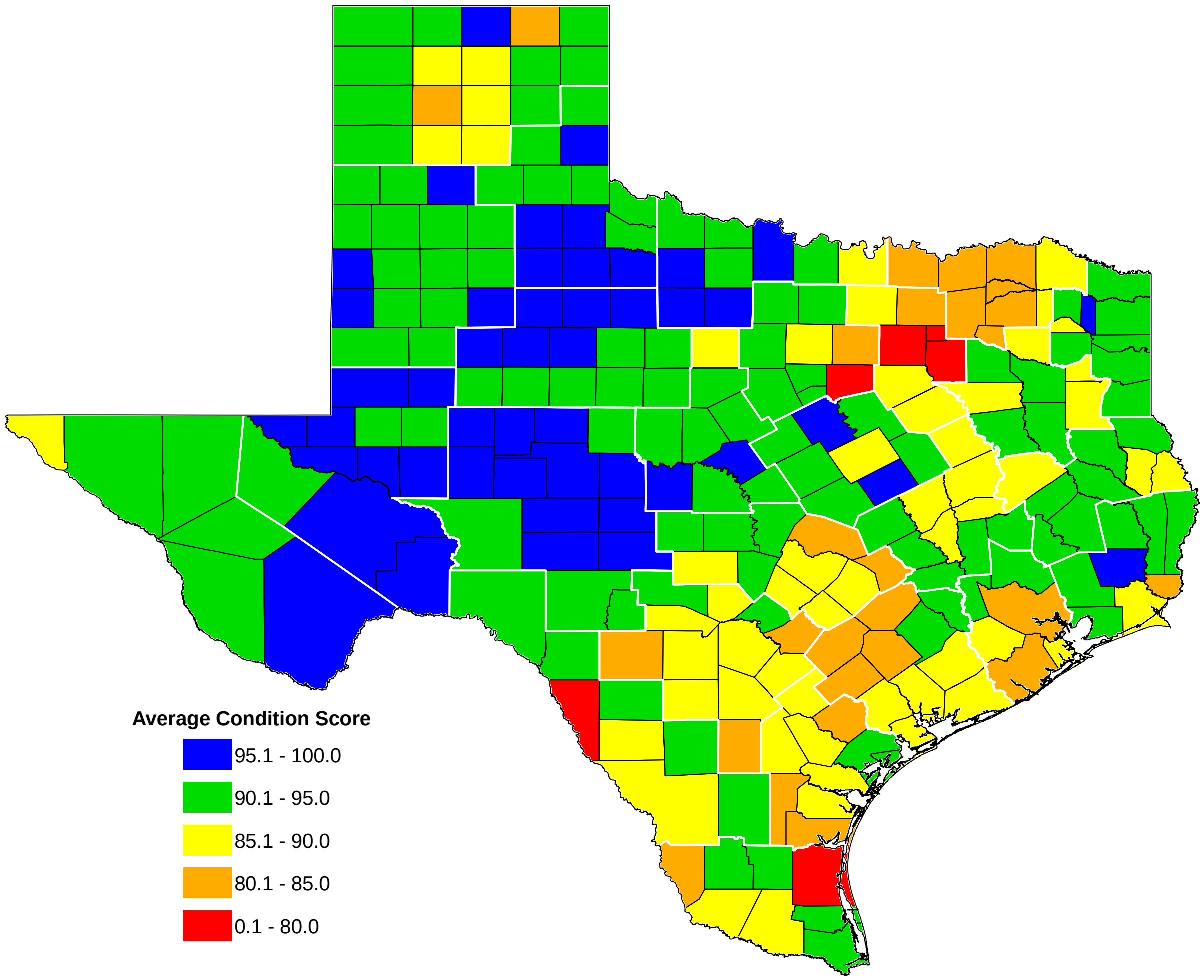
Maps 1.1 and 1.2 show average PMIS Condition Scores in each county for fiscal years 2006 and 2007. The averages are weighted by lane miles for all mainlane pavements in each county. Counties in red have the lowest average Condition Scores, while counties in blue have the highest average Condition Scores.

Overall pavement condition got slightly worse in FY 2007 because of increased pavement distress, despite an improvement in ride quality. As will be discussed in Chapters 2-5, condition improved for IH, SH, CRCP, and JCP mileage, but got worse for US, FM, and ACP mileage. Despite the slight decline in overall condition in FY 2007, many areas of the state still provide "Very Good" (90-100) pavement condition, described in terms of distress and ride quality.

Map 1.1 — Average Condition Scores, FY 2006.



Map 1.2 — Average Condition Scores, FY 2007.



PMIS Distress Score Classes

The PMIS Distress Score describes visible surface deterioration ("pavement distress") on a scale of 1 (most distress) to 100 (least distress).

For the purposes of this report, PMIS Distress Score values have been grouped into descriptive classes, as shown below:

Table 1.2 — PMIS Distress Score Classes.

Distress Score	Description
90-100	Very Good
80-89	Good
70-79	Fair
60-69	Poor
1-59	Very Poor

Distress Score is one of the factors used to calculate the PMIS Condition Score.

Additional information about the PMIS Distress Score may be found in *PMIS Score Equations and Utility Factors* and *Overview of Calculation of PMIS Condition Score*. These documents are available from the Construction Division, Materials and Pavements Section.

Figure 1.4 shows the statewide distribution of Distress Score classes for fiscal years 2004 through 2007. Distress Scores are determined from rating visually-apparent pavement distresses such as cracking, patching, and various types of failures, and also by measurements of rutting on asphalt ("flexible" or "ACP") pavement.

79.40 percent of mainlane mileage was "Very Good" in terms of pavement distress in FY 2007.

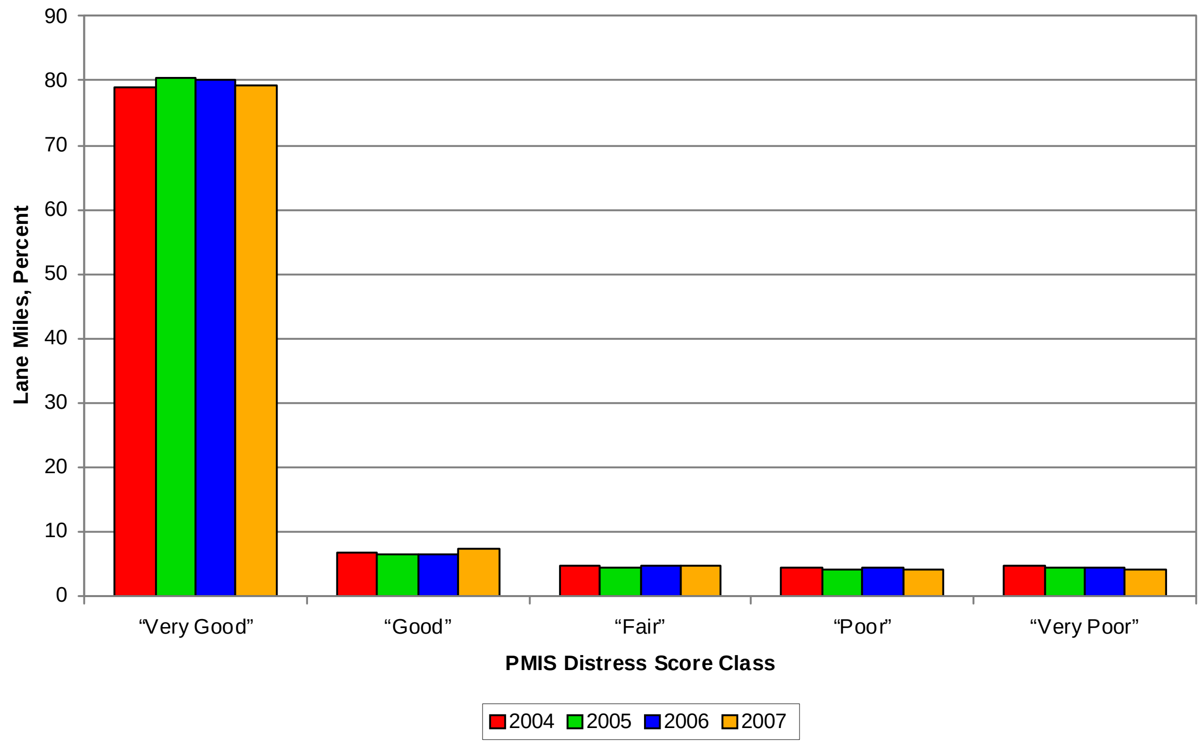


Figure 1.4 — Distress Score Classes, FY 2004-2007.

The Distress Score Classes show that:

- "Very Good" mileage decreased (from 80.06% in 2006 to 79.40% in 2007)
- "Good" mileage increased (from 6.59% in 2006 to 7.44% in 2007)
- "Fair" mileage remained the same (4.68% in 2006 to 4.73% in 2007)
- "Poor" mileage decreased (from 4.31% in 2006 to 4.20% in 2007)
- "Very Poor" mileage decreased (from 4.37% in 2006 to 4.25% in 2007).

Work on PMIS began in response to a January 1989 Federal mandate that all States have a pavement management system in place by February 1993. PMIS was completed and accepted before the Federal deadline.

Distress Score Maps, FY 2006-2007

Maps 1.3 and 1.4 show average PMIS Distress Scores in each county for fiscal years 2006 and 2007. The averages are weighted by lane miles for all mainlane pavements in each county. Counties in red have the lowest average Distress Scores, while counties in blue have the highest average Distress Scores.

Overall pavement distress got slightly worse in FY 2007. As will be discussed in Chapters 2-5, pavement distress got worse for FM, ACP, and JCP mileage.

However, although overall pavement distress got worse, most pavement distress types actually improved in FY 2007.

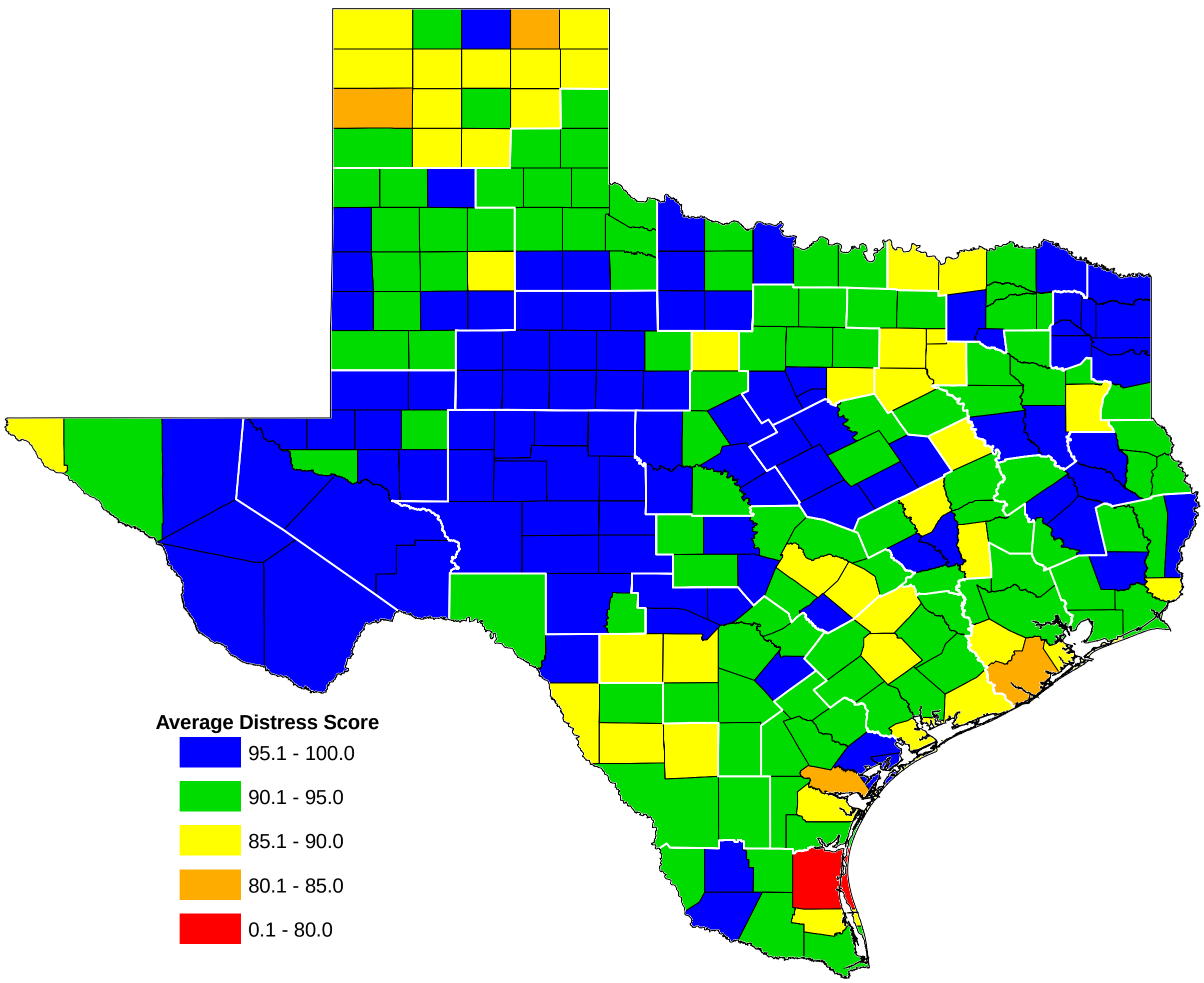
Eleven pavement distress types improved in FY 2007: ACP Alligator Cracking, ACP Transverse Cracking, ACP Block Cracking, ACP Patching, CRCP Spalled Cracks, CRCP Punchouts, CRCP Asphalt Patches, CRCP Concrete Patches, JCP Failed Joints and Cracks, JCP Failures, and JCP Shattered Slabs.

Six pavement distress types got worse in FY 2007: ACP Shallow Rutting, ACP Deep Rutting, ACP Failures, ACP Longitudinal Cracking, JCP Slabs with Longitudinal Cracks, and JCP Concrete Patching.

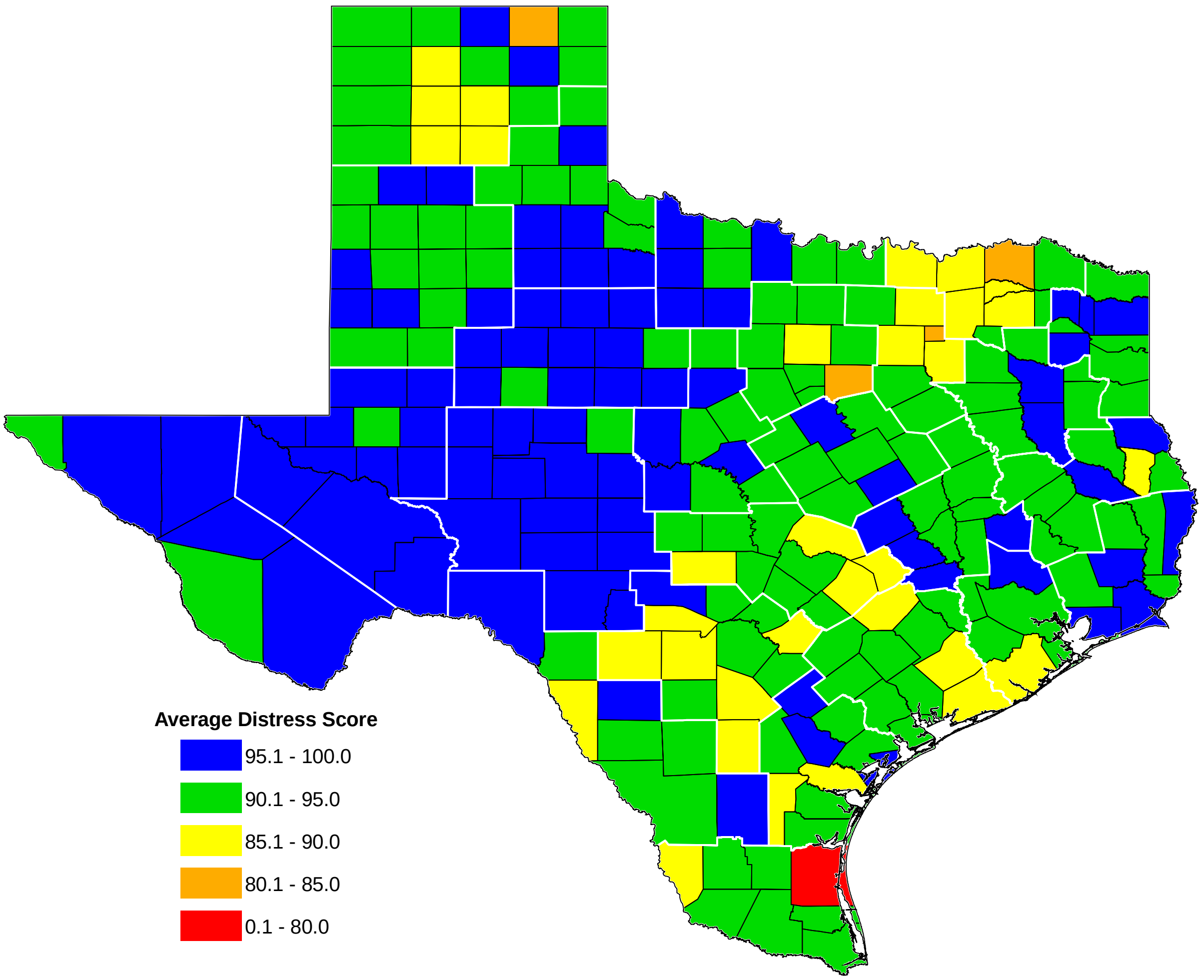
The Distress Score maps show the overall increase in the amount of pavement distress, with many counties getting worse and fewer counties getting better. However, even with the recent increase in pavement distress, most counties are still in the "Very Good" (90-100) range.

It should be noted that these Distress Score maps do not distinguish between surface ("non load-associated") and structural ("load-associated") distress types, thus they do not specifically identify preventive maintenance and rehabilitation needs. That will be done in Chapter 8 (Estimate of Total Pavement Needs).

Map 1.3 — Average Distress Scores, FY 2006.



Map 1.4 — Average Distress Scores, FY 2007.



PMIS Deep Distress Score Classes

Some of the distress types rated in PMIS indicate problems that affect the pavement structure's ability to carry traffic loads. These "deep" distress types usually require extensive – and expensive – sub-surface rehabilitation.

It is possible to separate the "deep" distress types from the overall PMIS Distress Score and create a "Deep Distress Score." PMIS sections with a "Deep Distress Score" less than 70 typically will be beyond the realm of preventive maintenance or surface repairs, and will require sub-surface rehabilitation.

For the purposes of this report, PMIS Deep Distress Score values have been grouped into descriptive classes, as shown below:

Table 1.3 — PMIS Deep Distress Score Classes.

Deep Distress Score	Description
90-100	Very Good
80-89	Good
70-79	Fair
60-69	Poor
1-59	Very Poor

The "Deep" distress types are:

- ACP Deep Rutting
- ACP Failures
- ACP Alligator Cracking
- ACP Longitudinal Cracking
- CRCP Punchouts
- CRCP Asphalt Patches
- JCP Failures
- JCP Shattered Slabs
- JCP Slabs with Longitudinal Cracks.

Figure 1.5 shows the statewide distribution of Deep Distress Score classes for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

89.48 percent of mainlane mileage was “Very Good” in terms of pavement deep distress in FY 2007.

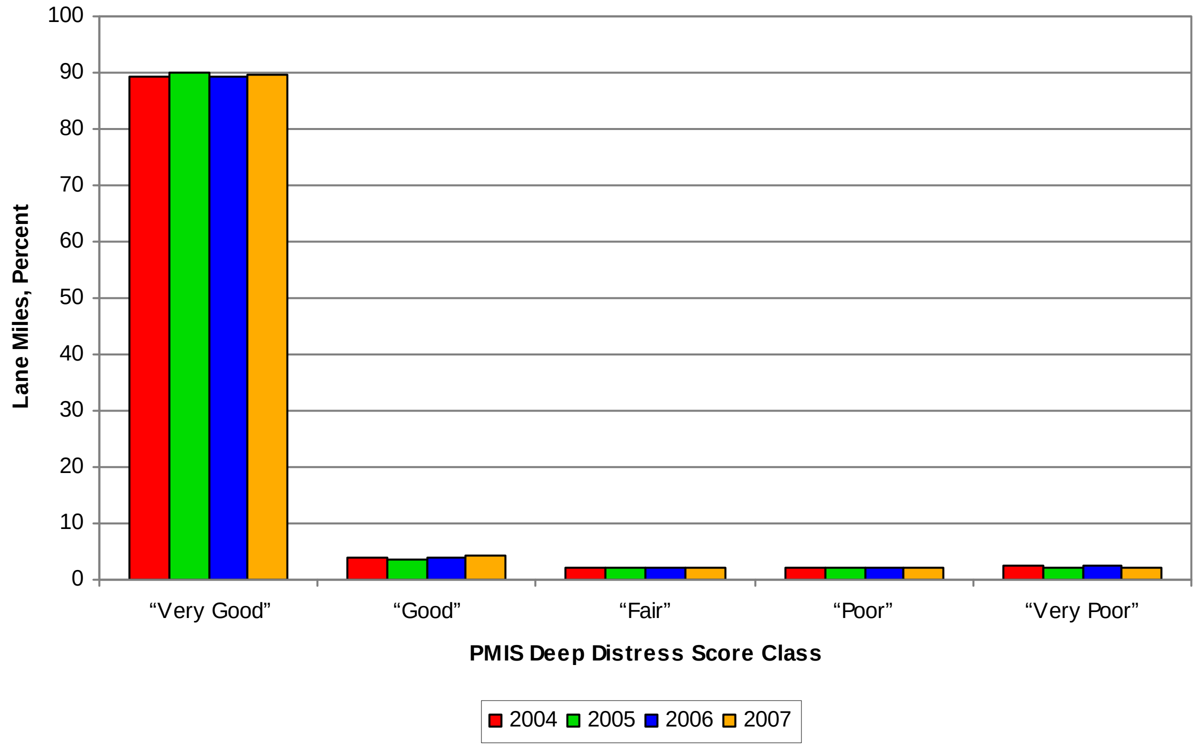


Figure 1.5 — Deep Distress Score Classes FY 2004-2007.

The Deep Distress Score Classes show that:

- “Very Good” mileage increased (from 89.39% in 2006 to 89.48% in 2007)
- “Good” mileage increased (from 3.88% in 2006 to 4.14% in 2007)
- “Fair” mileage decreased (from 2.17% in 2006 to 2.12% in 2007)
- “Poor” mileage decreased (from 2.24% in 2006 to 2.10% in 2007)
- “Very Poor” mileage decreased (from 2.32% in 2006 to 2.17% in 2007).

Aside from visual pavement distress ratings, PMIS includes measurements of pavement rutting, ride quality, surface friction, and structural strength (deflection).

Deep Distress Score Maps, FY 2006-2007

Maps 1.5 and 1.6 show average PMIS Deep Distress Scores in each county for fiscal years 2006 and 2007. The averages are weighted by lane miles for all mainlane pavements in each county. Counties in red have the lowest average Deep Distress Scores, while counties in blue have the highest average Deep Distress Scores.

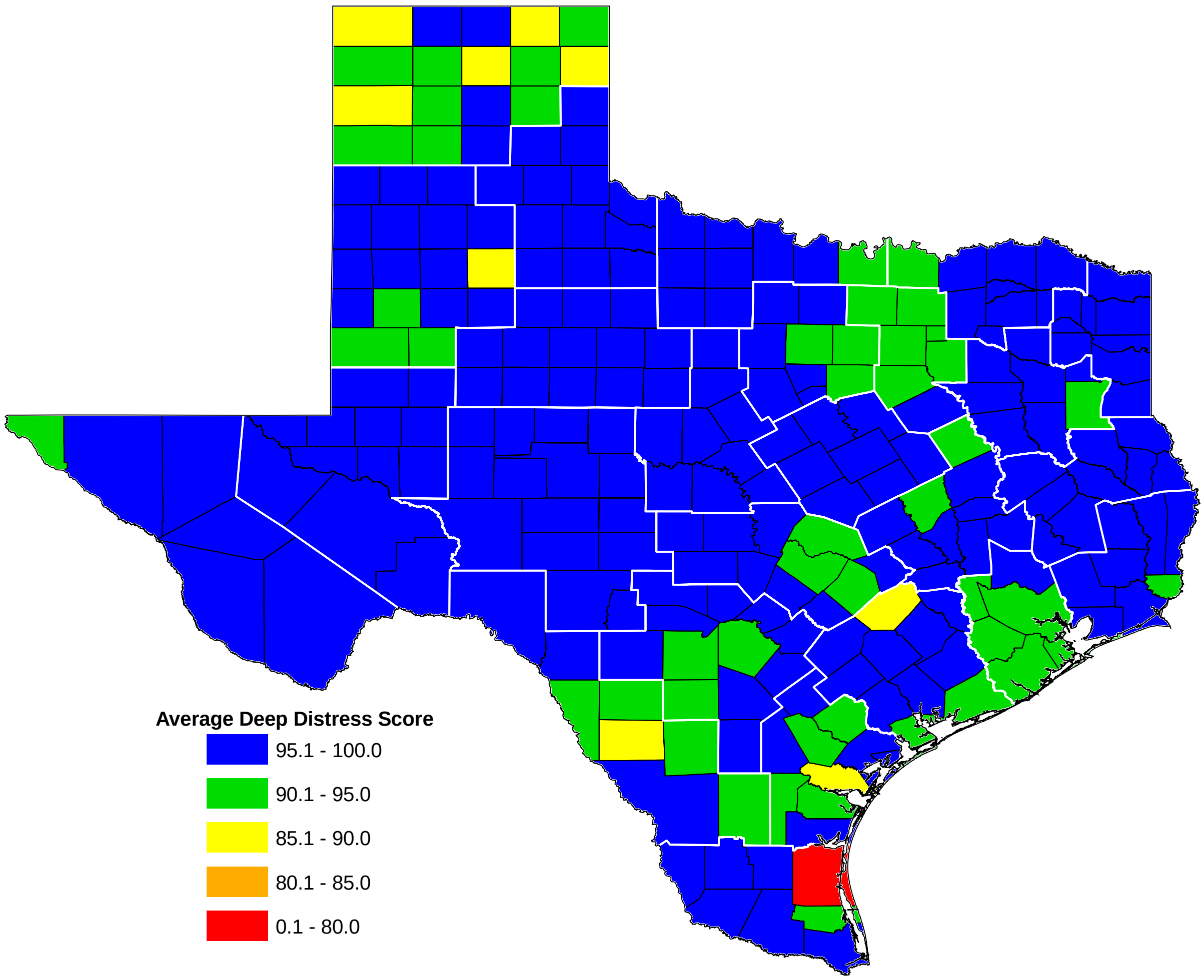
Overall deep distress got slightly better in FY 2007. As will be discussed in Chapters 2-5, deep distress got better for all highway systems (except FM) and for all pavement types.

Five deep distress types improved in FY 2007: ACP Alligator Cracking, CRCP Punchouts, CRCP Asphalt Patches, JCP Failures, and JCP Shattered Slabs.

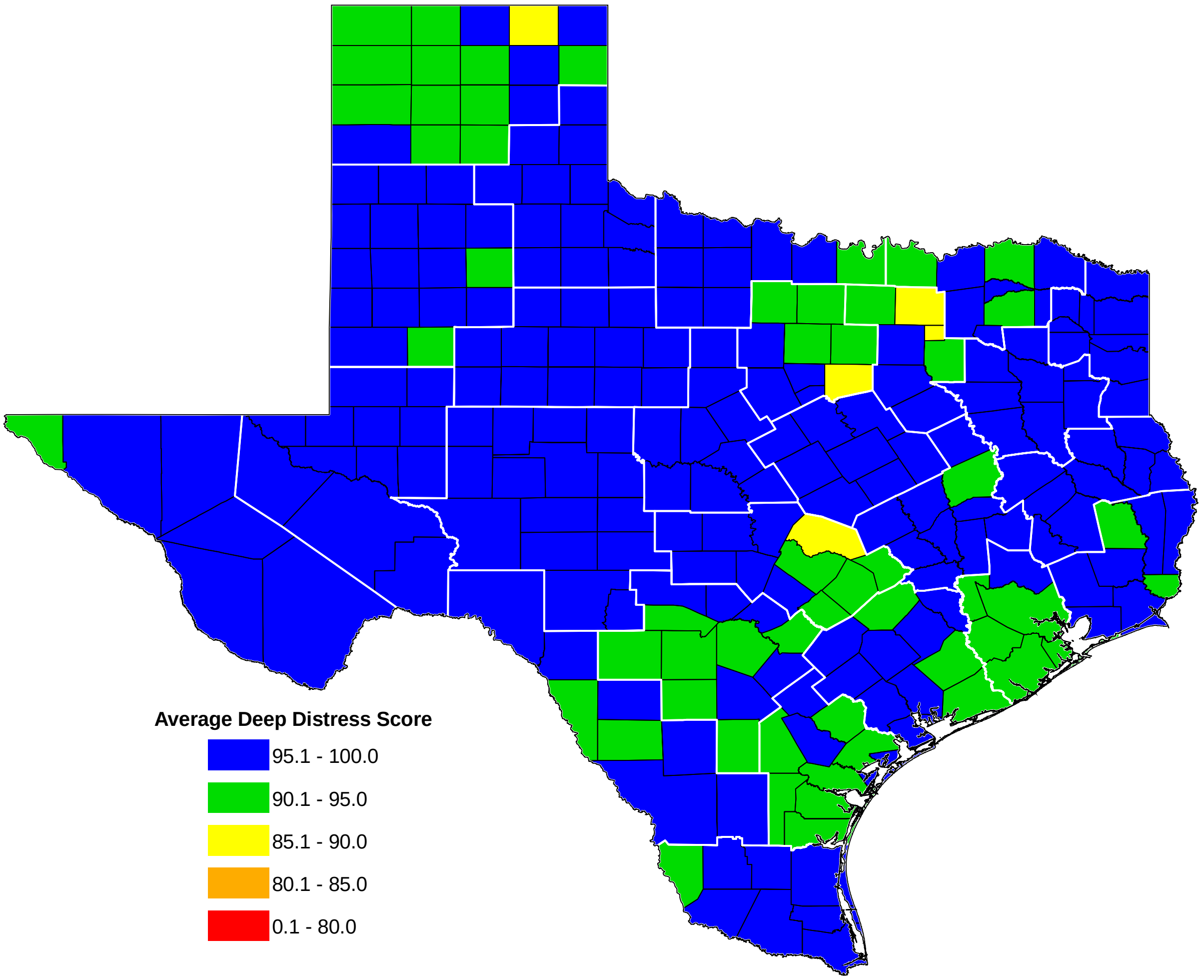
Four deep distress types got worse in FY 2007: ACP Deep Rutting, ACP Failures, ACP Longitudinal Cracking, and JCP Slabs with Longitudinal Cracks.

The Deep Distress Score maps show the overall slight improvement (reduction) in deep distress, with some counties getting better and only a few getting worse. The Deep Distress Score maps suggest that some areas still will need more extensive sub-surface rehabilitation to improve load-carrying capacity. Most counties are still in the "Very Good" (90-100) range.

Map 1.5 — Average Deep Distress Scores, FY 2006.



Map 1.6 — Average Deep Distress Scores, FY 2007.



PMIS Ride Score Classes

The PMIS Ride Score describes pavement ride quality on a scale from 0.1 (roughest) to 5.0 (smoothest). Ride Score is calculated from pavement roughness measured by calibrated electronic equipment.

For the purposes of this report, PMIS Ride Score values have been grouped into descriptive classes, as shown below:

Table 1.4 — PMIS Ride Score Classes.

Ride Score	Description
4.0-5.0	Very Good
3.0-3.9	Good
2.0-2.9	Fair
1.0-1.9	Poor
0.1-0.9	Very Poor

In general terms, the average person would consider a road to be "rough" when its PMIS Ride Score drops below 3.0 (that is, drops into "Fair," "Poor," or "Very Poor" class).

Ride Score is one of the factors used to calculate the PMIS Condition Score.

Additional information about the PMIS Ride Score may be found in *PMIS Score Equations and Utility Factors* and *Overview of Calculation of PMIS Condition Score*. These documents are available from the Construction Division, Materials and Pavements Section.

Figure 1.6 shows the statewide distribution of Ride Score classes for fiscal years 2004 through 2007. Ride Scores are measured using calibrated automated ride quality measuring equipment developed by TxDOT.

25.48 percent of the mainlane mileage had "Very Good" ride quality in FY 2007.

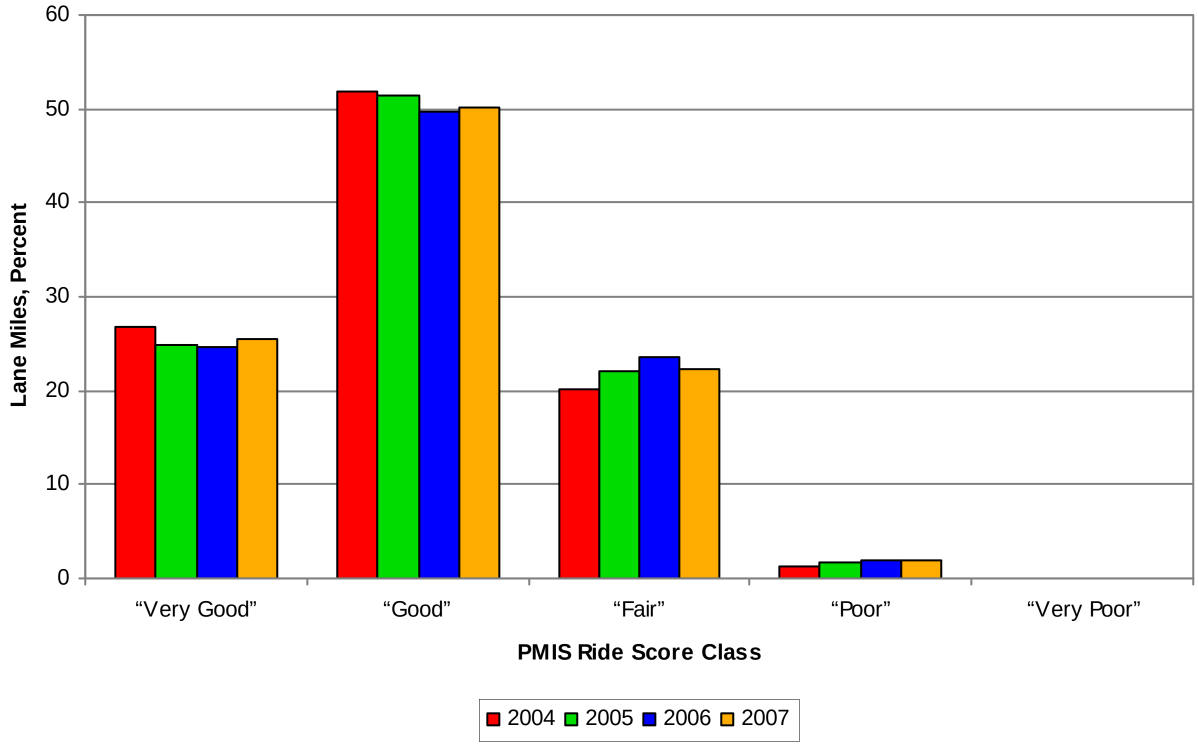


Figure 1.6 — Ride Score Classes, FY 2004-2007.

The Ride Score Classes show that:

- "Very Good" mileage increased (from 24.68% in 2006 to 25.48% in 2007)
- "Good" mileage increased (from 49.80% in 2006 to 50.13% in 2007)
- "Fair" mileage decreased (from 23.58% in 2006 to 22.31% in 2007)
- "Poor" mileage increased (from 1.86% in 2006 to 2.00% in 2007)
- "Very Poor" mileage remained the same (0.07% in 2006 to 0.07% in 2007).

When PMIS began, Rutting on flexible pavements was rated visually with a string (or straightedge) and a block of wood. Starting in FY 1996, ruts have been measured at highway speed using five fixed-position non-contact acoustic sensors mounted on the front bumper of a vehicle.

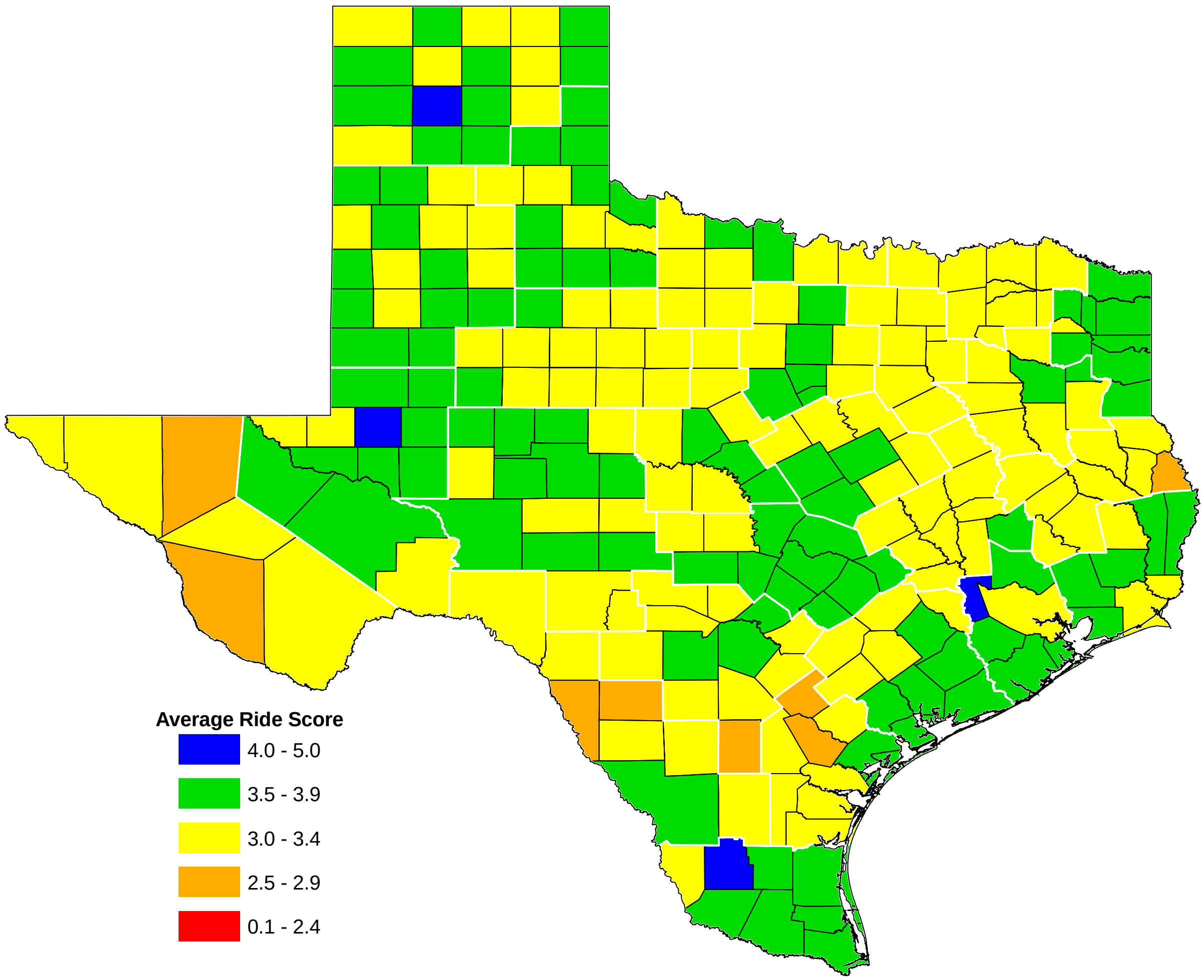
Ride Score Maps, 2006-2007

Maps 1.7 and 1.8 on the following pages show average PMIS Ride Scores in each county for fiscal years 2006 and 2007. The averages are weighted by lane miles for all mainlane pavements in each county. Counties in red have the lowest average Ride Scores, while counties in blue have the highest average Ride Scores.

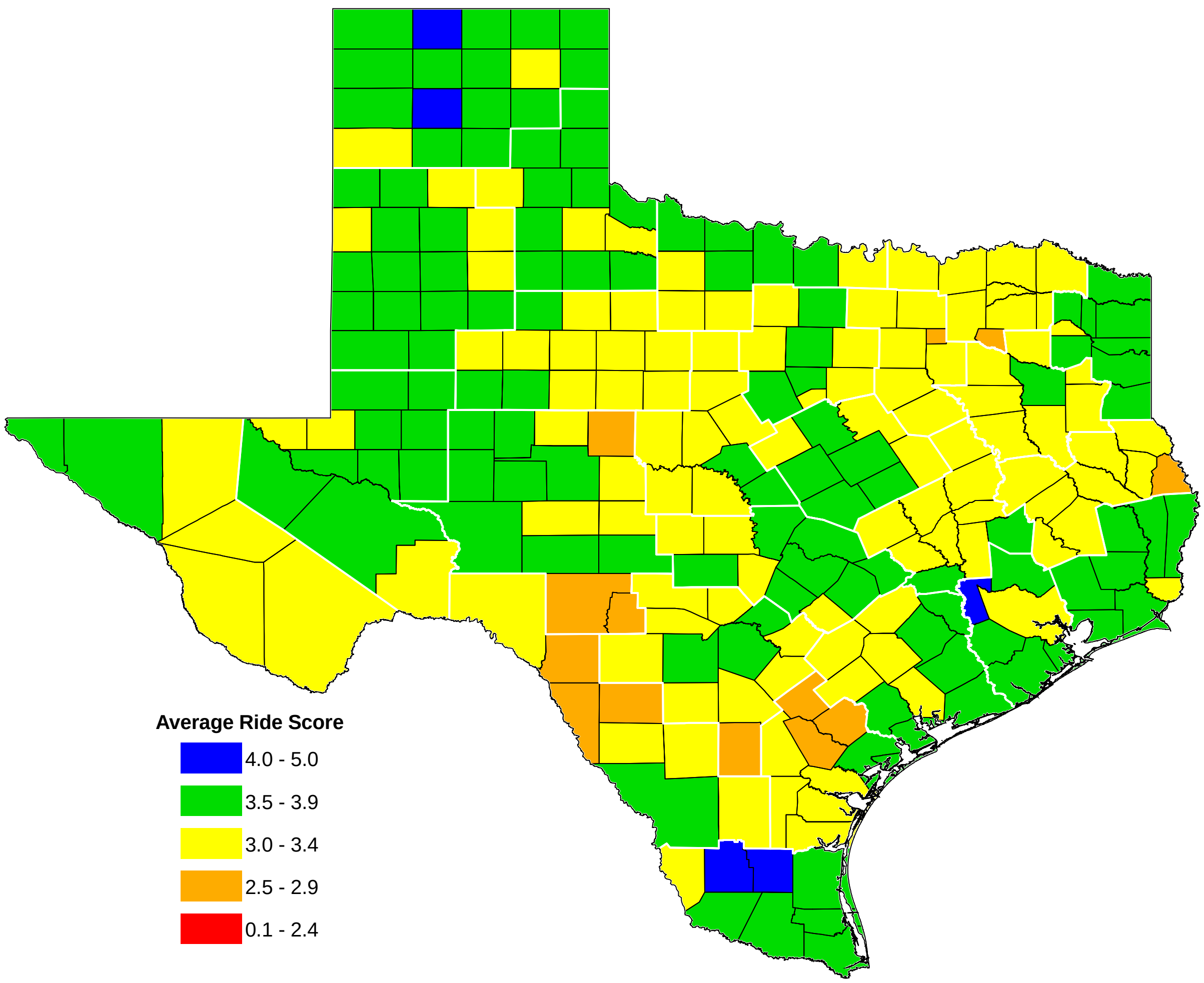
Overall ride quality improved in FY 2007. As will be discussed in Chapters 2-5, ride quality improved for all highway systems, and for all pavement types (except CRCP).

The Ride Score maps show the improvement in statewide ride quality, with many counties rising into the Green (average Ride Score 3.5-3.9) category. No counties had an average ride quality in the Red category (average Ride Score 0.1-2.4) in FY 2006 or 2007.

Map 1.7 — Average Ride Scores, FY 2006.



Map 1.8 — Average Ride Scores, FY 2007.



PMIS IRI Score Classes

The PMIS IRI Score describes pavement ride quality values on a scale from 1 (smoothest) to 950 (roughest). The units are inches (of roughness) per mile.

For the purposes of this report, PMIS IRI Score values have been grouped into classes, as shown below:

Table 1.5 — PMIS IRI Score Classes

IRI Score	Description
1-59	Very Good
60-95	Good
96-130	Fair
131-169	Poor
170-950	Very Poor

NOTE: These IRI Score categories are not the same as the Ride Score categories shown in Table 1.4. For example, the "Very Good" Ride Score category in Table 1.4 (Ride Score 4.0 – 5.0) is not the same as the "Very Good" IRI category in this table (IRI 1-59). As a result, Ride Score and IRI will not show the same percentages of mileage in each category, but they will show the same trends.

The IRI Score categories are based on the construction specification for ride quality and on the Federal Highway Administration (FHWA) strategic goal for ride quality on National Highway System (NHS) routes. The first two categories, "Very Good" and "Good," are based on the ride quality specification. Mileage in those two categories would not require corrective action under the construction specification. The final category, "Very Poor," identifies mileage that would not meet the FHWA strategic goal for NHS ride quality.

IRI Score is the average of the IRI values measured in the left and right wheelpaths.

Although IRI Score is a description of ride quality, it is not one of the factors used to calculate the PMIS Condition Score.

Figure 1.7 shows the statewide distribution of IRI Score classes for fiscal years 2004 through 2007. IRI Scores are measured using calibrated automated ride value measuring equipment developed by TxDOT. The IRI categories in this Figure are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

6.64 percent of the mainlane mileage had "Very Good" IRI Scores in FY 2007.

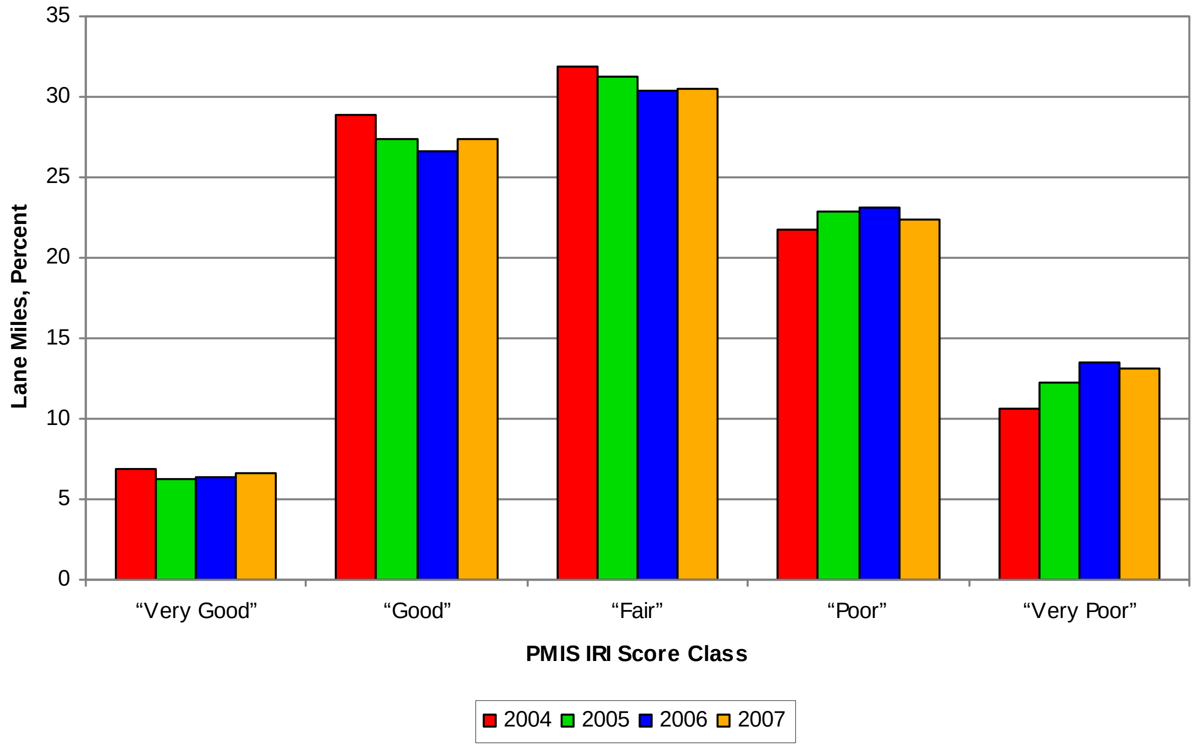


Figure 1.7 — IRI Score Classes, FY 2004-2007.

The IRI Score Classes show that:

- "Very Good" mileage increased (from 6.32% in 2006 to 6.64% in 2007)
- "Good" mileage increased (from 26.68% in 2006 to 27.36% in 2007)
- "Fair" mileage increased (from 30.34% in 2006 to 30.54% in 2007)
- "Poor" mileage decreased (from 23.18% in 2006 to 22.35% in 2007)
- "Very Poor" mileage decreased (from 13.49% in 2006 to 13.11% in 2007).

TxDOT owns and operates 16 pavement Profilers, seven Skid trucks, and 15 Falling Weight Deflectometers (FWDs) used in annual PMIS data collection.

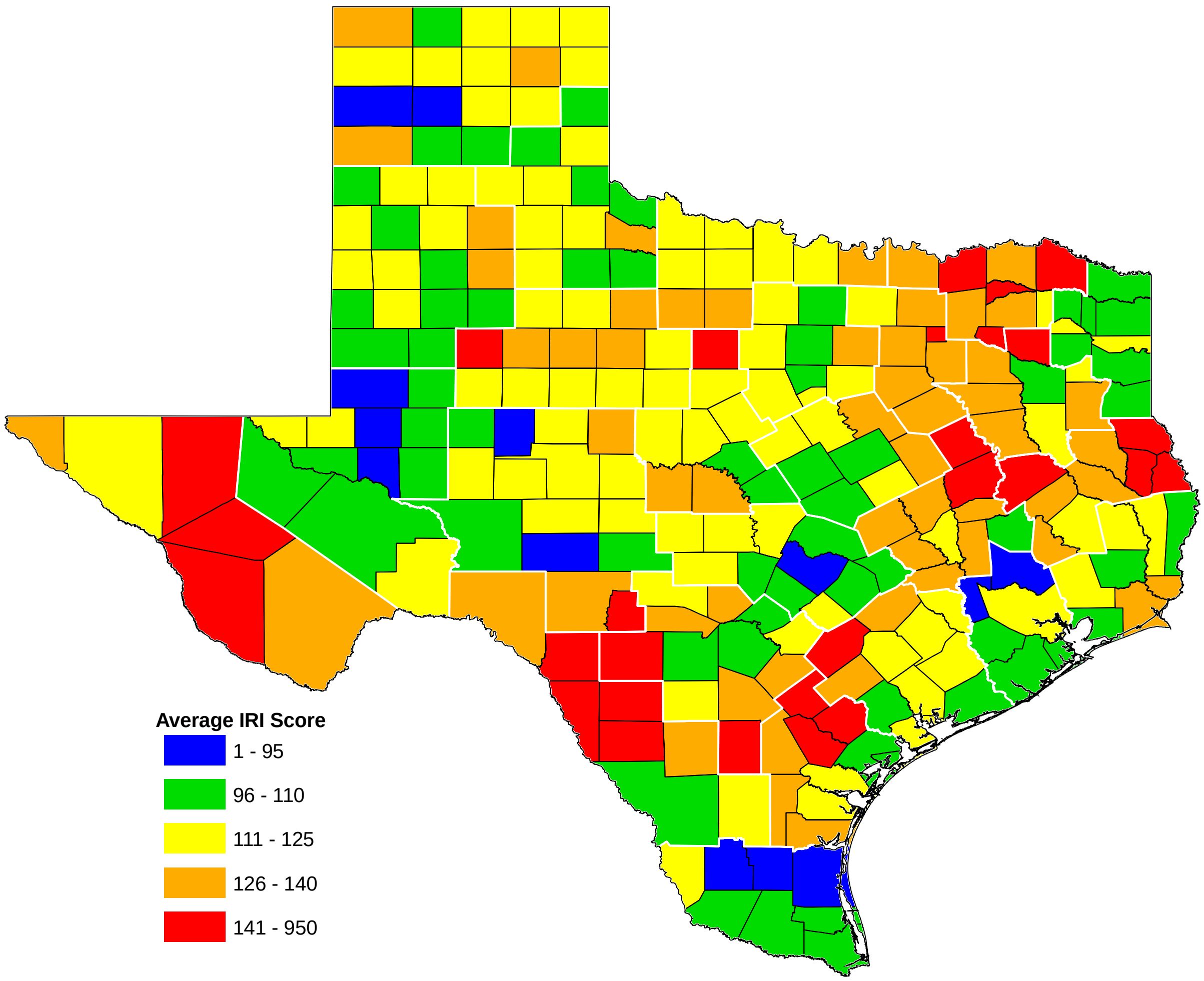
IRI Score Maps, 2006-2007

Maps 1.9 and 1.10 on the following pages show average PMIS IRI Scores in each county for fiscal years 2006 and 2007. The averages are weighted by lane miles for all mainlane pavements in each county. Counties in red have the highest average IRI Scores, while counties in blue have the lowest average IRI Scores.

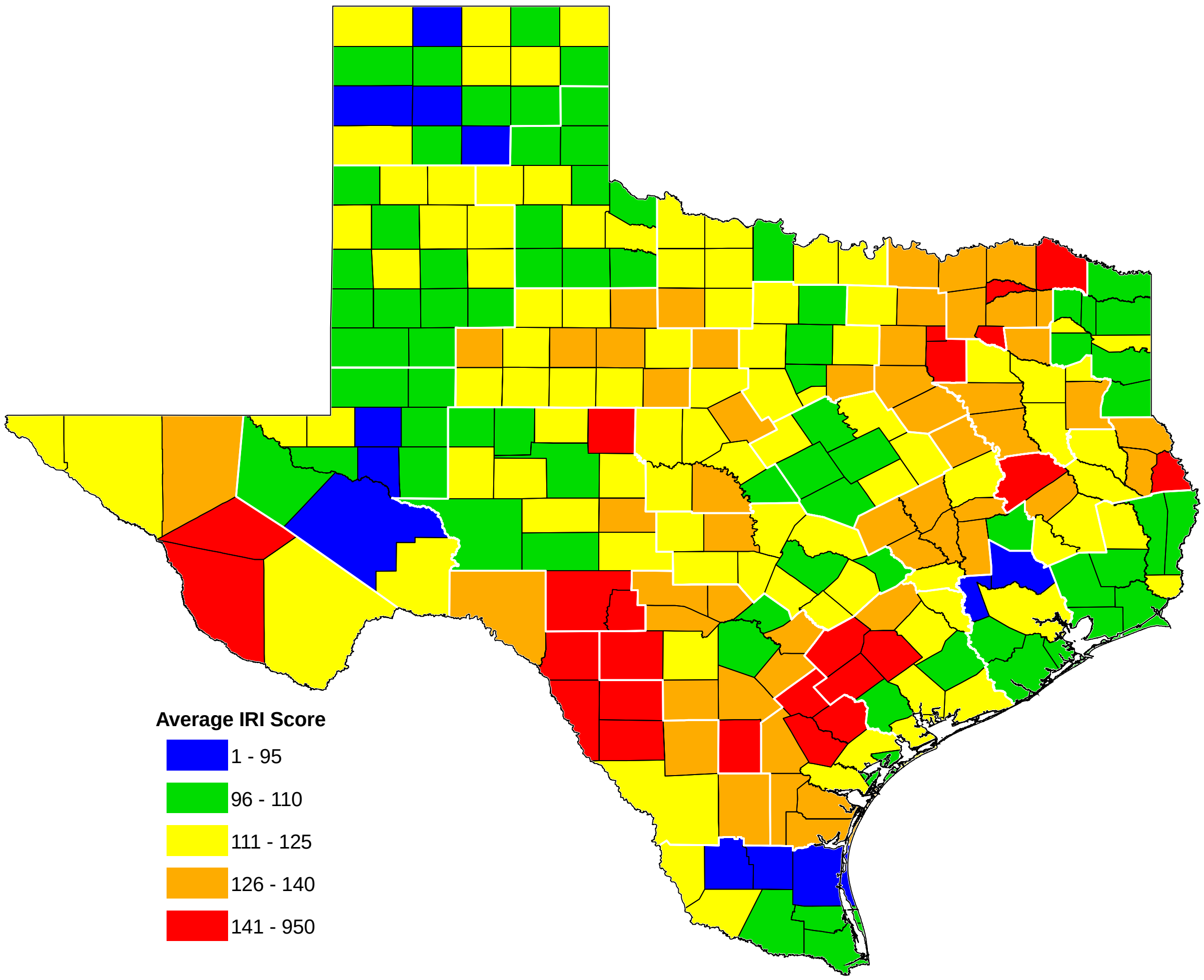
Overall IRI values improved in FY 2007. As will be discussed in Chapters 2-5, IRI improved for all highway systems, and for all pavement types (except CRCP).

The IRI maps are not as obvious in showing the improvement in statewide ride quality, except for a reduction in counties in the Red category (average IRI more than 140 inches per mile).

Map 1.9 — Average IRI Scores, FY 2006.



Map 1.10 — Average IRI Scores, FY 2007.



Average Condition Scores of the Highway Systems

PMIS classifies Texas roads into the following seven highway systems:

- Interstate Highways (IH)
- United States highways (US)
- State Highways (SH)
- Farm-to-Market (FM), including Ranch Roads (RR) and Ranch-to-Market (RM)
- Business Routes (BR)
- Park Roads (PR), including Recreational Roads (RE)
- Principal Arterial Streets (PA).

Figure 1.8 shows average PMIS Condition Scores for each highway system for fiscal years 2004 through 2007. Average pavement condition got worse statewide and for US and FM routes, but improved for IH and SH routes in FY 2007.

Condition, distress, and ride quality trends for the four major highway systems (IH, US, SH, and FM) will be discussed in Chapter 2.

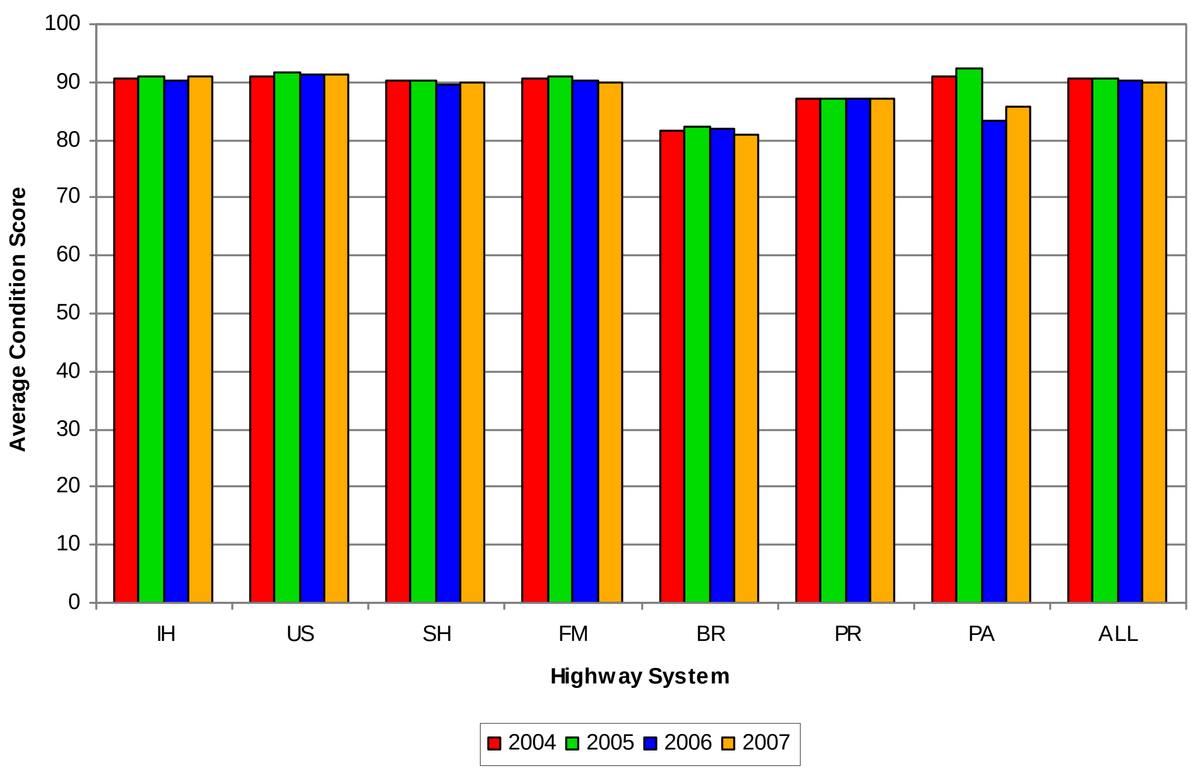


Figure 1.8 — Average Condition Scores, by Highway System, FY 2004-2007.

Average Condition Scores of the Major Pavement Types

PMIS also classifies Texas roads into the following three major pavement types:

- Flexible Pavements, also known as Asphalt Concrete Pavements (ACP)
- Continuously Reinforced Concrete Pavements (CRCP)
- Jointed Concrete Pavements (JCP).

Figure 1.9 shows average PMIS Condition Scores for each pavement type for fiscal years 2004 through 2007. Average pavement condition got worse in FY 2007 statewide and for ACP, but improved for CRCP and JCP.

Condition, distress, and ride quality trends for each of the three major pavement types will be discussed in Chapters 3-5.

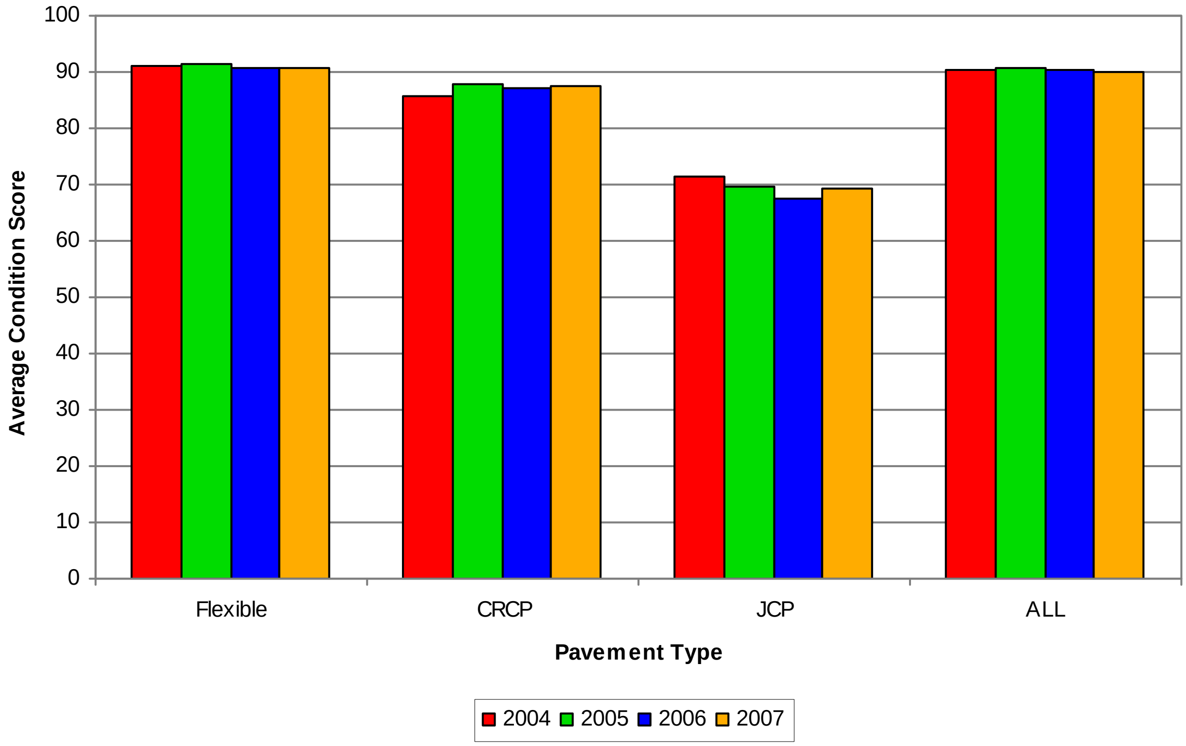


Figure 1.9 — Average Condition Scores, by Pavement Type, FY 2004-2007.

Lane Miles in PMIS, by Highway System

Table 1.6 shows the total lane miles in PMIS for each of the highway systems. These mileages are obtained at the beginning of each fiscal year from TxDOT's Texas Reference Marker (TRM) system. Updates to TRM are not picked up in PMIS until the start of a new fiscal year. Some differences may occur when comparing PMIS to other TxDOT management systems, because PMIS sections are only accurate to a tenth of a mile.

Table 1.6 — Total Lane Miles in PMIS, by Highway System, FY 2004-2007.

Highway System	Fiscal Year			
	2004	2005	2006	2007
Interstate Highways, mainlanes only	15,049.6	15,066.0	15,090.3	15,105.7
Interstate Highways, frontage roads	9,227.8	9,296.7	9,333.4	9,334.3
United States Highways	37,983.0	38,294.9	38,522.6	38,693.1
State Highways	40,002.7	40,343.1	40,628.9	40,830.5
Farm-to-Market Roads	84,615.2	84,688.6	84,778.8	84,774.5
Business Routes	2,952.7	2,966.0	2,999.0	3,064.0
Park Roads	694.7	694.5	694.5	692.7
Principal Arterial Streets	52.3	65.5	65.5	36.0
STATEWIDE	**190,578.0**	**191,415.3**	**192,113.0**	**192,530.8**

Lane Miles in PMIS, by Pavement Type

Table 1.7 shows the total lane miles in PMIS for each of the major pavement types.

Table 1.7 — Total Lane Miles in PMIS, by Pavement Type, FY 2004-2007.

Pavement Type	Fiscal Year			
	2004	2005	2006	2007
Flexible or Asphalt Concrete Pavements (ACP)	176,807.4	177,071.9	177,398.7	177,717.0
Continuously Reinforced Concrete Pavement (CRCP)	9,426.3	9,940.3	10,269.8	10,467.4
Jointed Concrete Pavement (JCP)	4,344.3	4,403.1	4,444.5	4,346.4
STATEWIDE	**190,578.0**	**191,415.3**	**192,113.0**	**192,530.8**

NOTE: These are approximate lane mile totals, based on PMIS. Official mileage totals should be obtained from TxDOT's Transportation Planning and Programming Division.

Rated/Measured Lane Miles in PMIS, by Highway System

In fiscal year 2001, TxDOT began rating and measuring PMIS data (visual distress, ride quality, and rutting) for all mileage, except for sections that were under construction during the PMIS data collection season (usually September-February). Unlike previous years (FY 1993-2000), PMIS is now rating and measuring the same roads every year.

Table 1.8 shows the total lane miles (mainlanes only) rated/measured in PMIS, by highway system. A section must have a PMIS Condition Score (that is, it must have both distress data and ride data stored) to be included in this table.

Table 1.8 — Rated/Measured Lane Miles in PMIS, by Highway System, FY 2004-2007.

Highway System	Fiscal Year			
	2004	2005	2006	2007
Interstate Highways	14,250.2	14,131.3	14,072.2	14,350.5
United States Highways	33,831.6	33,979.9	33,821.7	34,393.7
State Highways	37,048.4	37,339.8	37,280.4	37,828.7
Farm-to-Market Roads	82,800.2	82,988.9	83,152.0	82,594.7
Business Routes	2,693.3	2,735.6	2,679.5	2,813.4
Park Roads	555.4	535.3	558.0	587.8
Principal Arterial Streets	40.3	41.8	41.8	23.4
STATEWIDE	**171,219.4**	**171,752.6**	**171,605.6**	**172,592.2**

Rated/Measured Lane Miles in PMIS, by Pavement Type

Table 1.9 shows the total lane miles (mainlanes only) rated/measured in PMIS, by pavement type.

Table 1.9 — Rated/Measured Lane Miles in PMIS, by Pavement Type, FY 2004-2007.

Pavement Type	Fiscal Year			
	2004	2005	2006	2007
Flexible or Asphalt Concrete Pavements (ACP)	160,262.8	160,309.0	159,983.1	160,811.2
Continuously Reinforced Concrete Pavement (CRCP)	8,016.4	8,341.0	8,516.1	8,814.3
Jointed Concrete Pavement (JCP)	2,940.2	3,102.6	3,106.4	2,966.7
STATEWIDE	**171,219.4**	**171,752.6**	**171,605.6**	**172,592.2**

NOTE: Analysis of frontage roads is not included in this report (except for most Tables in Chapter 7) because of insufficient traffic and PMIS data. Obtaining consistent traffic data and PMIS data (ride and distress) on frontage roads is difficult because of the many entrance/exit ramps and intersecting streets, and because some frontage roads are discontinuous.

Rated/Measured Lane Miles in PMIS, by Data/Score Type

Although TxDOT began rating and measuring all State-maintained mileage for PMIS in FY 2001, it is not possible to rate or measure every mile of the system because of construction and other site-specific conditions that make it difficult to get good ratings and measurements.

Table 1.10 shows the total lane miles (mainlanes only) rated/measured in PMIS, by data type and PMIS Score type. A section must have a PMIS Condition Score (that is, it must have both distress data and ride data stored) to be included in this table.

Table 1.10— Rated/Measured Mileage in PMIS, by Data/Score Type, FY 2004-2007.

Data/Score Type	Fiscal Year							
	2004		2005		2006		2007	
	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles
Distress	86,154.6	186,098.5	86,235.8	186,625.3	85,998.4	186,419.7	86,857.8	188,457.5
Ride	86,091.9	185,980.3	86,538.4	187,414.8	86,649.2	187,973.2	86,719.3	188,271.2
Rut	81,235.0	173,020.0	81,276.4	173,345.4	85,770.1	186,012.2	86,309.3	187,289.7
Distress Score	85,001.5	183,666.6	84,972.4	183,937.8	84,984.4	184,238.1	85,425.9	185,353.4
Ride Score	86,091.9	185,980.3	86,538.4	187,414.8	86,649.2	187,973.2	86,719.3	188,271.2
Condition Score	84,690.6	182,889.9	84,819.3	183,591.8	84,664.1	183,502.7	85,104.9	184,601.9

Percent Rated/Measured Mileage in PMIS, by Data/Score Type

Table 1.11 shows the percentage of rated/measured mileage in PMIS, by data type and PMIS Score type. In FY 2007, PMIS had Condition Scores for 95.88 percent of State-maintained lane mileage.

Table 1.11— Percent Rated/Measured Mileage in PMIS, by Data/Score Type, FY 2004-2007.

Data/Score Type	Fiscal Year							
	2004		2005		2006		2007	
	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles	Roadbed Miles	Lane Miles
Distress	97.67%	97.65%	97.54%	97.50%	97.12%	97.04%	97.96%	97.88%
Ride	97.60%	97.59%	97.89%	97.91%	97.85%	97.85%	97.80%	97.79%
Rut	92.09%	90.79%	91.93%	90.56%	96.86%	96.82%	97.34%	97.28%
Distress Score	96.36%	96.37%	96.11%	96.09%	95.97%	95.90%	96.34%	96.27%
Ride Score	97.60%	97.59%	97.89%	97.91%	97.85%	97.85%	97.80%	97.79%
Condition Score	96.01%	95.97%	95.94%	95.91%	95.61%	95.52%	95.98%	95.88%

Discussion

The overall condition of Texas pavements got slightly worse in FY 2007 mainly because of increased distress on asphalt pavements. Overall pavement distress got worse, but overall ride quality improved.

As will be discussed in Chapters 2-5, condition improved for IH, SH, CRCP, and JCP mileage, but got worse for US, FM, and ACP mileage. Ride quality improved for all highway systems, and for all pavement types (except CRCP). Pavement distress got worse for FM, ACP, and JCP mileage, and these drops drove the slight decline in overall statewide condition.

Several factors contributed to the decline in statewide pavement condition in FY 2007. A prolonged drought began in mid-FY 2005, intensified by the end of FY 2005, and lasted until the end of FY 2006.

Rising material costs also contributed to the statewide decline in condition by reducing the amount of mileage that could be repaired with existing maintenance and rehabilitation funds. In FY 2005, overall construction costs rose by more than 21 percent. Hot-mix asphalt concrete costs rose more than 27 percent, asphalt cement used for seal coats rose more than 38 percent, and concrete pavement rose 11 percent. These sharp rises in cost affected pavement conditions observed during the FY 2006 PMIS evaluations.

Material costs continued to increase in FY 2006. Overall construction costs rose by another 17 percent. Hot-mix asphalt concrete costs rose by another 34 percent, asphalt cement used for seal coats rose by another 41 percent, and concrete pavement rose by another 13 percent. These trends, along with increased competition for limited construction materials and increased oilfield development traffic, helped increase distress and lower pavement condition in FY 2007.

In fiscal year 2001, TxDOT began rating and measuring PMIS data (visual distress, ride quality, and rutting) for all mileage, except for sections that were under construction during the PMIS data collection season (usually September-February). Unlike previous years (FY 1993-2000), PMIS is now rating and measuring the same roads every year. The sample size for PMIS Condition Score in FY 2007 was 95.88 percent of State-maintained lane mileage, up slightly from 95.52 percent in FY 2006.

Summary

The overall condition of Texas pavements got slightly worse in FY 2007 mainly because of increased distress on asphalt pavements. Overall pavement distress got worse, but overall ride quality improved. A prolonged drought that began in mid-FY 2005 and lasted through all of FY 2006, rising material costs, increased competition for limited construction materials, and increased oilfield development traffic contributed to the decline in statewide pavement condition.

The pavement Profiler also measures Rutting on flexible (asphalt) pavements. The five Rut sensors are numbered 1-5 from the left side of the vehicle to the right side. Sensor 2 measures rut depth in the left wheelpath and Sensor 4 measures rut depth in the right wheelpath. Ruts are measured approximately every four feet and they are summarized every 0.1-mile for use in PMIS.

Chapter 2 Condition of the Highway Systems

This chapter describes the condition of the four major highway systems in Texas. These highway systems are:

- Interstate Highways (IH)
- United States Highways (US)
- State Highways (SH)
- Farm-to-Market (FM), including Ranch Roads (RR) and Ranch-to-Market (RM).

Average Condition Scores, by Highway System

Figure 2.1 shows the average PMIS Condition Scores, by highway system, for fiscal years 2004 through 2007. Average pavement condition got worse statewide and for US and FM routes, but improved for IH and SH routes in FY 2007. This is the same chart from Figure 1.8, and is repeated here for ease of reference.

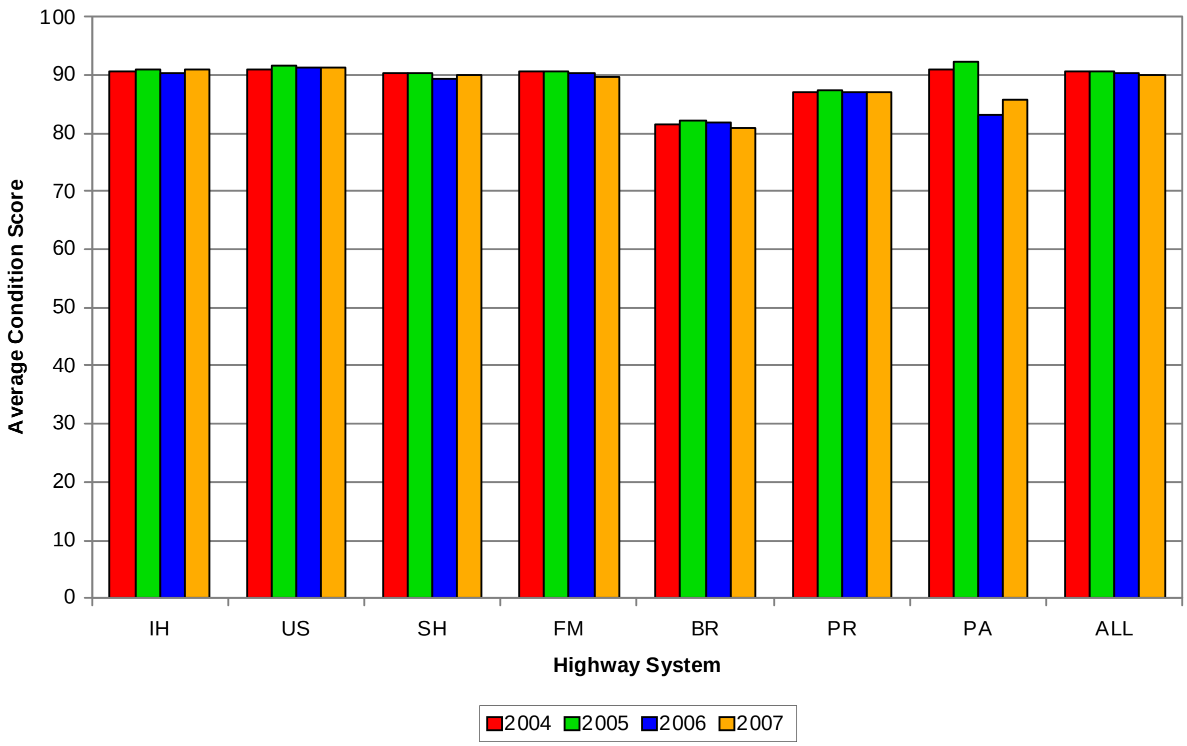


Figure 2.1 — Average Condition Scores, by Highway System, FY 2004-2007.

Although Business Routes (BR), Park Roads (PR), and Principal Arterial streets (PA) are included in the PMIS database (and in this Figure), they are not discussed in the rest of this chapter because the small amounts of data available tend to cause large fluctuations in results from year to year.

TxDOT's pavement Profilers measure ride quality using two lasers, one mounted over each wheelpath. The lasers operate at 16 kilohertz - that is, they measure ride quality 16,000 times per second. At a typical highway speed of 60 miles per hour, the lasers measure ride quality approximately 15 times per inch.

Interstate Highway (IH) System

Figure 2.2 shows the statewide distribution of Condition Score classes for the Interstate system for fiscal years 2004 through 2007.

75.72 percent of the IH lane miles were in "Very Good" condition in FY 2007.

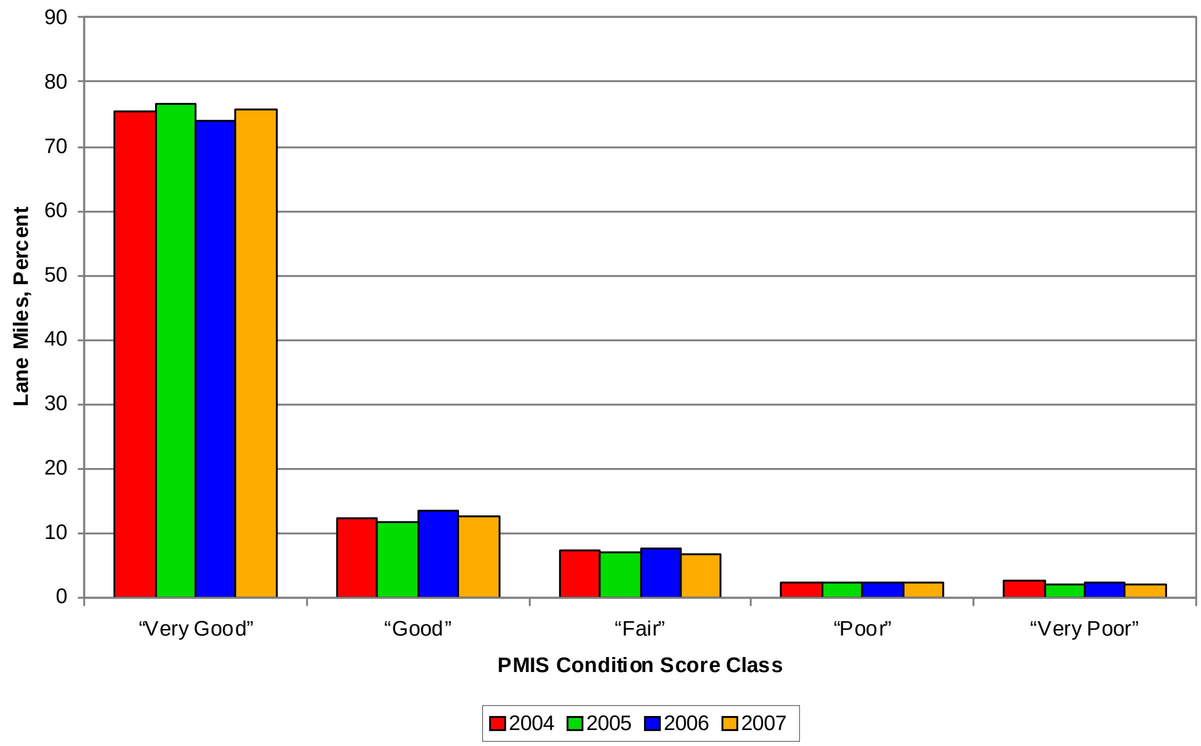
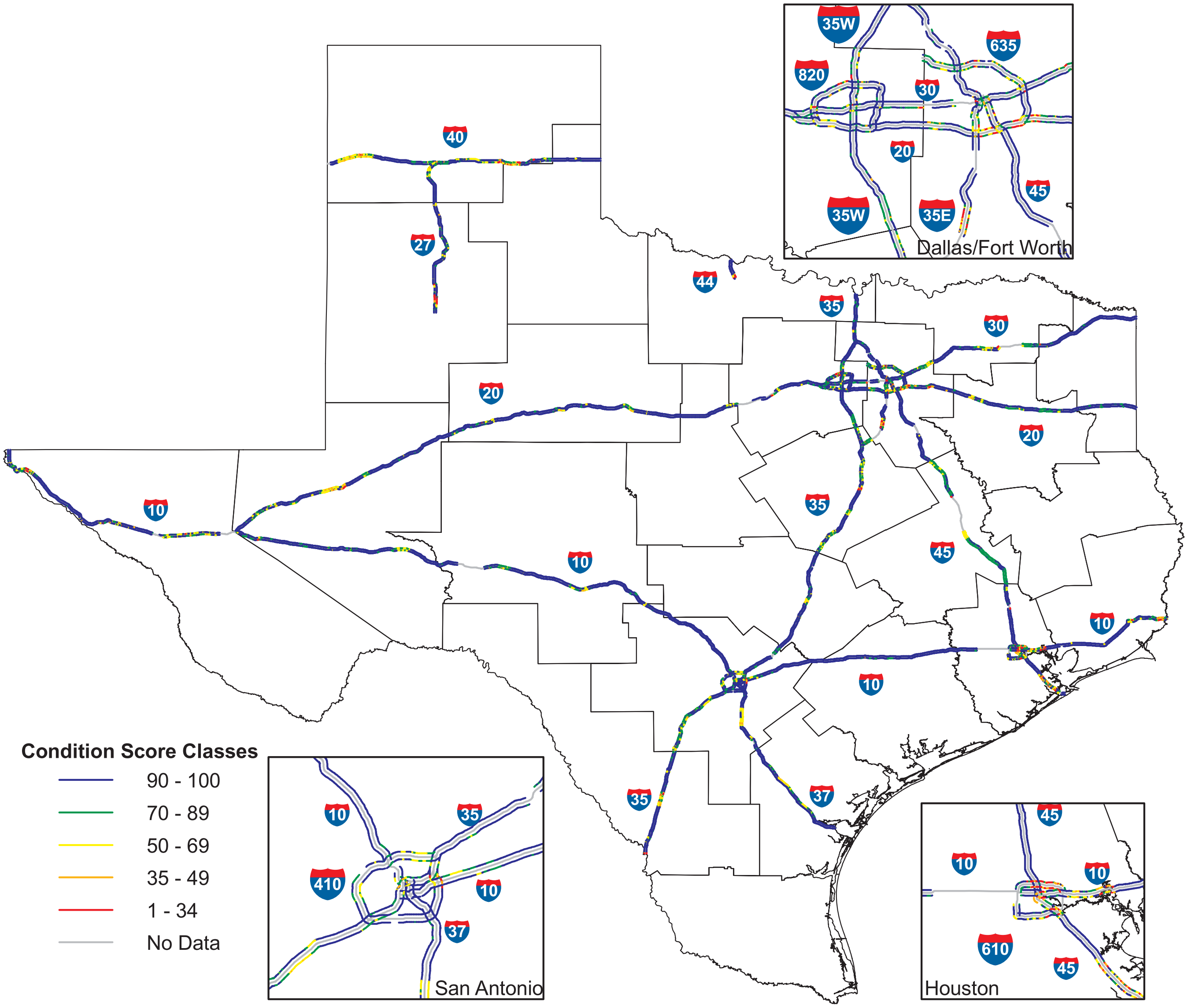


Figure 2.2 — IH System Condition Score Classes, FY 2004-2007.

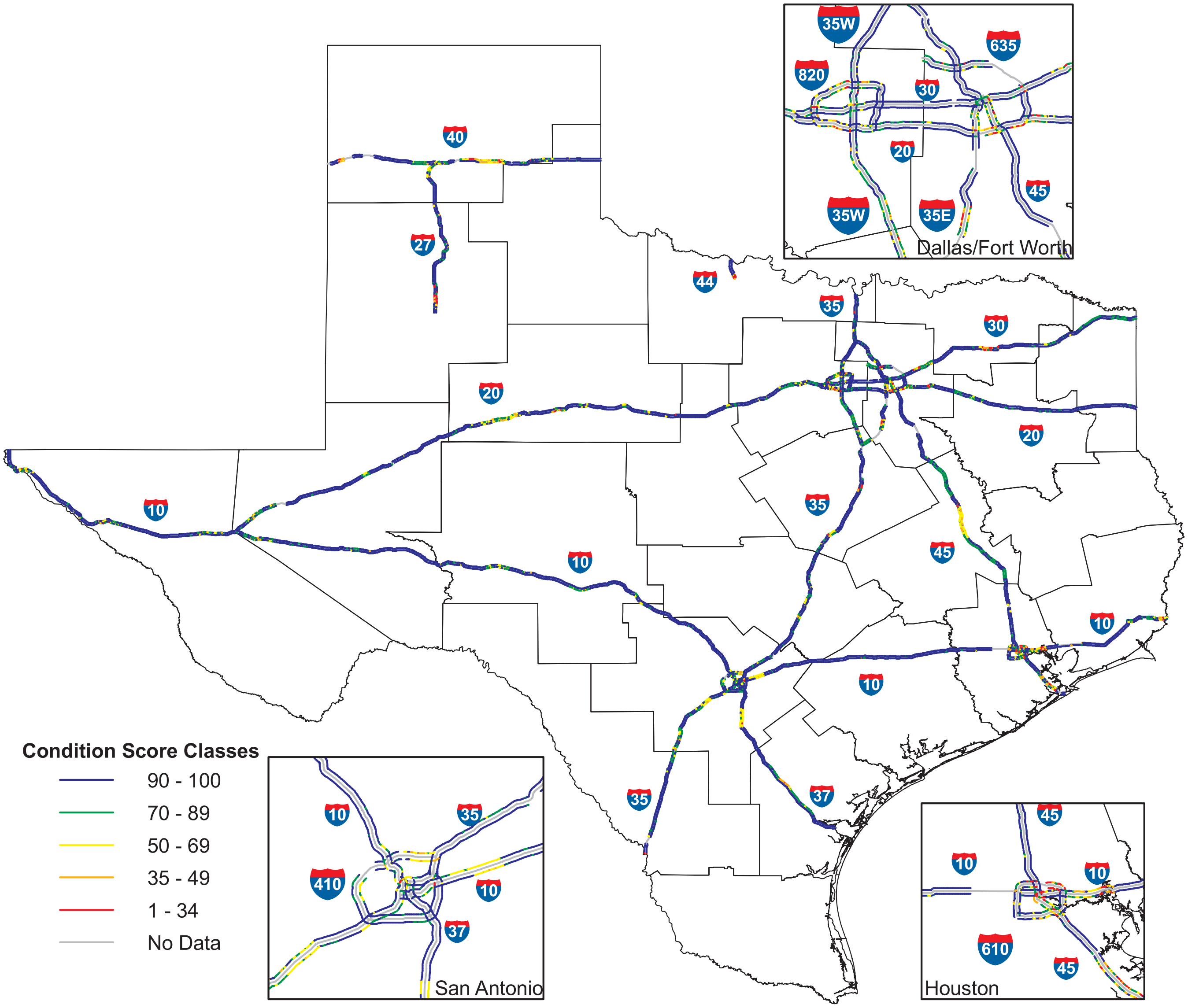
The Condition Score Classes for Interstate Highways show that:

- "Very Good" mileage increased (from 74.04% in 2006 to 75.72% in 2007)
- "Good" mileage decreased (from 13.61% in 2006 to 12.72% in 2007)
- "Fair" mileage decreased (from 7.68% in 2006 to 6.93% in 2007)
- "Poor" mileage increased (from 2.30% in 2006 to 2.44% in 2007)
- "Very Poor" mileage decreased (from 2.37% in 2006 to 2.19% in 2007).

Map 2.1 — IH System Condition Score Classes, FY 2006.



Map 2.2 — IH System Condition Score Classes, FY 2007.



TxDOT builds the pavement Profilers and Skid trucks in Austin, but purchases the FWDs from Dynatest, Inc.

Figure 2.3 shows the statewide distribution of the Distress Score classes for the Interstate system for fiscal years 2004 through 2007.

79.83 percent of the IH lane miles were "Very Good" in terms of pavement distress in FY 2007.

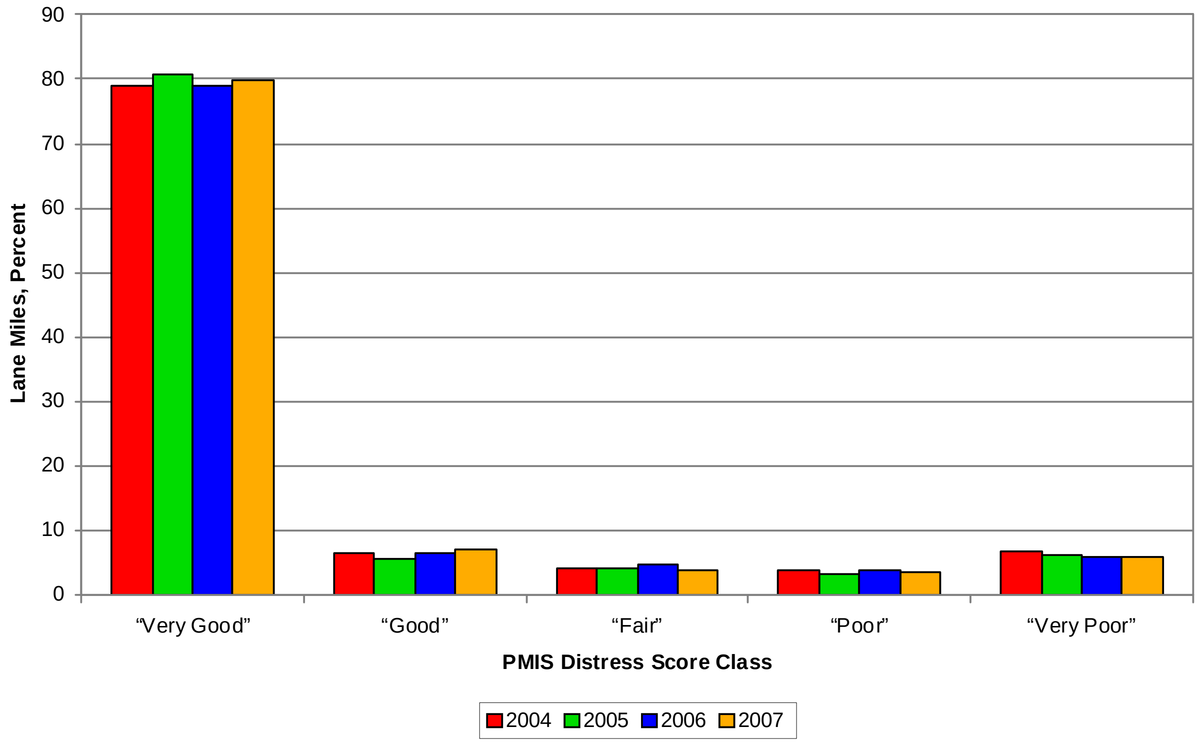
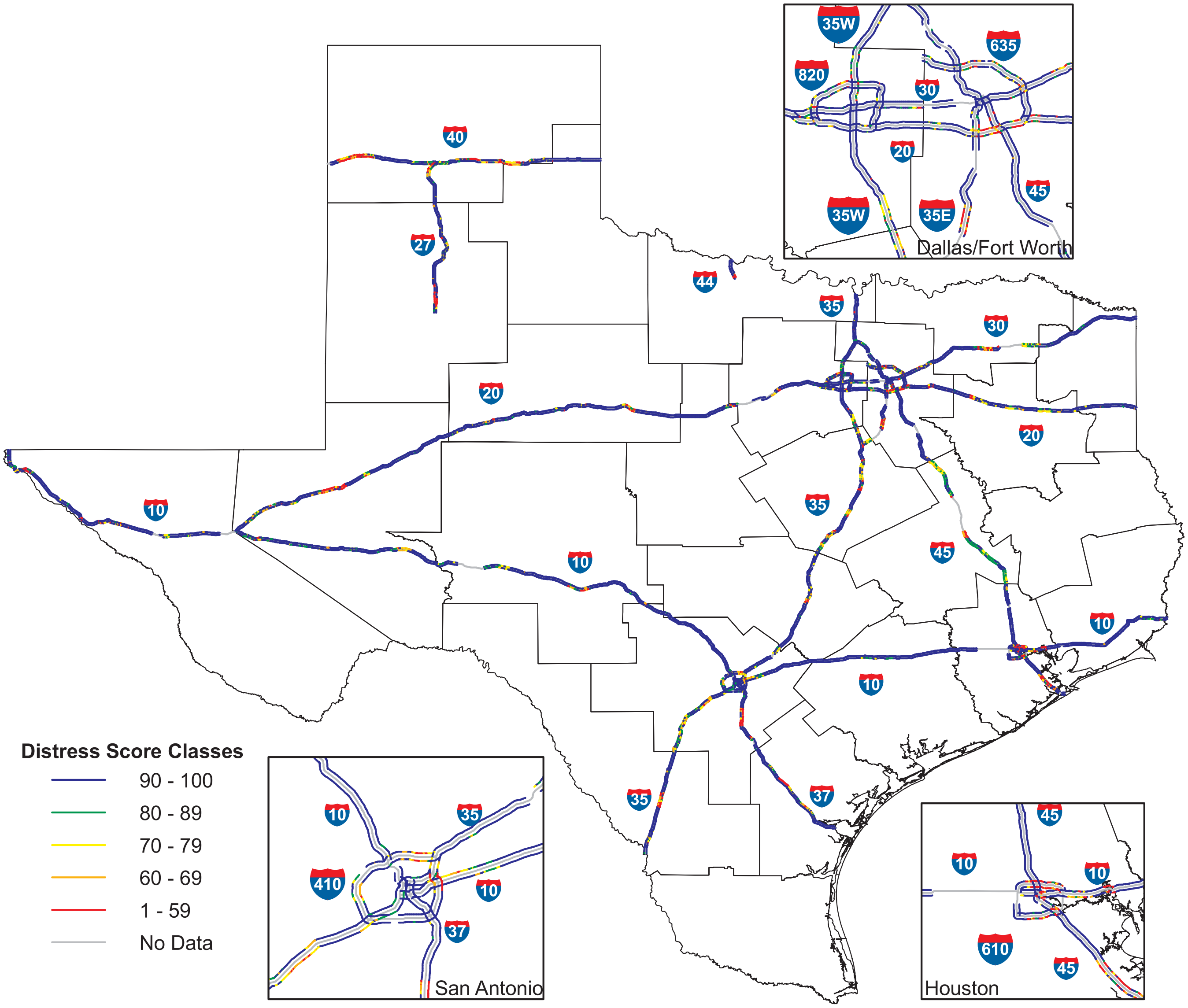


Figure 2.3 — IH System Distress Score Classes, FY 2004-2007.

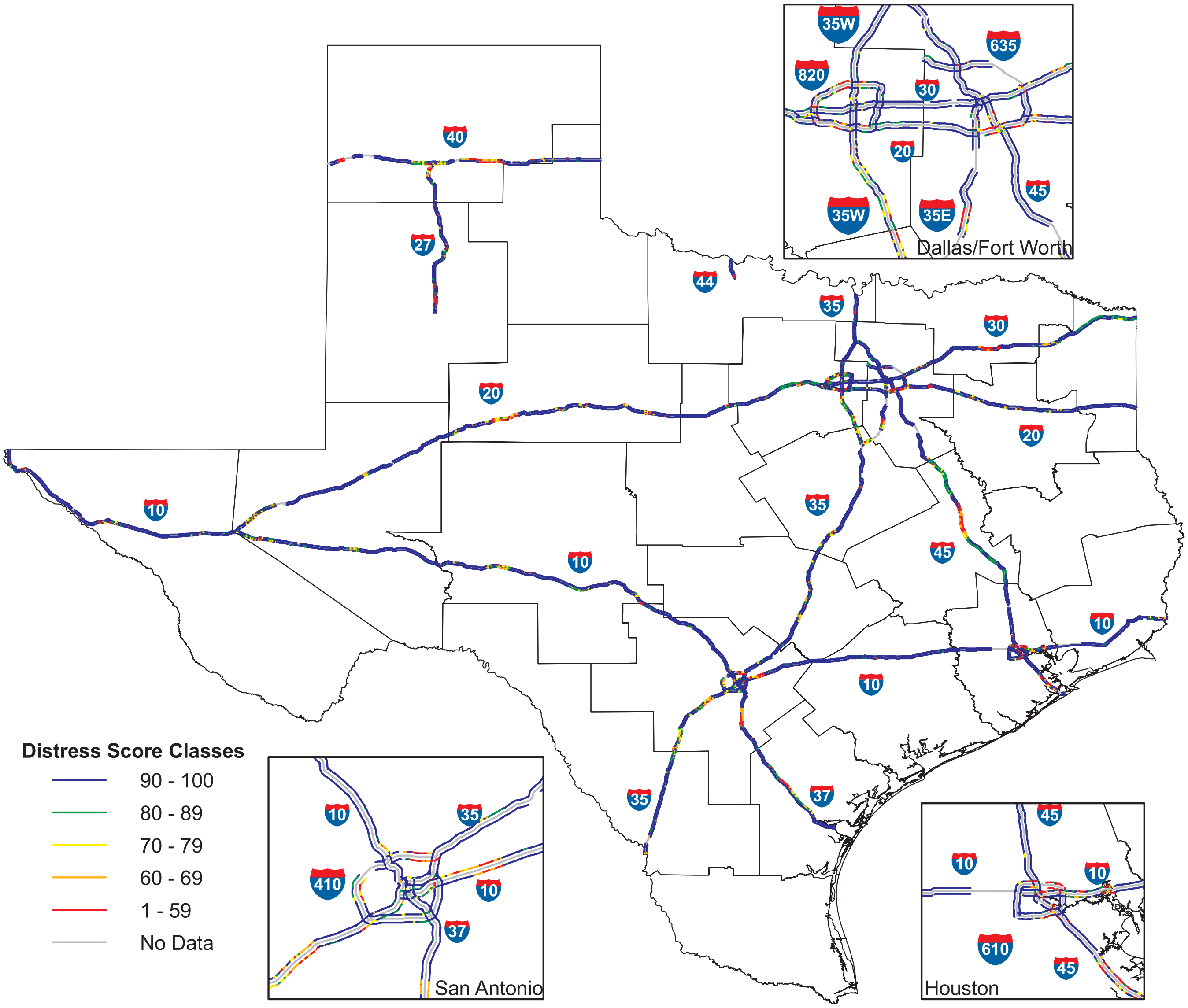
The Distress Score Classes for Interstate Highways show that:

- "Very Good" mileage increased (from 78.93% in 2006 to 79.83% in 2007)
- "Good" mileage increased (from 6.56% in 2006 to 7.02% in 2007)
- "Fair" mileage decreased (from 4.69% in 2006 to 3.84% in 2007)
- "Poor" mileage decreased (from 3.78% in 2006 to 3.50% in 2007)
- "Very Poor" mileage decreased (from 6.04% in 2006 to 5.81% in 2007).

Map 2.3 — IH System Distress Score Classes, FY 2006.



Map 2.4 — IH System Distress Score Classes, FY 2007.



Ride quality measurements in Texas were first performed using Mays Ride Meters, then Walker SIometers, and now with the current Pavement Profilers.

Figure 2.4 shows the statewide distribution of Deep Distress Score classes for the Interstate system for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

86.83 percent of the IH lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

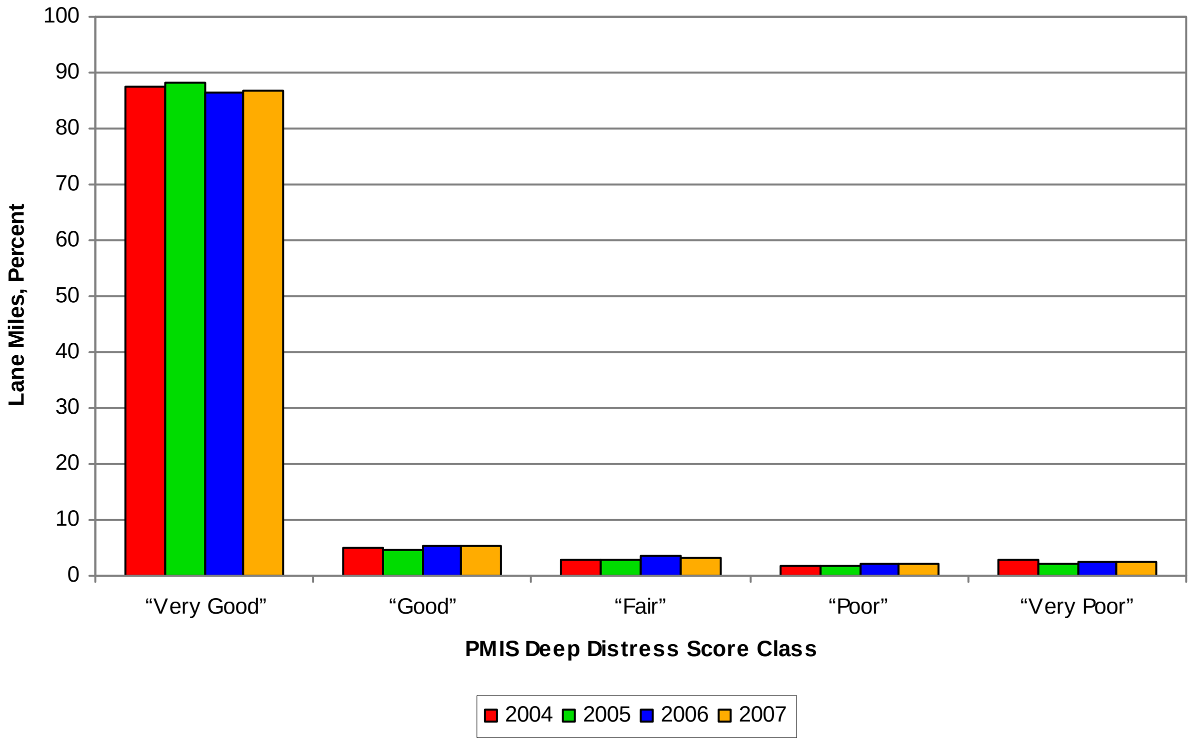
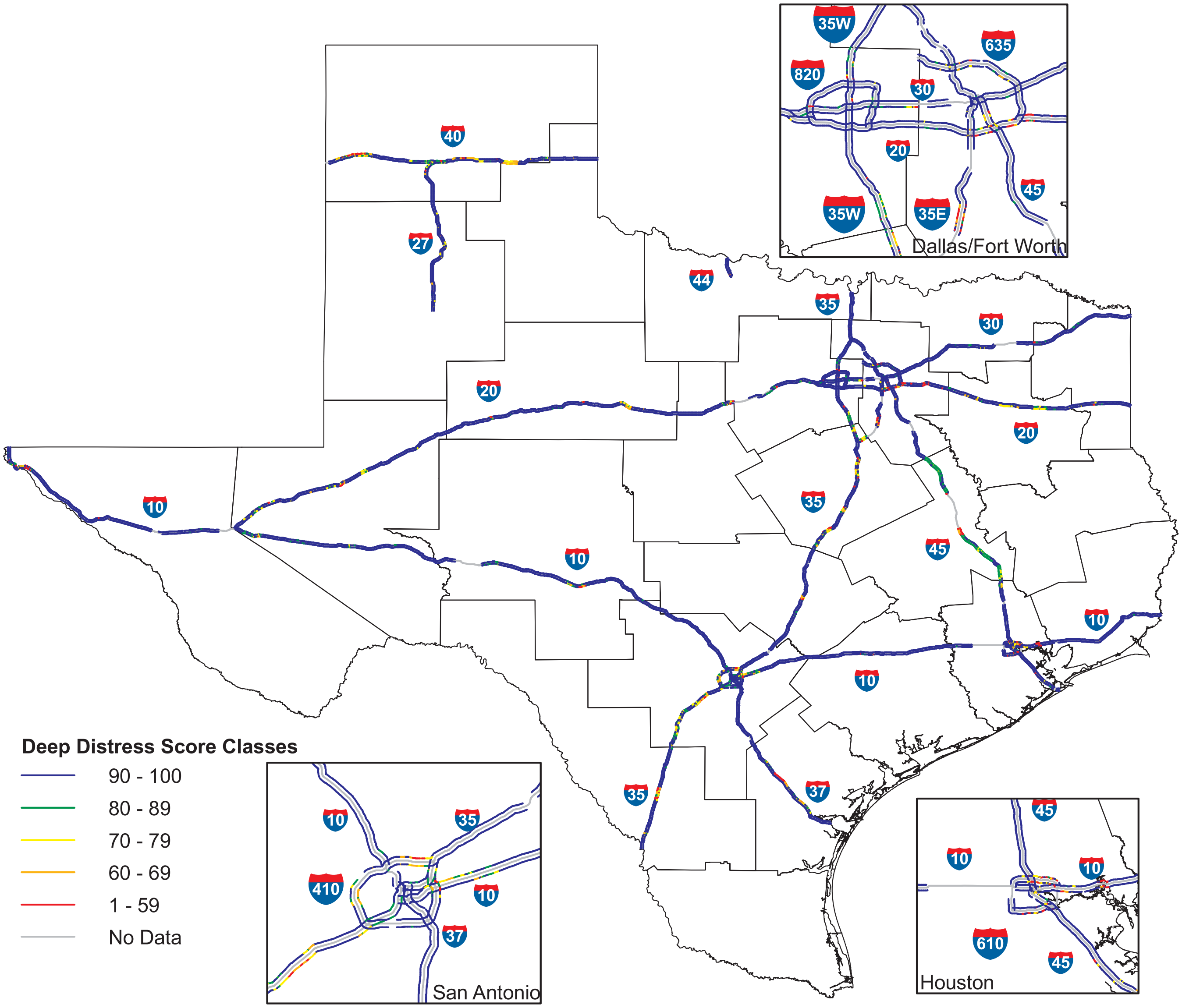


Figure 2.4 — IH System Deep Distress Score Classes, FY 2004-2007.

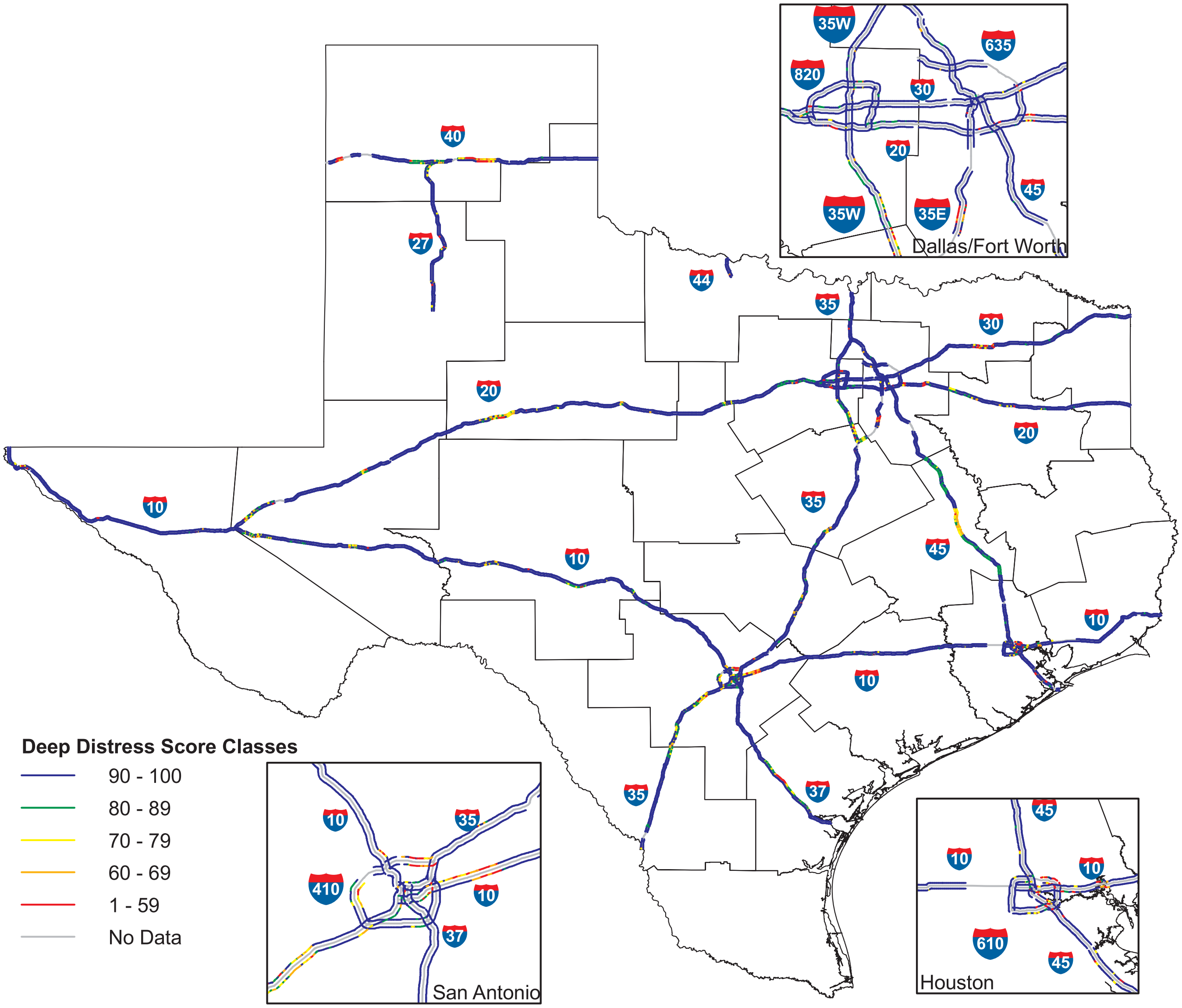
The Deep Distress Score Classes for Interstate Highways show that:

- "Very Good" mileage increased (from 86.55% in 2006 to 86.83% in 2007)
- "Good" mileage increased (from 5.33% in 2006 to 5.45% in 2007)
- "Fair" mileage decreased (from 3.57% in 2006 to 3.20% in 2007)
- "Poor" mileage decreased (from 2.12% in 2006 to 2.03% in 2007)
- "Very Poor" mileage increased (from 2.43% in 2006 to 2.49% in 2007).

Map 2.5 — IH System Deep Distress Score Classes, FY 2006.



Map 2.6 — IH System Deep Distress Score Classes, FY 2007.



PMIS uses Texas Reference Markers to locate the beginning and ending of each rating section. Reference Marker numbers increase northbound and eastbound for IH routes; southbound and eastbound for all other routes.

Figure 2.5 shows the statewide distribution of the Ride Score classes for the Interstate system for fiscal years 2004 through 2007. In general, the average person would consider 5.99 percent of IH pavements in Texas to be “rough.”

57.61 percent of the IH lane miles had “Very Good” ride quality in FY 2007.

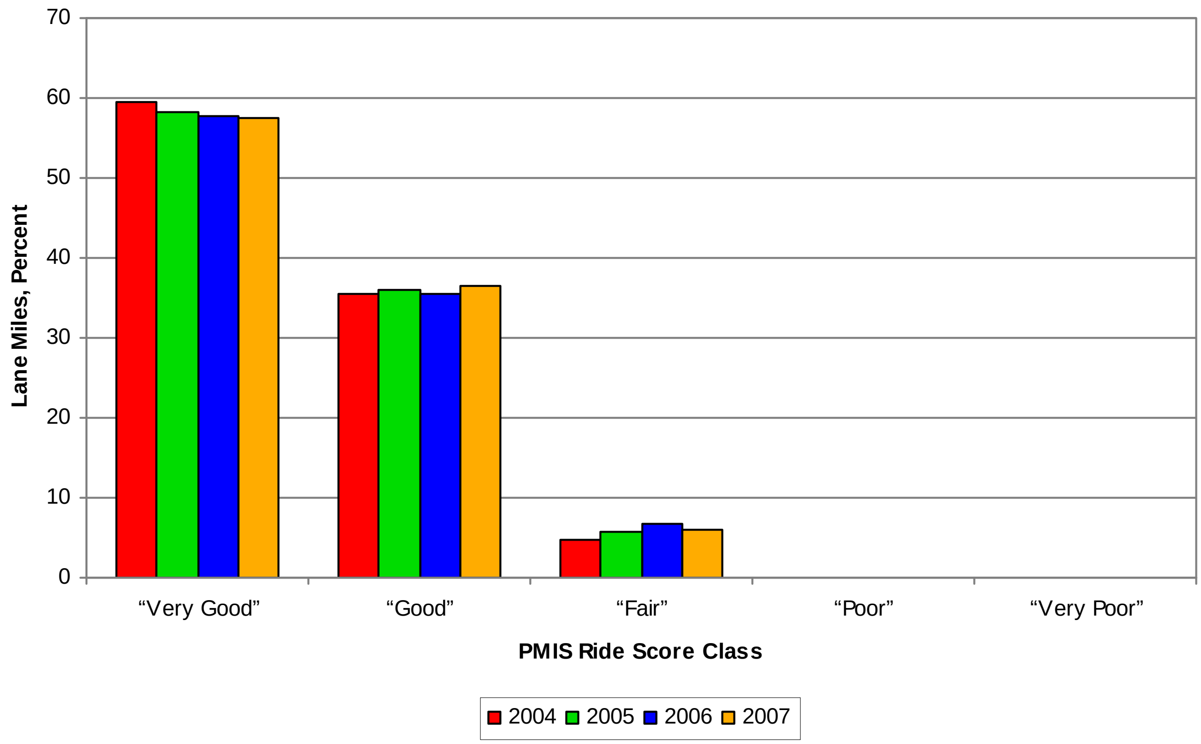
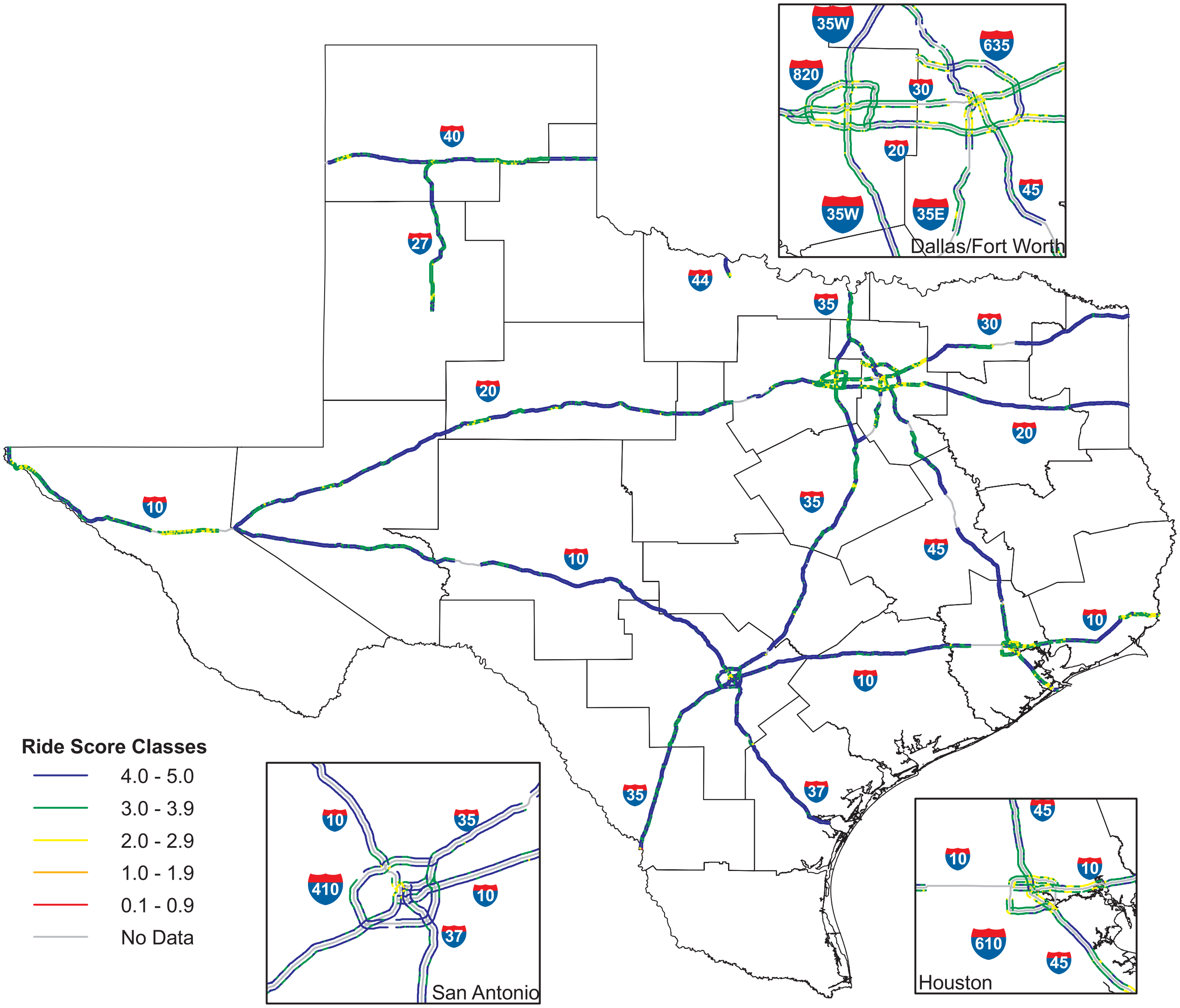


Figure 2.5 — IH System Ride Score Classes, FY 2004-2007.

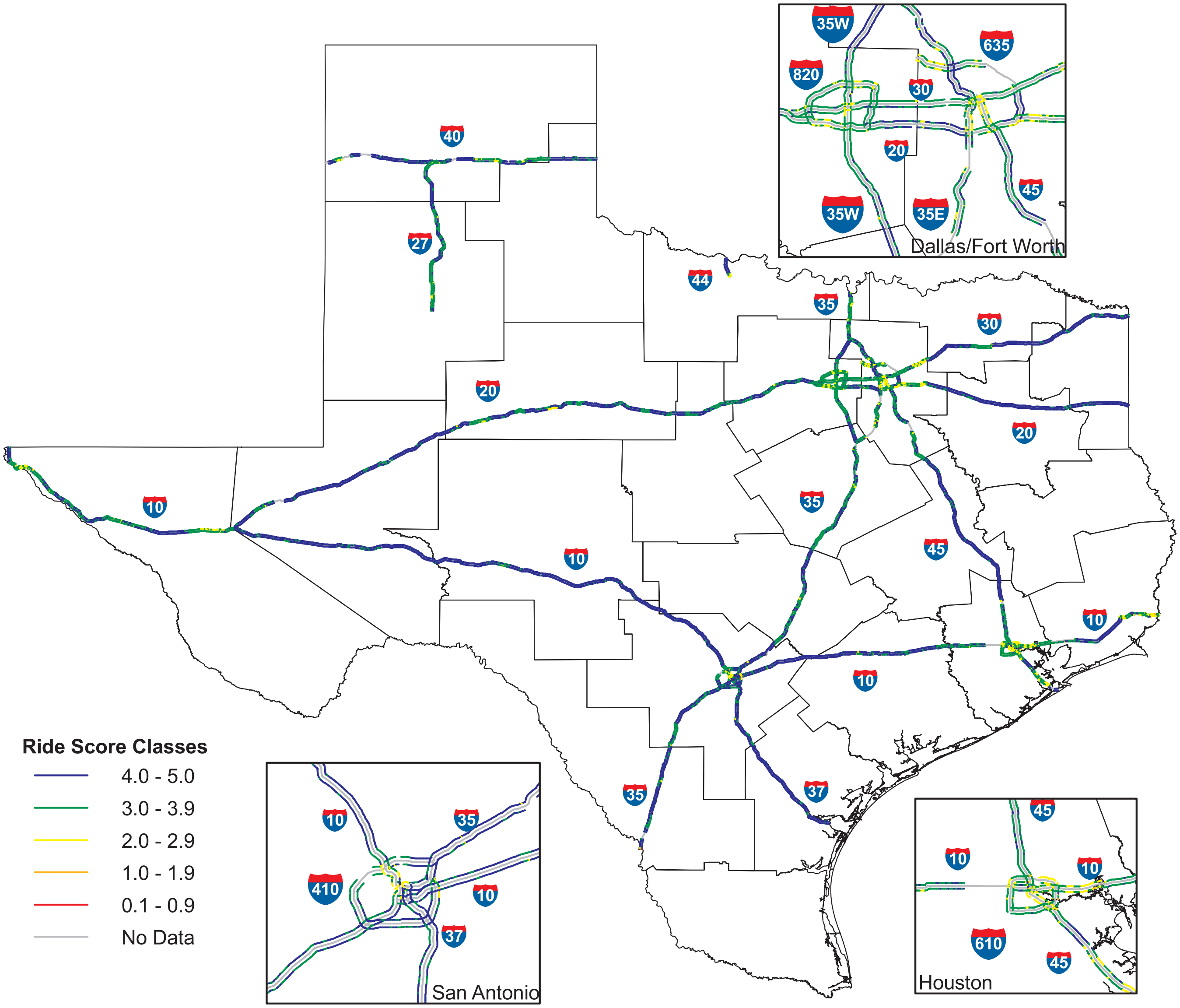
The Ride Score Classes for Interstate Highways show that:

- “Very Good” mileage decreased (from 57.66% in 2006 to 57.61% in 2007)
- “Good” mileage increased (from 35.45% in 2006 to 36.40% in 2007)
- “Fair” mileage decreased (from 6.79% in 2006 to 5.88% in 2007)
- “Poor” mileage increased (from 0.09% in 2006 to 0.10% in 2007)
- “Very Poor” mileage remained the same (0.01% in 2006 to 0.01% in 2007).

Map 2.7 — IH System Ride Score Classes, FY 2006.



Map 2.8— IH System Ride Score Classes, FY 2007.



The first PMIS Annual Report was actually a PES Annual Report that summarized the results of the 1982 pavement evaluation survey. That survey began on October 1, 1982, and finished on January 20, 1983.

Figure 2.6 shows the statewide distribution of the IRI Score classes for the Interstate system for fiscal years 2004 through 2007. In general, the average person would consider 32.00 percent of IH pavements in Texas to be "rough," based on IRI. This is not the same as the 5.99 percent of "rough" IH mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

20.68 percent of the IH lane miles had "Very Good" IRI Scores in FY 2007.

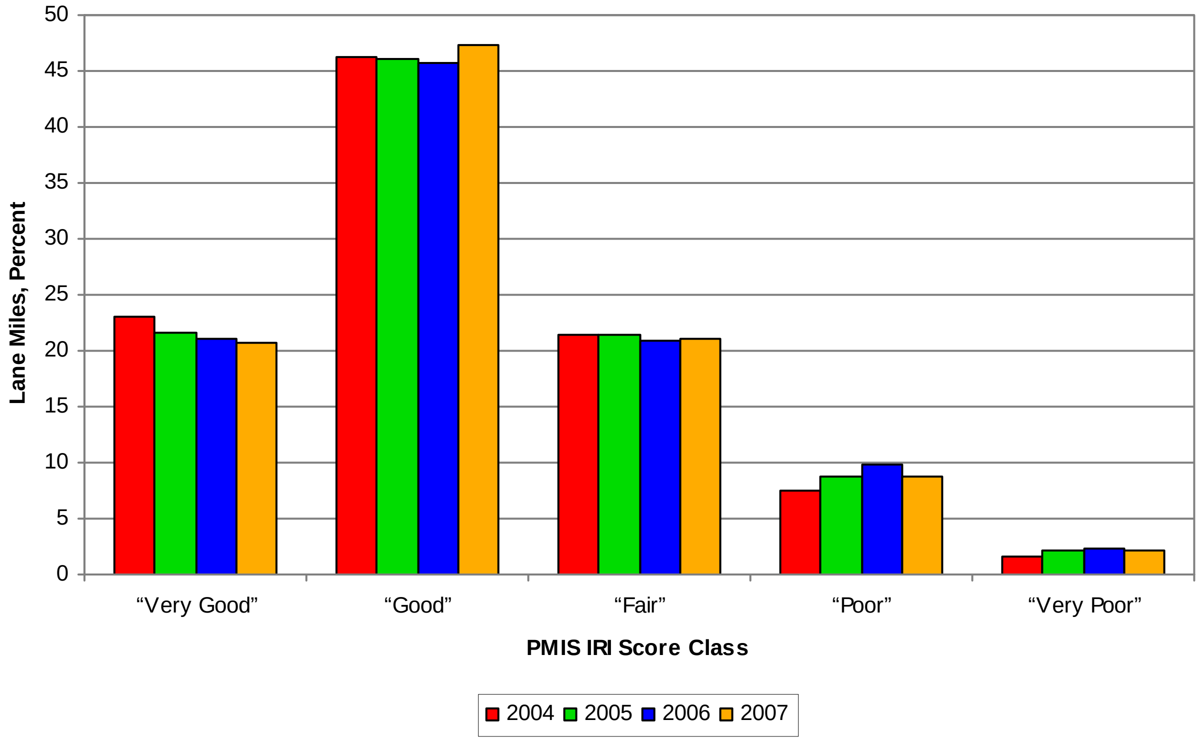
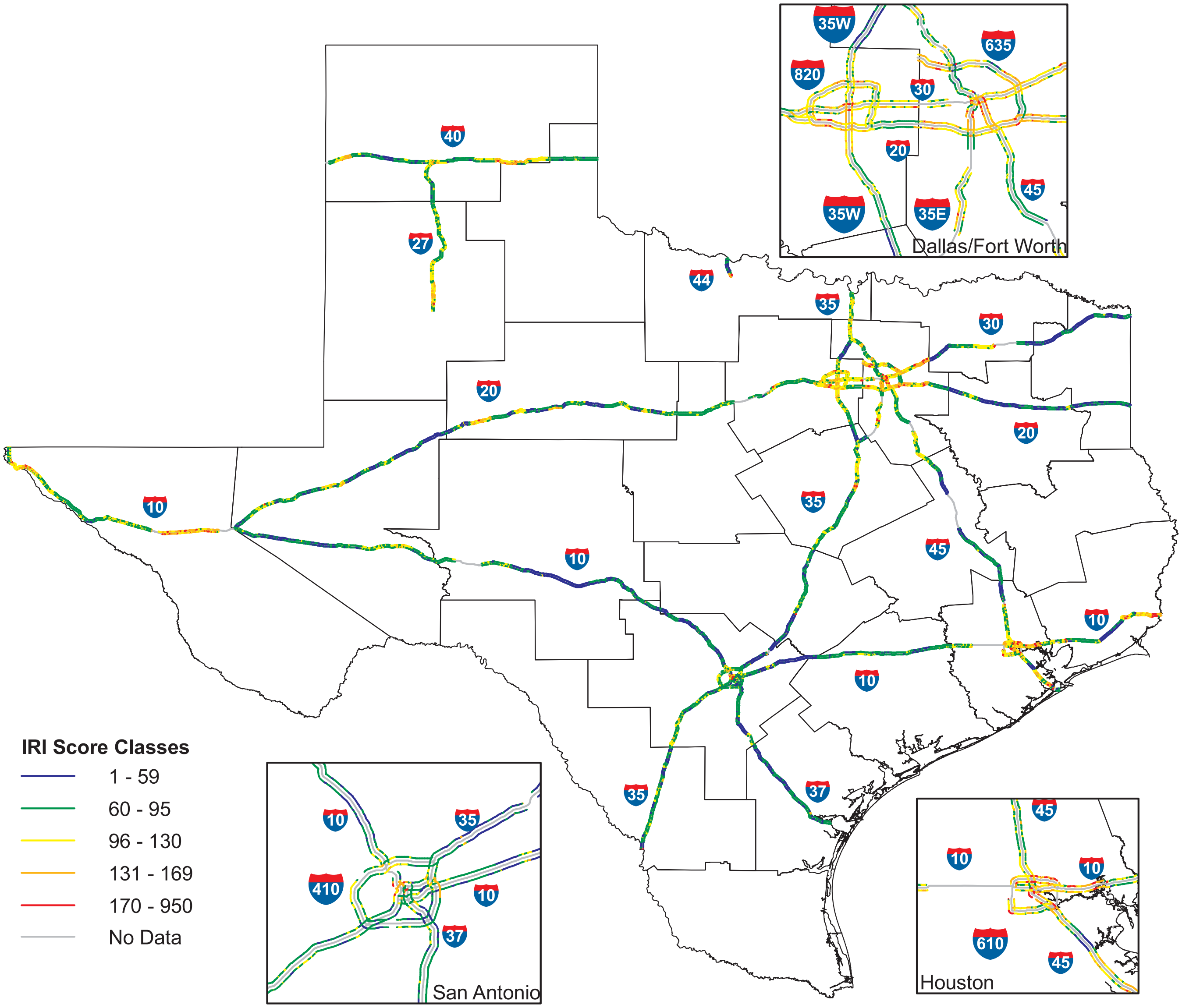


Figure 2.6 — IH System IRI Score Classes, FY 2004-2007.

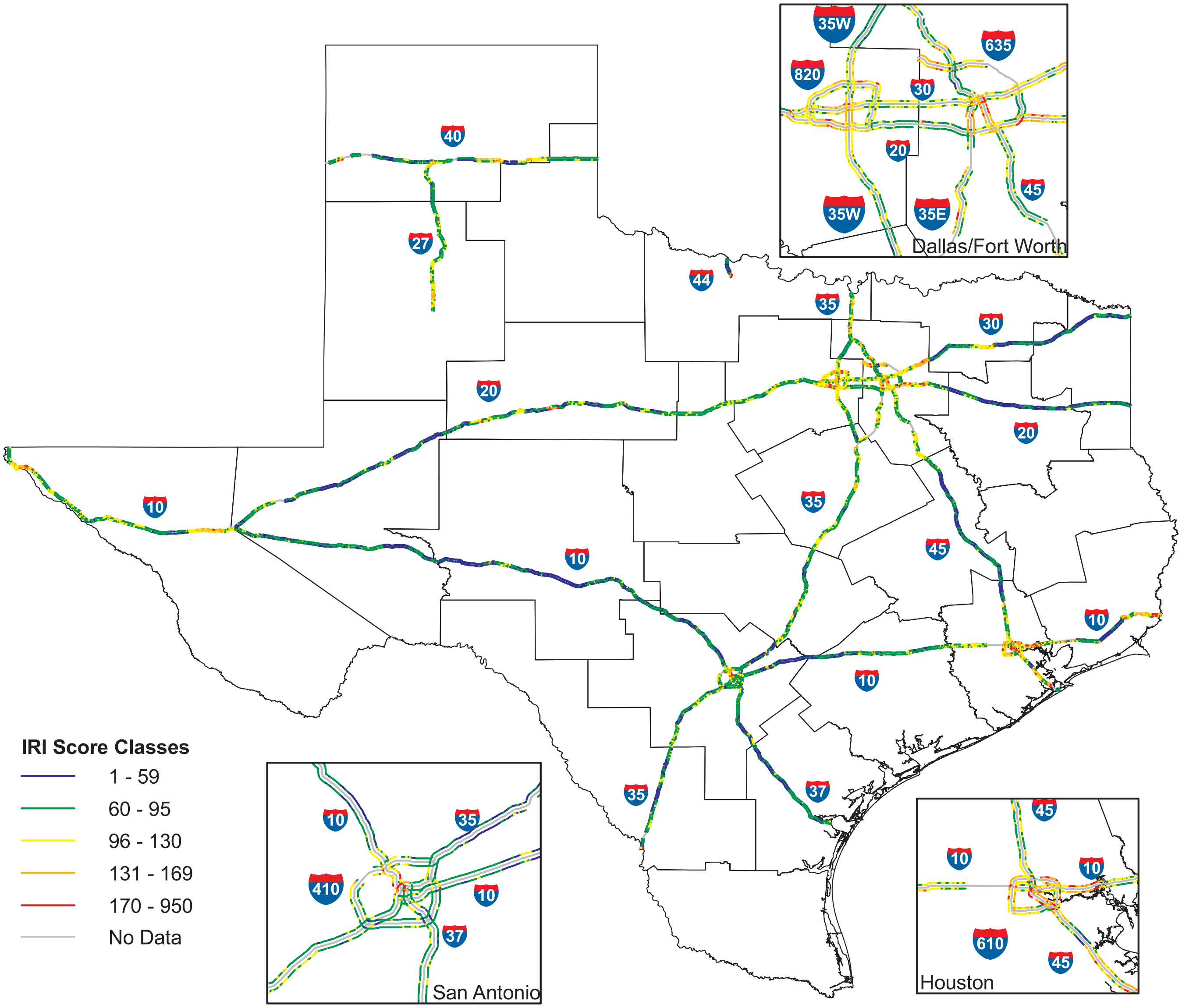
The IRI Score Classes for Interstate Highways show that:

- "Very Good" mileage decreased (from 21.14% in 2006 to 20.68% in 2007)
- "Good" mileage increased (from 45.72% in 2006 to 47.32% in 2007)
- "Fair" mileage increased (from 20.87% in 2006 to 21.07% in 2007)
- "Poor" mileage decreased (from 9.89% in 2006 to 8.73% in 2007)
- "Very Poor" mileage decreased (from 2.38% in 2006 to 2.19% in 2007).

Map 2.9 — IH System IRI Score Classes, FY 2006.



Map 2.10 — IH System IRI Score Classes, FY 2007.



United States (US) Highway System

Figure 2.7 shows the statewide distribution of Condition Score classes for the US Highway system for fiscal years 2004 through 2007.

75.27 percent of the US lane miles were in “Very Good” condition in FY 2007.

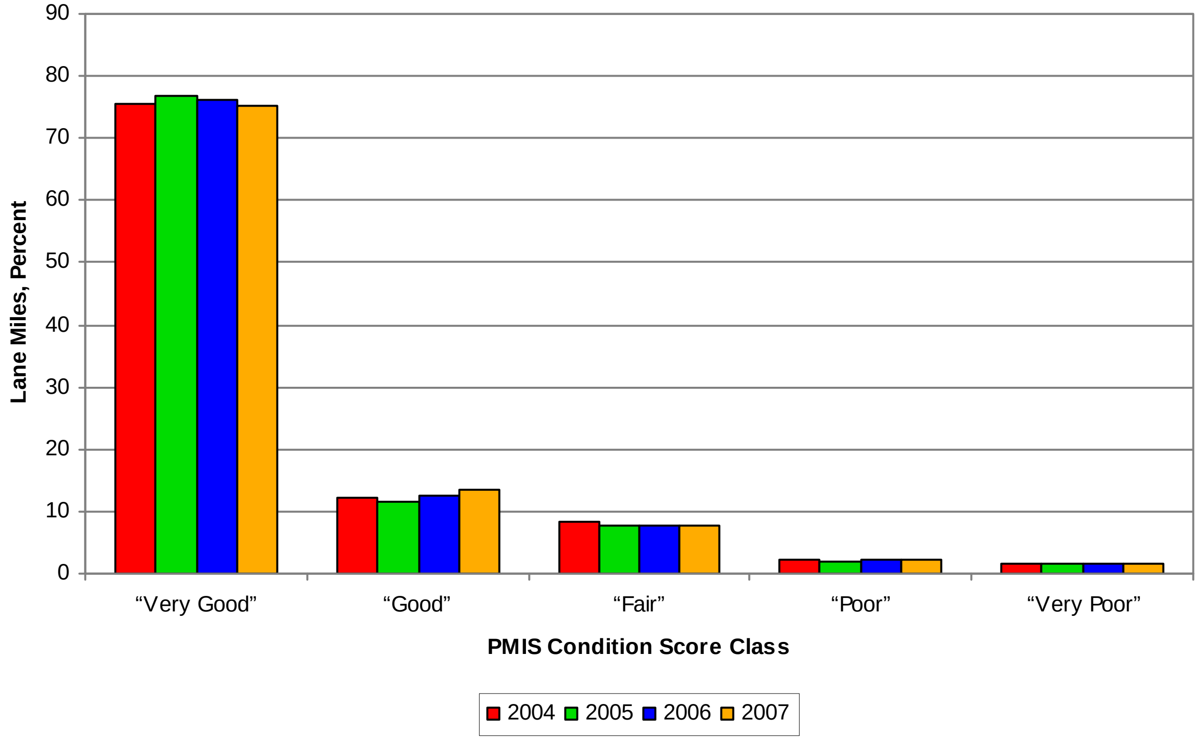


Figure 2.7 — US System Condition Score Classes, FY 2004-2007.

The Condition Score Classes for US Highways show that:

- “Very Good” mileage decreased (from 76.06% in 2006 to 75.27% in 2007)
- “Good” mileage increased (from 12.41% in 2006 to 13.42% in 2007)
- “Fair” mileage decreased (from 7.76% in 2006 to 7.69% in 2007)
- “Poor” mileage increased (from 2.09% in 2006 to 2.13% in 2007)
- “Very Poor” mileage decreased (from 1.68% in 2006 to 1.50% in 2007).

Figure 2.8 shows the statewide distribution of the Distress Score classes for the US Highway system for fiscal years 2004 through 2007.

79.65 percent of the US lane miles were "Very Good" in terms of pavement distress in FY 2007.

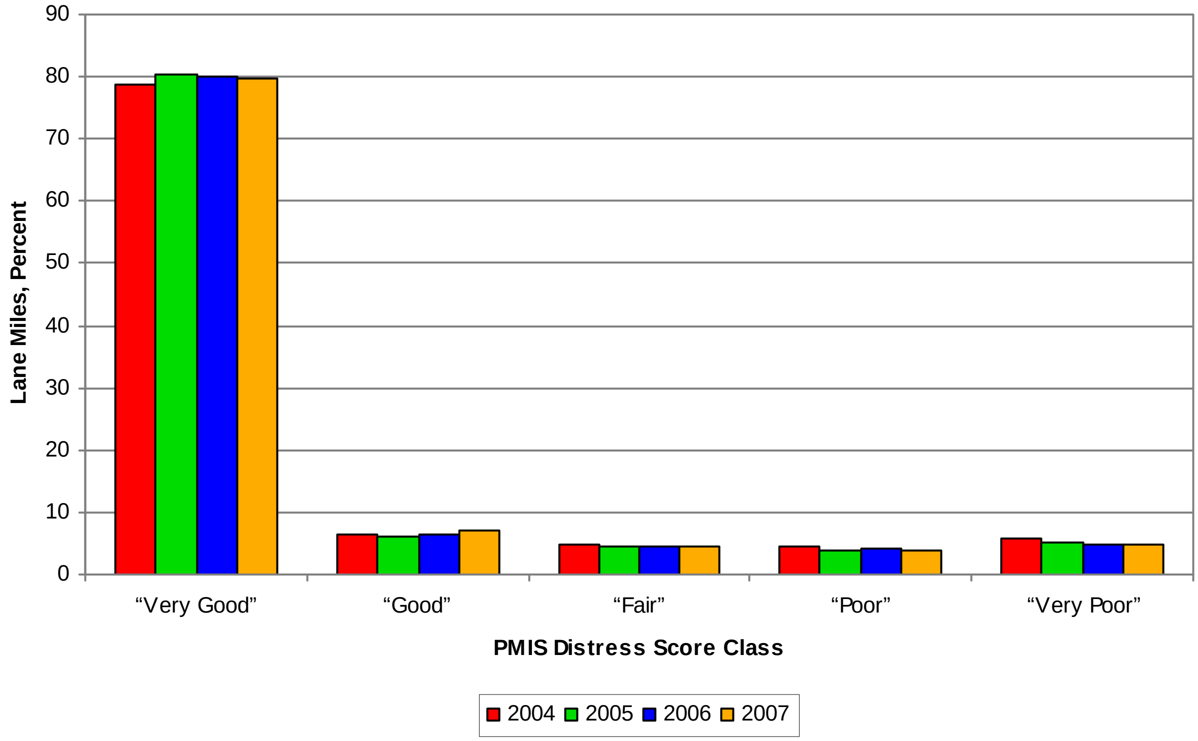


Figure 2.8 — US System Distress Score Classes, FY 2004-2007.

The Distress Score Classes for US Highways show that:

- "Very Good" mileage decreased (from 80.04% in 2006 to 79.65% in 2007)
- "Good" mileage increased (from 6.38% in 2006 to 7.19% in 2007)
- "Fair" mileage increased (from 4.44% in 2006 to 4.46% in 2007)
- "Poor" mileage decreased (from 4.22% in 2006 to 3.85% in 2007)
- "Very Poor" mileage decreased (from 4.93% in 2006 to 4.84% in 2007).

Figure 2.9 shows the statewide distribution of Deep Distress Score classes for the US Highway system for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

88.78 percent of the US lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

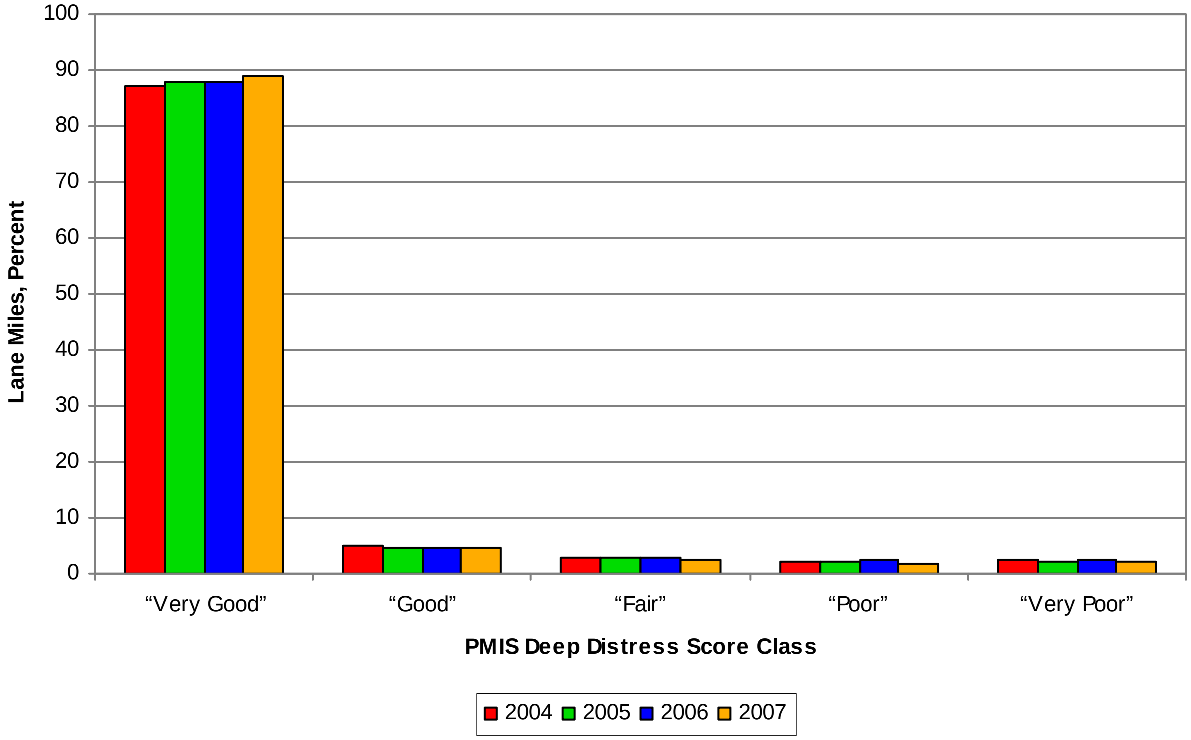


Figure 2.9 — US System Deep Distress Score Classes, FY 2004-2007.

The Deep Distress Score Classes for US Highways show that:

- "Very Good" mileage increased (from 87.72% in 2006 to 88.78% in 2007)
- "Good" mileage increased (from 4.64% in 2006 to 4.73% in 2007)
- "Fair" mileage decreased (from 2.79% in 2006 to 2.37% in 2007)
- "Poor" mileage decreased (from 2.33% in 2006 to 1.96% in 2007)
- "Very Poor" mileage decreased (from 0.04% in 2006 to 0.02% in 2007).

Figure 2.10 shows the statewide distribution for the Ride Score classes for the US Highway system for fiscal years 2004 through 2007. In general, the average person would consider 7.90 percent of US pavements in Texas to be "rough."

43.37 percent of the US lane miles had "Very Good" ride quality in FY 2007.

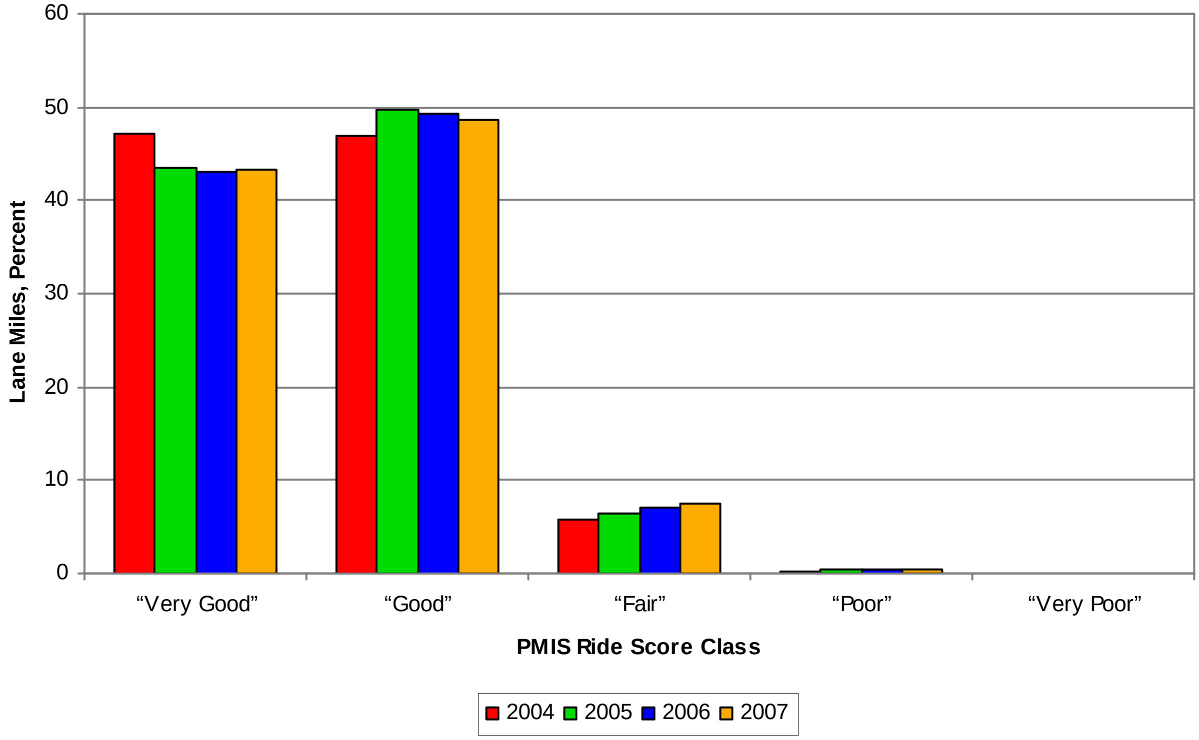


Figure 2.10 — US System Ride Score Classes, FY 2004-2007.

The Ride Score Classes for US Highways show that:

- "Very Good" mileage increased (from 42.97% in 2006 to 43.37% in 2007)
- "Good" mileage decreased (from 49.39% in 2006 to 48.73% in 2007)
- "Fair" mileage increased (from 7.16% in 2006 to 7.47% in 2007)
- "Poor" mileage decreased (from 0.45% in 2006 to 0.42% in 2007)
- "Very Poor" mileage decreased (from 0.04% in 2006 to 0.02% in 2007).

Figure 2.11 shows the statewide distribution for the IRI Score classes for the US Highway system for fiscal years 2004 through 2007. In general, the average person would consider 44.51 percent of US pavements in Texas to be “rough,” based on IRI. This is not the same as the 7.90 percent of “rough” US mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

12.98 percent of the US lane miles had “Very Good” IRI Scores in FY 2007.

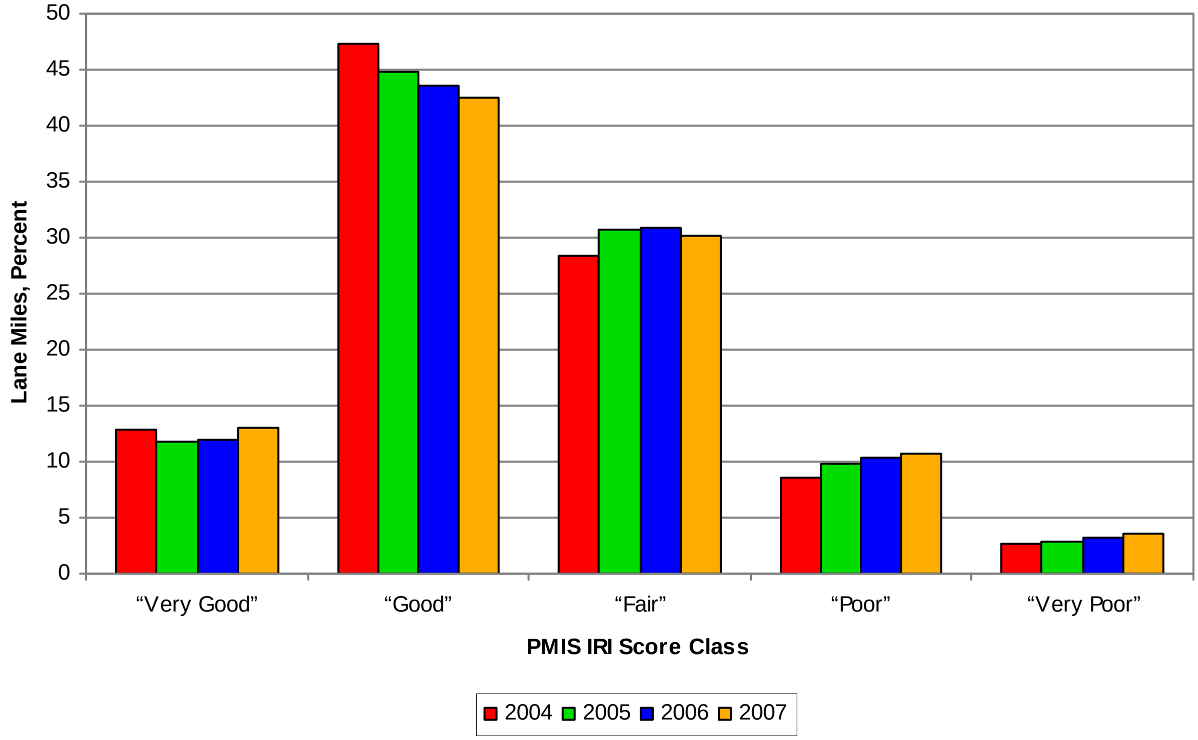


Figure 2.11 — US System IRI Score Classes, FY 2004-2007.

The IRI Score Classes for US Highways show that:

- “Very Good” mileage increased (from 11.96% in 2006 to 12.98% in 2007)
- “Good” mileage decreased (from 43.57% in 2006 to 42.51% in 2007)
- “Fair” mileage decreased (from 30.88% in 2006 to 30.26% in 2007)
- “Poor” mileage increased (from 10.30% in 2006 to 10.72% in 2007)
- “Very Poor” mileage increased (from 3.29% in 2006 to 3.53% in 2007).

State Highway (SH) System

Figure 2.12 shows the statewide distribution for the Condition Score classes for the SH system for fiscal years 2004 through 2007.

73.32 percent of the SH lane miles were in "Very Good" condition in FY 2007.

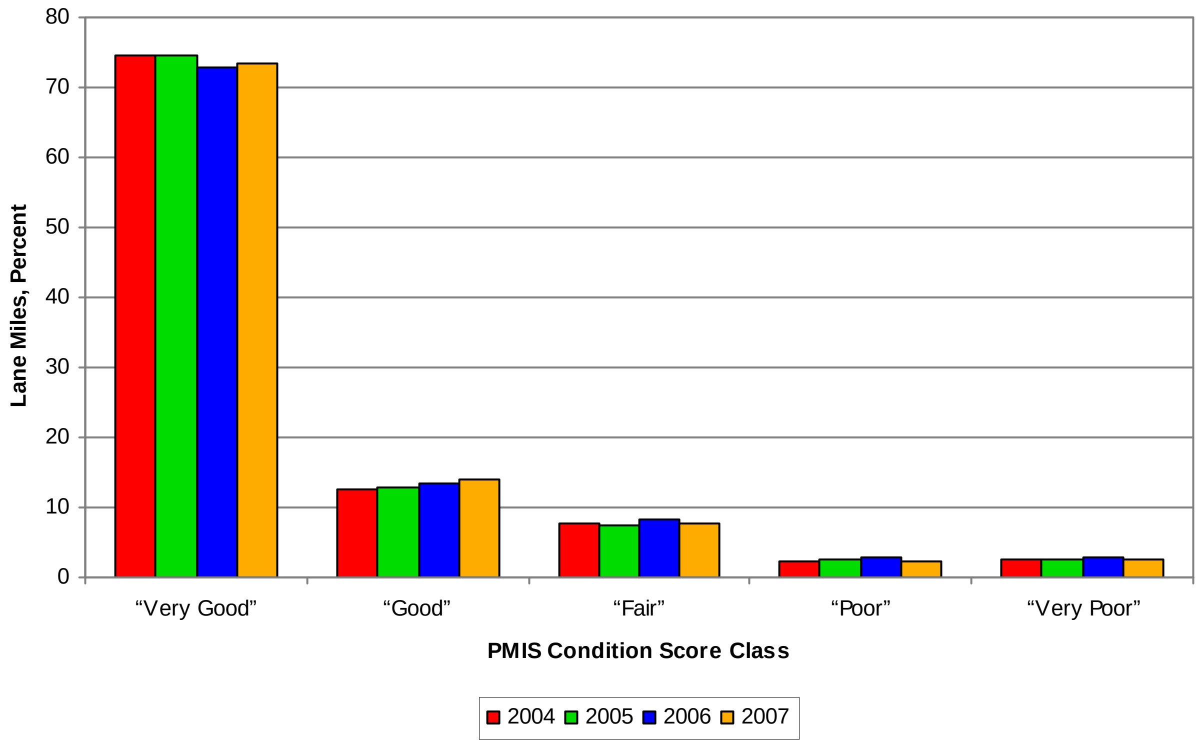


Figure 2.12 — SH System Condition Score Classes, FY 2004-2007.

The Condition Score Classes for State Highways show that:

- "Very Good" mileage increased (from 72.82% in 2006 to 73.32% in 2007)
- "Good" mileage increased (from 13.38% in 2006 to 13.93% in 2007)
- "Fair" mileage decreased (from 8.19% in 2006 to 7.76% in 2007)
- "Poor" mileage decreased (from 2.80% in 2006 to 2.42% in 2007)
- "Very Poor" mileage decreased (from 2.80% in 2006 to 2.58% in 2007).

Figure 2.13 shows the statewide distribution of the Distress Score classes for the SH system for fiscal years 2004 through 2007.

80.51 percent of the SH lane miles were "Very Good" in terms of pavement distress in FY 2007.

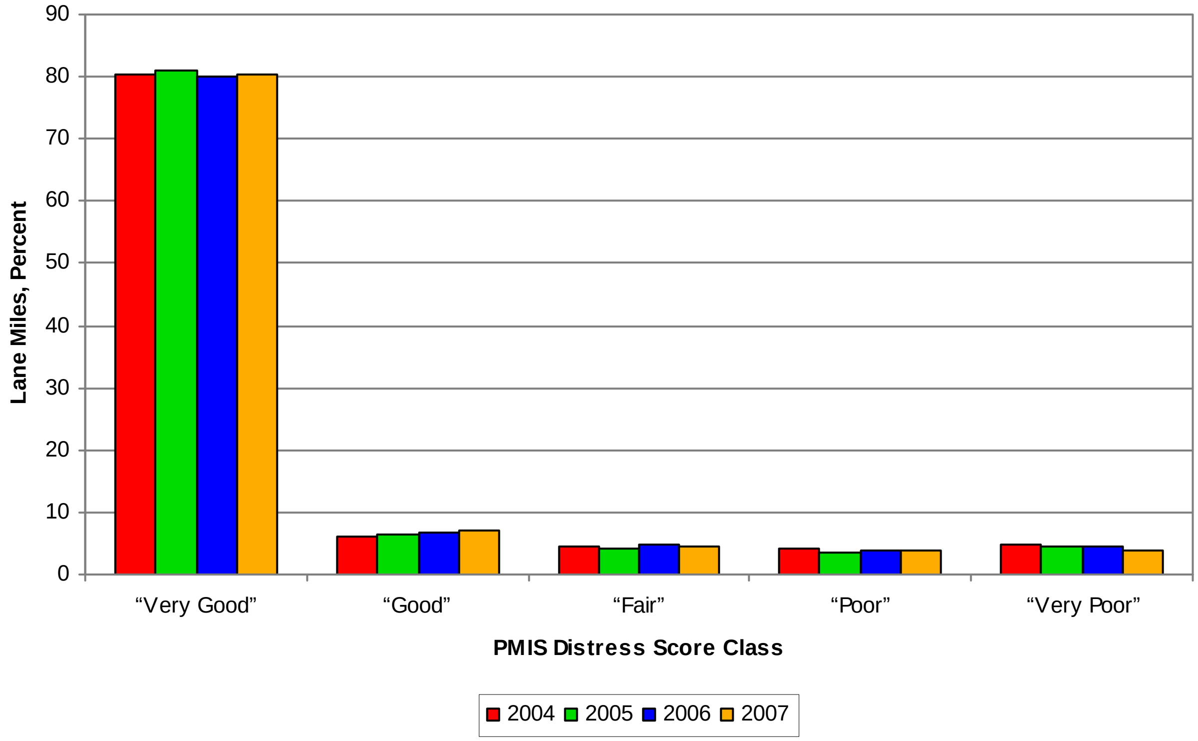


Figure 2.13 — SH System Distress Score Classes, FY 2004-2007.

The Distress Score Classes for State Highways show that:

- "Very Good" mileage increased (from 79.93% in 2006 to 80.51% in 2007)
- "Good" mileage increased (from 6.71% in 2006 to 7.00% in 2007)
- "Fair" mileage decreased (from 4.80% in 2006 to 4.60% in 2007)
- "Poor" mileage decreased (from 3.99% in 2006 to 3.91% in 2007)
- "Very Poor" mileage decreased (from 4.56% in 2006 to 3.97% in 2007).

Figure 2.14 shows the statewide distribution of Deep Distress Score classes for the SH system for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

89.12 percent of the SH lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

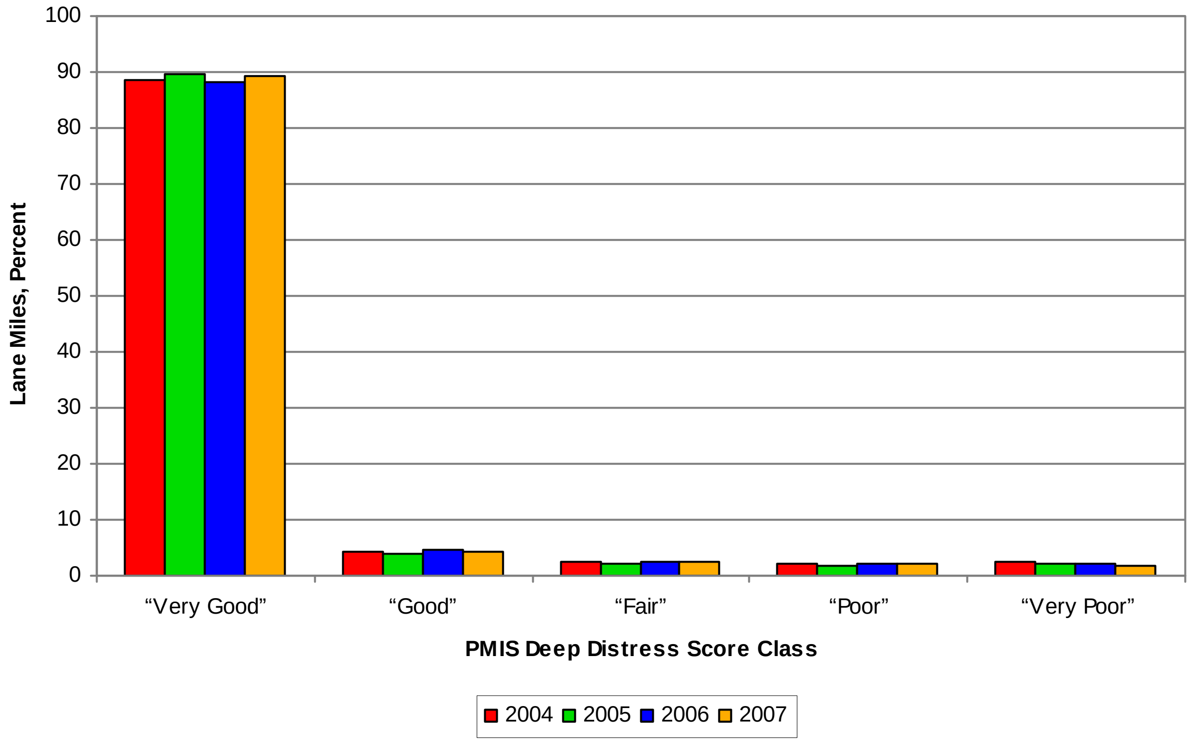


Figure 2.14 — SH System Deep Distress Score Classes, FY 2004-2007.

The Deep Distress Score Classes for State Highways show that:

- "Very Good" mileage increased (from 88.12% in 2006 to 89.12% in 2007)
- "Good" mileage decreased (from 4.66% in 2006 to 4.36% in 2007)
- "Fair" mileage decreased (from 2.67% in 2006 to 2.60% in 2007)
- "Poor" mileage decreased (from 2.31% in 2006 to 2.03% in 2007)
- "Very Poor" mileage decreased (from 2.25% in 2006 to 1.89% in 2007).

Figure 2.15 shows the statewide distribution for the Ride Score classes for the SH system for fiscal years 2004 through 2007. In general, the average person would consider 15.49 percent of SH pavements in Texas to be “rough.”

30.27 percent of the SH lane miles had “Very Good” ride quality in FY 2007.

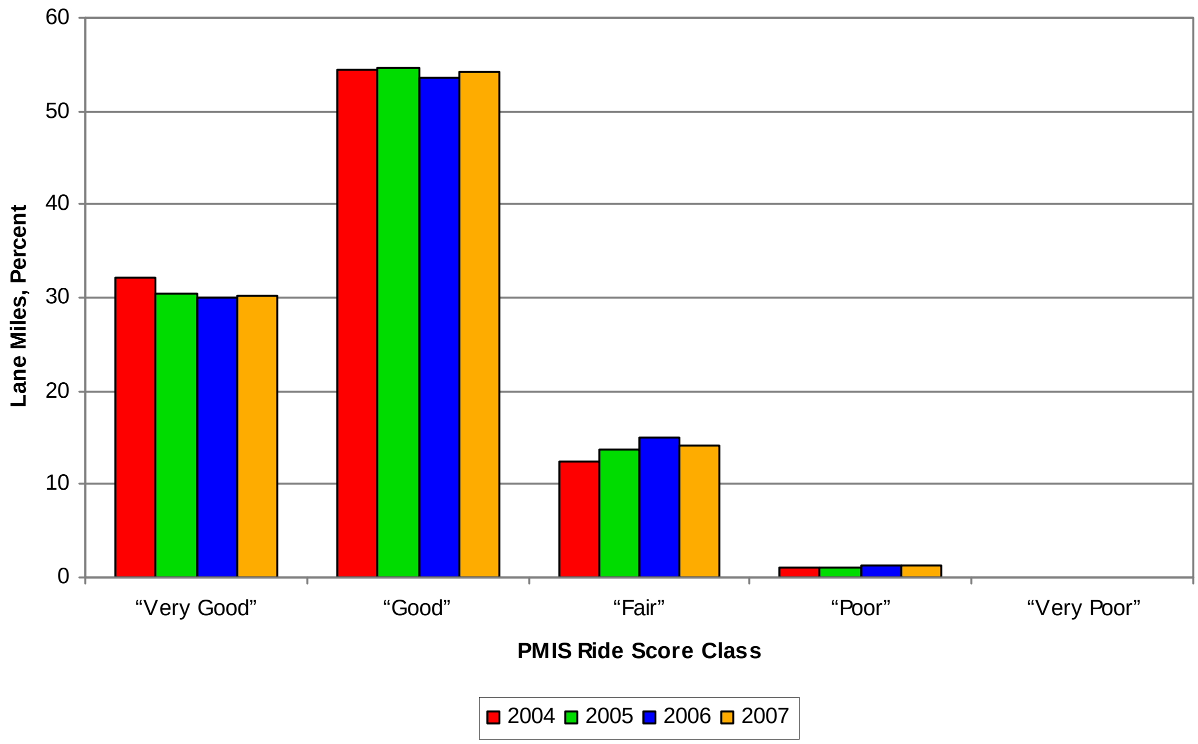


Figure 2.15 — SH System Ride Score Classes, FY 2004-2007.

The Ride Score Classes for State Highways show that:

- “Very Good” mileage increased (from 30.05% in 2006 to 30.27% in 2007)
- “Good” mileage increased (from 53.64% in 2006 to 54.24% in 2007)
- “Fair” mileage decreased (from 14.99% in 2006 to 14.22% in 2007)
- “Poor” mileage decreased (from 1.24% in 2006 to 1.18% in 2007)
- “Very Poor” mileage increased (from 0.07% in 2006 to 0.09% in 2007).

Figure 2.16 shows the statewide distribution for the IRI Score classes for the SH system for fiscal years 2004 through 2007. In general, the average person would consider 58.71 percent of SH pavements in Texas to be "rough," based on IRI. This is not the same as the 15.49 percent of "rough" SH mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

6.90 percent of the SH lane miles had "Very Good" IRI Scores in FY 2007.

Figure 2.16 — SH System IRI Score Classes, FY 2004-2007.

The IRI Score Classes for State Highways show that:

- "Very Good" mileage increased (from 6.75% in 2006 to 6.90% in 2007)
- "Good" mileage decreased (from 34.57% in 2006 to 34.39% in 2007)
- "Fair" mileage increased (from 33.78% in 2006 to 33.95% in 2007)
- "Poor" mileage increased (from 16.52% in 2006 to 16.91% in 2007)
- "Very Poor" mileage decreased (from 8.38% in 2006 to 7.84% in 2007).

Farm-to-Market (FM) Roads

Figure 2.17 shows the statewide distribution of the Condition Score classes for FM roads for fiscal years 2004 through 2007.

71.69 percent of the FM miles were in "Very Good" condition in FY 2007.

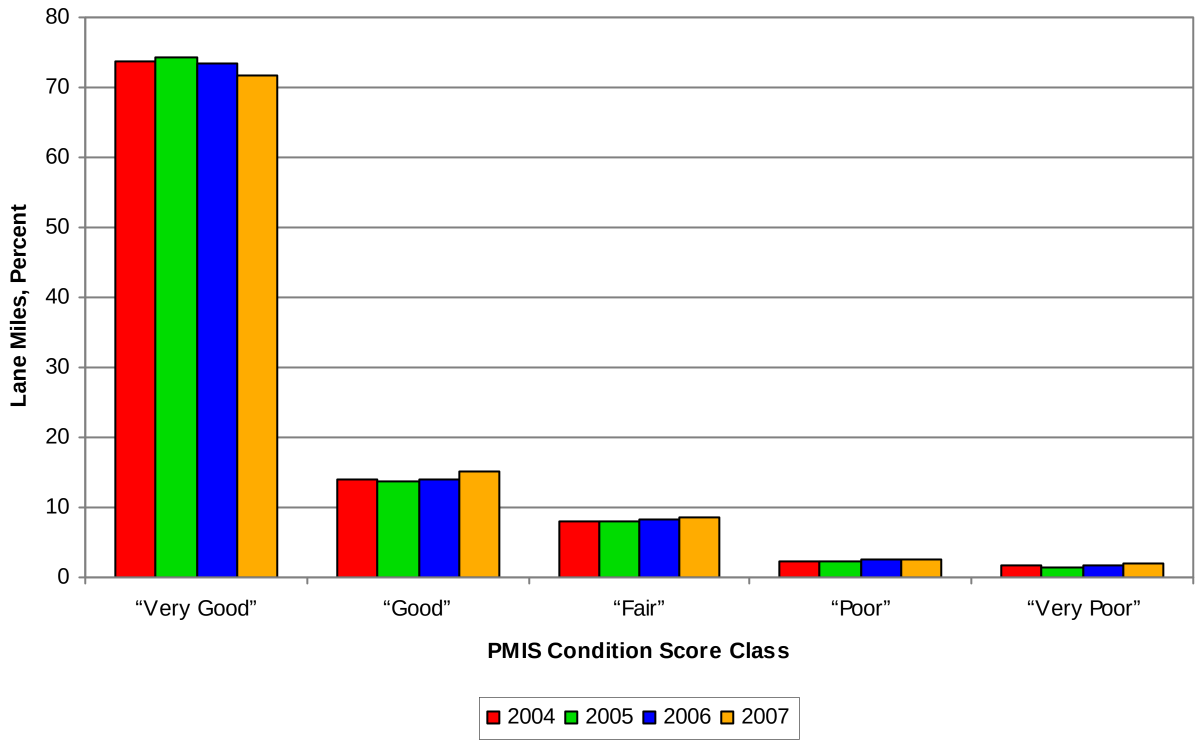


Figure 2.17 — FM Roads Condition Score Classes, FY 2004-2007.

The Condition Score Classes for Farm-to-Market Roads show that:

- "Very Good" mileage decreased (from 73.50% in 2006 to 71.69% in 2007)
- "Good" mileage increased (from 13.99% in 2006 to 15.23% in 2007)
- "Fair" mileage increased (from 8.36% in 2006 to 8.63% in 2007)
- "Poor" mileage increased (from 2.45% in 2006 to 2.58% in 2007)
- "Very Poor" mileage increased (from 1.70% in 2006 to 1.87% in 2007).

Figure 2.18 shows the statewide distribution of the Distress Score classes for FM roads for fiscal years 2004 through 2007.

78.97 percent of FM lane miles were "Very Good" in terms of pavement distress in FY 2007.

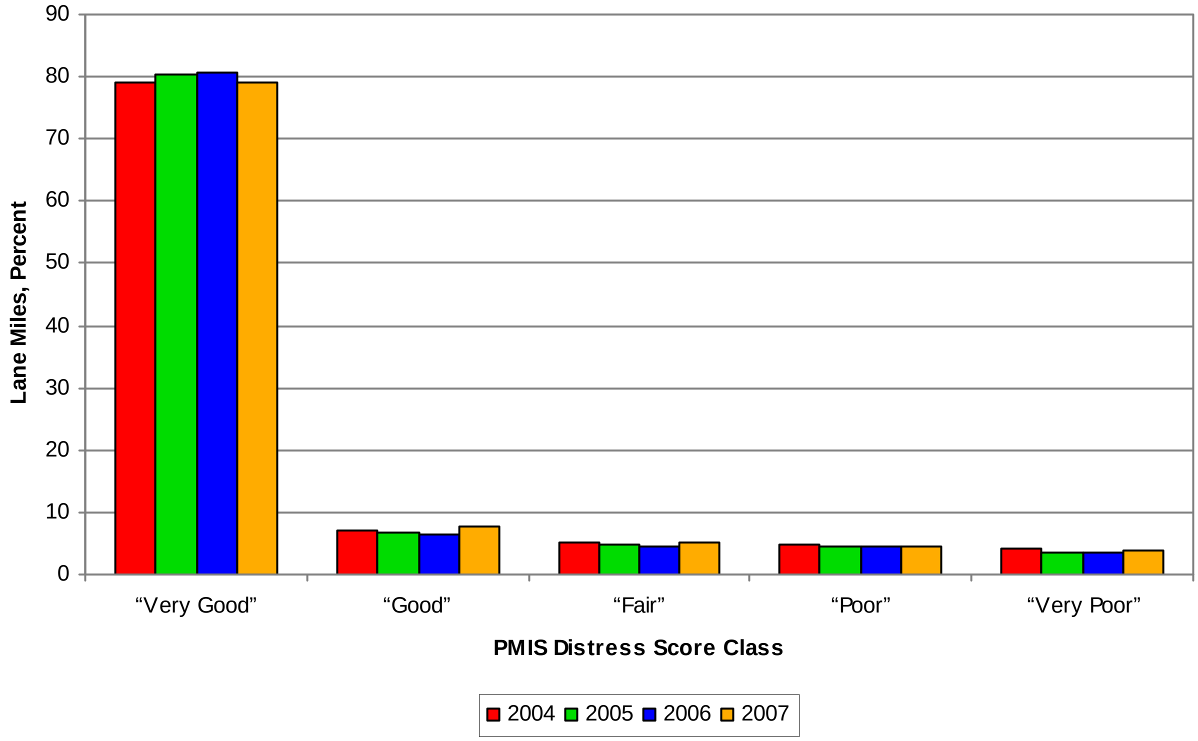


Figure 2.18 — FM Roads Distress Score Classes, FY 2004-2007.

The Distress Score Classes for Farm-to-Market Roads show that:

- "Very Good" mileage decreased (from 80.61% in 2006 to 78.97% in 2007)
- "Good" mileage increased (from 6.53% in 2006 to 7.72% in 2007)
- "Fair" mileage increased (from 4.62% in 2006 to 4.99% in 2007)
- "Poor" mileage increased (from 4.55% in 2006 to 4.59% in 2007)
- "Very Poor" mileage increased (from 3.70% in 2006 to 3.72% in 2007).

Figure 2.19 shows the statewide distribution of Deep Distress Score classes for FM roads for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

90.73 percent of FM lane miles were “Very Good” in terms of pavement deep distress in FY 2007.

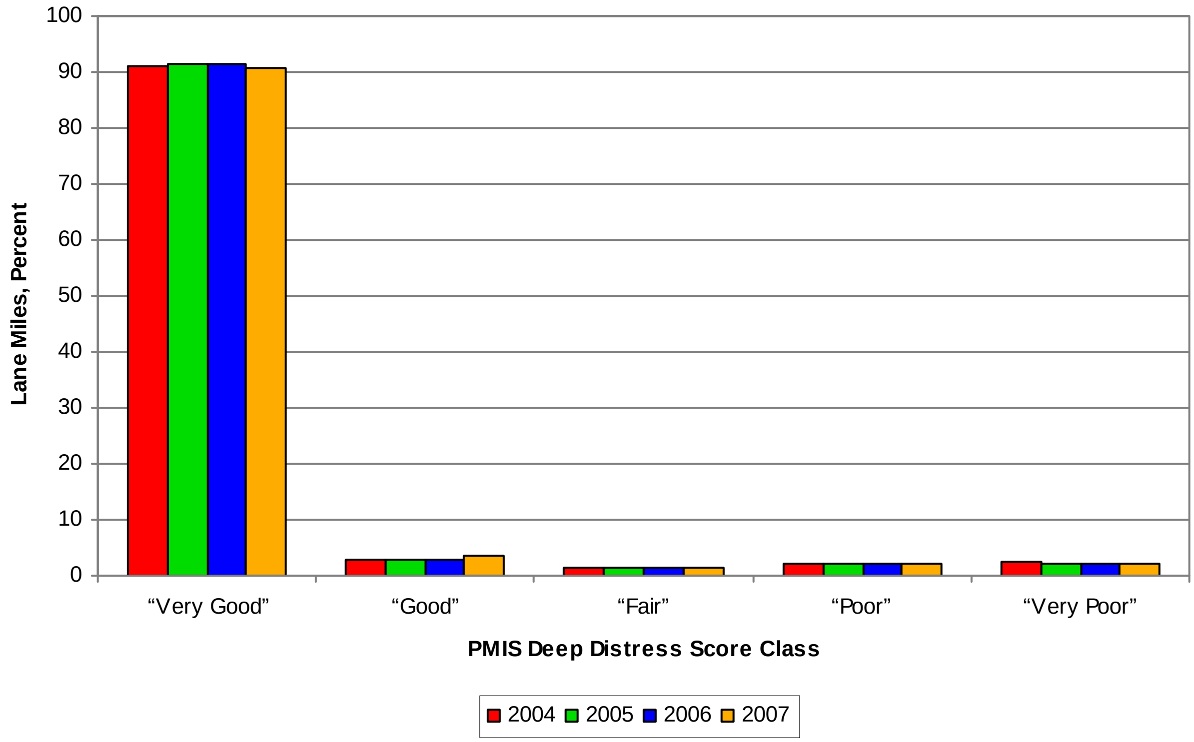


Figure 2.19 — FM Roads Deep Distress Score Classes, FY 2004-2007.

The Deep Distress Score Classes for Farm-to-Market Roads show that:

- “Very Good” mileage decreased (from 91.44% in 2006 to 90.73% in 2007)
- “Good” mileage increased (from 2.83% in 2006 to 3.43% in 2007)
- “Fair” mileage increased (from 1.37% in 2006 to 1.54% in 2007)
- “Poor” mileage decreased (from 2.15% in 2006 to 2.13% in 2007)
- “Very Poor” mileage decreased (from 2.20% in 2006 to 2.17% in 2007).

Figure 2.20 shows the statewide distribution of the Ride Score classes for FM roads for fiscal years 2004 through 2007. In general, the average person would consider 38.18 percent of FM roads in Texas to be "rough."

10.51 percent of the FM lane miles had "Very Good" ride quality in FY 2007.

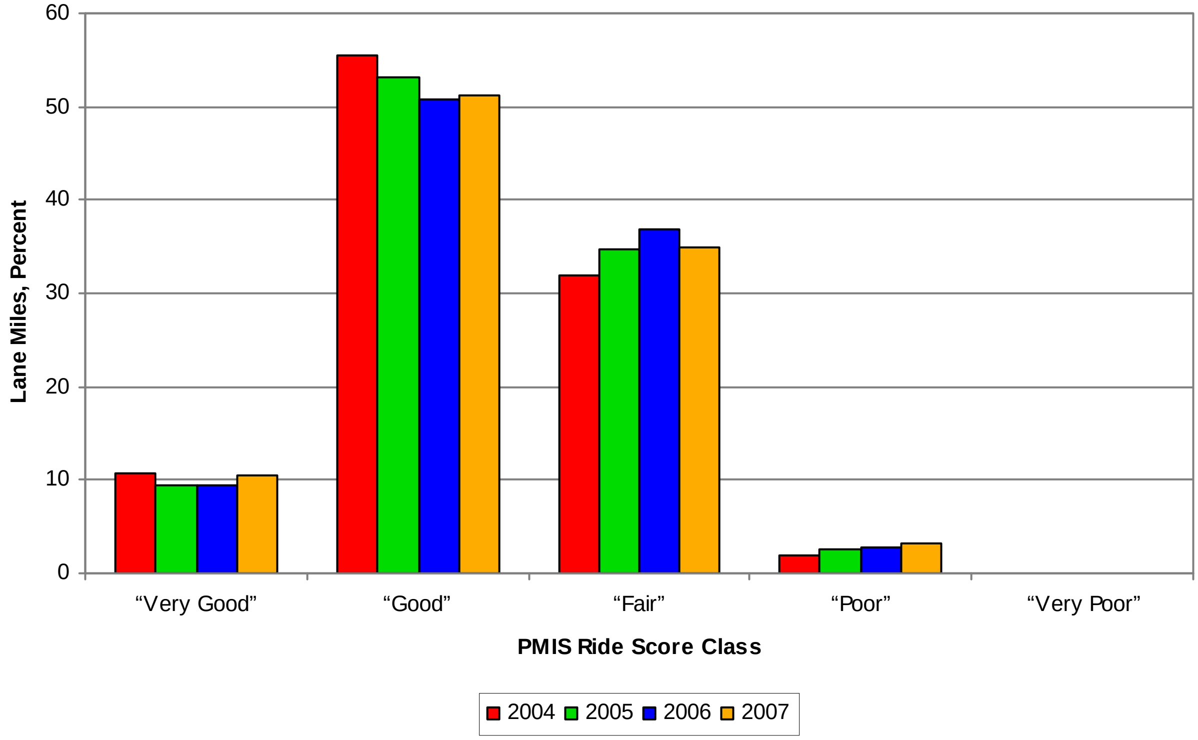


Figure 2.20 — FM Roads Ride Score Classes, FY 2004-2007.

The Ride Score Classes for Farm-to-Market Roads show that:

- "Very Good" mileage increased (from 9.41% in 2006 to 10.51% in 2007)
- "Good" mileage increased (from 50.78% in 2006 to 51.30% in 2007)
- "Fair" mileage decreased (from 36.84% in 2006 to 34.85% in 2007)
- "Poor" mileage increased (from 2.89% in 2006 to 3.25% in 2007)
- "Very Poor" mileage increased (from 0.08% in 2006 to 0.09% in 2007).

Figure 2.21 shows the statewide distribution of the IRI Score classes for FM roads for fiscal years 2004 through 2007. In general, the average person would consider 83.84 percent of FM roads in Texas to be “rough,” based on IRI. This is not the same as the 38.18 percent of “rough” FM mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

1.59 percent of the FM lane miles had “Very Good” IRI Scores in FY 2007.

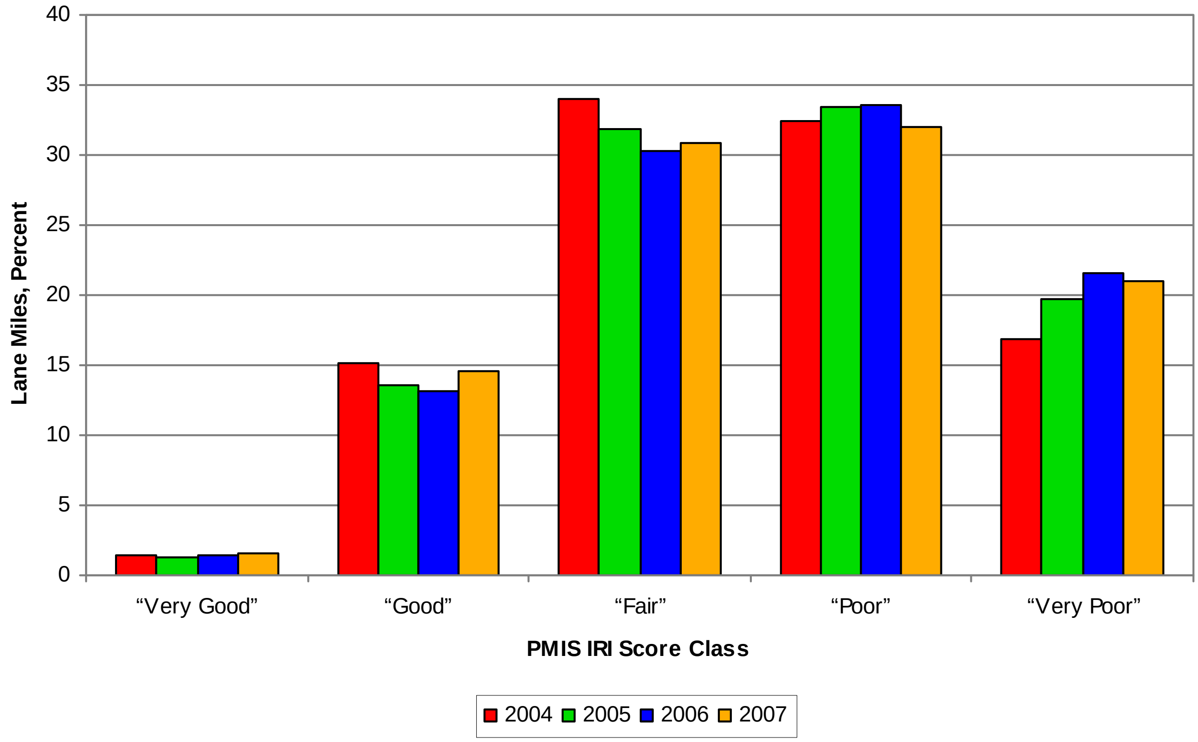


Figure 2.21 — FM Roads IRI Score Classes, FY 2004-2007.

The IRI Score Classes for Farm-to-Market Roads show that:

- “Very Good” mileage increased (from 1.43% in 2006 to 1.59% in 2007)
- “Good” mileage increased (from 13.13% in 2006 to 14.57% in 2007)
- “Fair” mileage increased (from 30.26% in 2006 to 30.81% in 2007)
- “Poor” mileage decreased (from 33.56% in 2006 to 31.97% in 2007)
- “Very Poor” mileage decreased (from 21.61% in 2006 to 21.06% in 2007).

Discussion

Pavement condition and distress trends were mixed, but ride quality improved for each of the four major highway systems (IH, US, SH, and FM) in FY 2007.

For Interstate highways (IH), FY 2007 condition, distress, and ride quality all improved. Deep Distress Scores on the IH system also improved in FY 2007. IH had the best overall ride quality of the major highway systems in FY 2007, as it has had since FY 1998. IH had the worst overall distress and "deep" distress of the major highway systems in FY 2007, as it has had since FY 2004.

For US highways, FY 2007 condition got worse, but distress and ride quality improved. Deep Distress Scores on US highways also improved in FY 2007. The US system had the best overall condition of the major highway systems in FY 2007 (as it has had since FY 2004), and also had the best overall distress in FY 2007.

For State highways (SH), FY 2007 condition, distress, and ride quality all improved. Deep Distress Scores on SH routes also improved in FY 2007. The SH system no longer had the worst overall condition of the major highway systems in FY 2007, as it has had since FY 2004.

For Farm-to-Market roads (FM), FY 2007 condition and distress got worse, but ride quality improved. Deep Distress Scores on FM roads got worse, though. Despite the worsening Deep Distress Scores in FY 2007, FM roads still had the best overall "deep" distress, as they have had since FY 2004. FM roads had the worst overall ride quality of the major highway systems in FY 2007 (as they have had since FY 2001) and the worst overall condition.

Summary

Pavement condition and distress trends were mixed, but ride quality improved for each of the four major highway systems (IH, US, SH, and FM) in FY 2007.

IH and SH routes improved in all categories – condition, distress, ride, and "deep" distress – in FY 2007. US highways improved in distress, "deep" distress, and ride, but the improvements were all very small, and were not enough to keep the overall condition from getting worse. FM roads improved in ride quality, but got worse in condition, distress, and "deep" distress.

The first actual PMIS Annual Report was published in April 1996 and summarized the results of the first three years of PMIS surveys (FY 1993-1995).

Chapter 3 Condition of Flexible Pavements — ACP

This chapter describes the condition of flexible pavements in Texas. Flexible pavements (sometimes known as "asphalt concrete pavement" or ACP) are surfaced with asphalt concrete. They make up 92.31 percent of the TxDOT-maintained lane mileage but carry only 72.38 percent of the vehicle miles traveled.

Flexible Pavement Distress Types

The following distress type ratings are used in the analysis:

- Shallow Rutting
- Deep Rutting
- Alligator Cracking
- Failures
- Longitudinal Cracking
- Transverse Cracking
- Block Cracking
- Patching.

Definition of "Shallow" and "Deep" Pavement Distress Types

Flexible pavement distress can be caused by many factors, and local conditions have a major impact. However, for this report, it is helpful to think of PMIS flexible pavement distress types in terms of:

- "Shallow" Distress Types – Shallow Rutting, Transverse Cracking, Block Cracking, and Patching. "Shallow" distress types usually indicate surface problems that are not directly caused by structural deficiency. In some cases, "shallow" distress types are caused by climate factors, such as temperature or rainfall, or by excessive age. "Shallow" distress usually does not require sub-surface structural rehabilitation and can be fixed by surface-type preventive maintenance treatments. However, "shallow" distress types can turn into "deep" distress types if not properly maintained.
- "Deep" Distress Types – Deep Rutting, Alligator Cracking, Failures, and Longitudinal Cracking. "Deep" distress types usually indicate sub-surface problems that reduce the pavement structure's ability to carry traffic loads. In many cases, "deep" distress types are caused by drainage problems, excessive moisture (rainfall), or moisture-reactive subgrades. "Deep" distress is usually beyond the realm of preventive maintenance and requires sub-surface structural rehabilition.

Distinguishing "Shallow" and "Deep" distress types can suggest how current funding needs to be distributed between preventive maintenance and rehabilitation. It can also identify regions of the state where load-related structural problems are prevalent.

Condition Score Classes for Flexible Pavement

Figure 3.1 shows the statewide distribution of Condition Score classes for flexible pavements for fiscal years 2004 through 2007.

73.45 percent of the flexible lane miles were in “Very Good” condition in FY 2007.

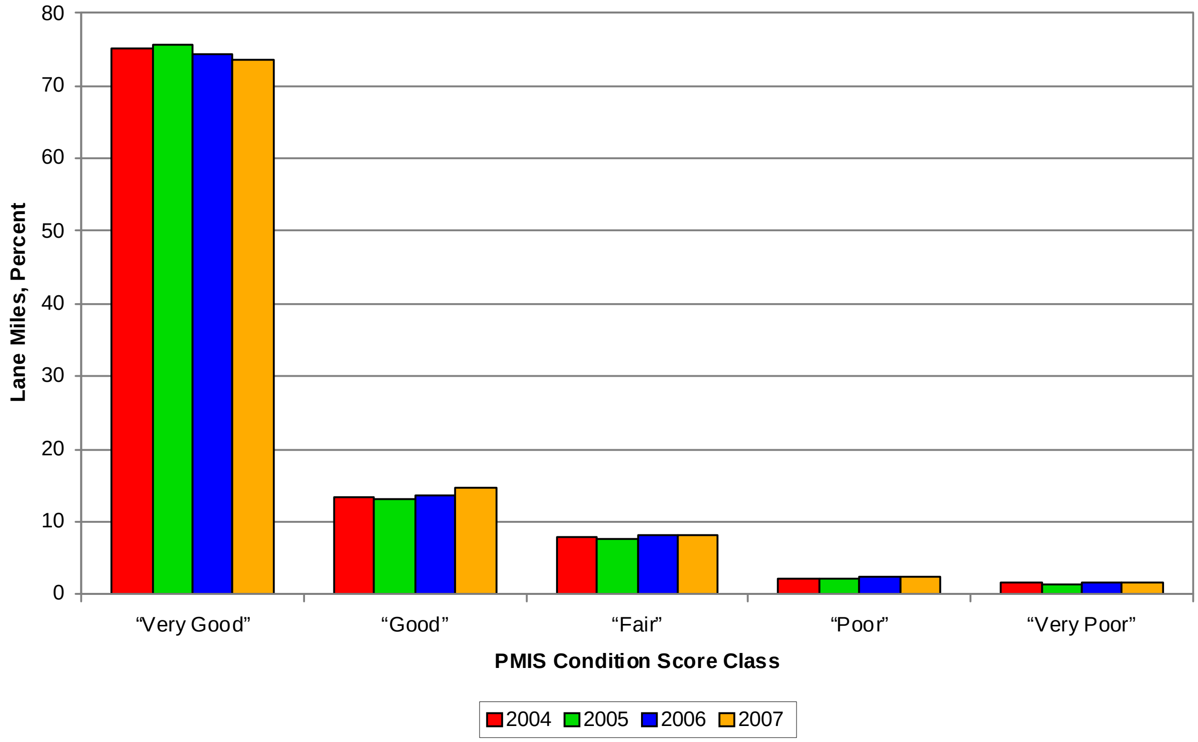


Figure 3.1 — Condition Score Classes for Flexible Pavement, FY 2004-2007.

The Condition Score Classes for Flexible Pavement shows that:

- “Very Good” mileage decreased (from 74.45% in 2006 to 73.45% in 2007)
- “Good” mileage increased (from 13.58% in 2006 to 14.54% in 2007)
- “Fair” mileage decreased (from 8.14% in 2006 to 8.08% in 2007)
- “Poor” mileage increased (from 2.28% in 2006 to 2.33% in 2007)
- “Very Poor” mileage increased (from 1.55% in 2006 to 1.60% in 2007).

Distress Score Classes for Flexible Pavement

Figure 3.2 shows the statewide distribution of the Distress Score classes for flexible pavements for fiscal years 2004 through 2007.

It should be noted that PMIS Distress Score values are not a complete description of flexible pavement condition because aggressive resurfacing can cover up visible distress and make a road look much better on top than it really is underneath. Such pavements tend to show rapid increases in load-associated distress because of failing structure or increased traffic load.

79.23 percent of the flexible lane miles were "Very Good" in terms of pavement distress in FY 2007.

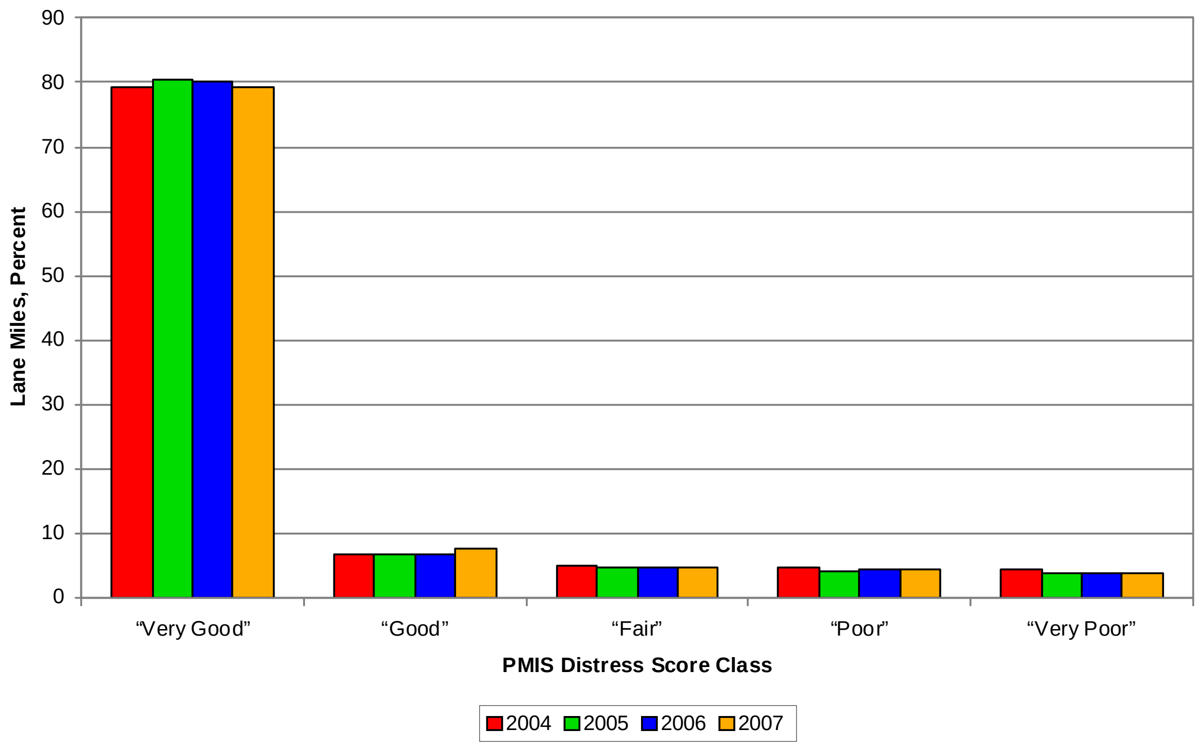


Figure 3.2 — Distress Score Classes for Flexible Pavement, FY 2004-2007.

The Distress Score Classes for Flexible Pavement shows that:

- "Very Good" mileage decreased (from 80.00% in 2006 to 79.23% in 2007)
- "Good" mileage increased (from 6.83% in 2006 to 7.72% in 2007)
- "Fair" mileage increased (from 4.79% in 2006 to 4.87% in 2007)
- "Poor" mileage decreased (from 4.43% in 2006 to 4.32% in 2007)
- "Very Poor" mileage decreased (from 3.94% in 2006 to 3.86% in 2007).

Deep Distress Score Classes for Flexible Pavement

Figure 3.3 shows the statewide distribution of Deep Distress Score classes for flexible pavements for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

89.20 percent of the flexible lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

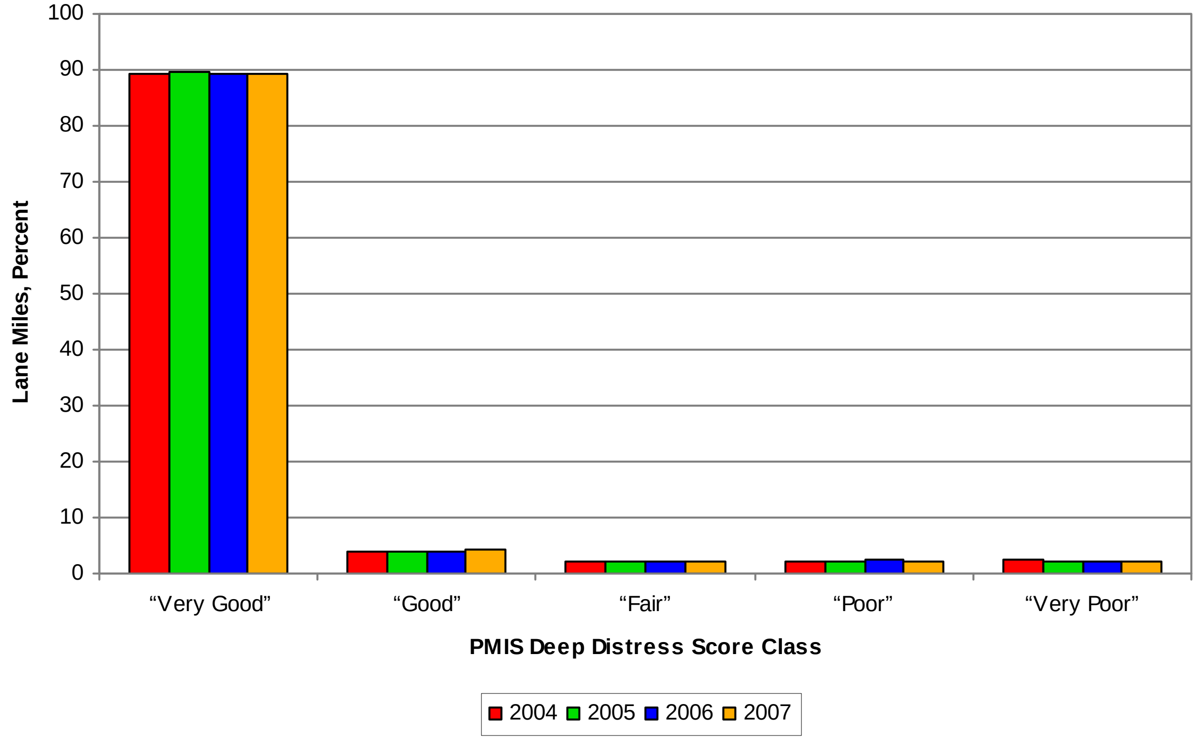


Figure 3.3 — Deep Distress Score Classes for Flexible Pavement, FY 2004-2007.

The Deep Distress Score Classes for Flexible Pavement shows that:

- "Very Good" mileage increased (from 89.19% in 2006 to 89.20% in 2007)
- "Good" mileage increased (from 4.06% in 2006 to 4.37% in 2007)
- "Fair" mileage decreased (from 2.15% in 2006 to 2.09% in 2007)
- "Poor" mileage decreased (from 2.34% in 2006 to 2.22% in 2007)
- "Very Poor" mileage decreased (from 2.26% in 2006 to 2.13% in 2007).

Ride Score Classes for Flexible Pavement

Figure 3.4 shows the statewide distribution of the Ride Score classes for flexible pavements for fiscal years 2004 through 2007. In general, the average person would consider 24.25 percent of the flexible pavements in Texas to be "rough."

26.28 percent of the flexible lane miles had "Very Good" ride quality in FY 2007.

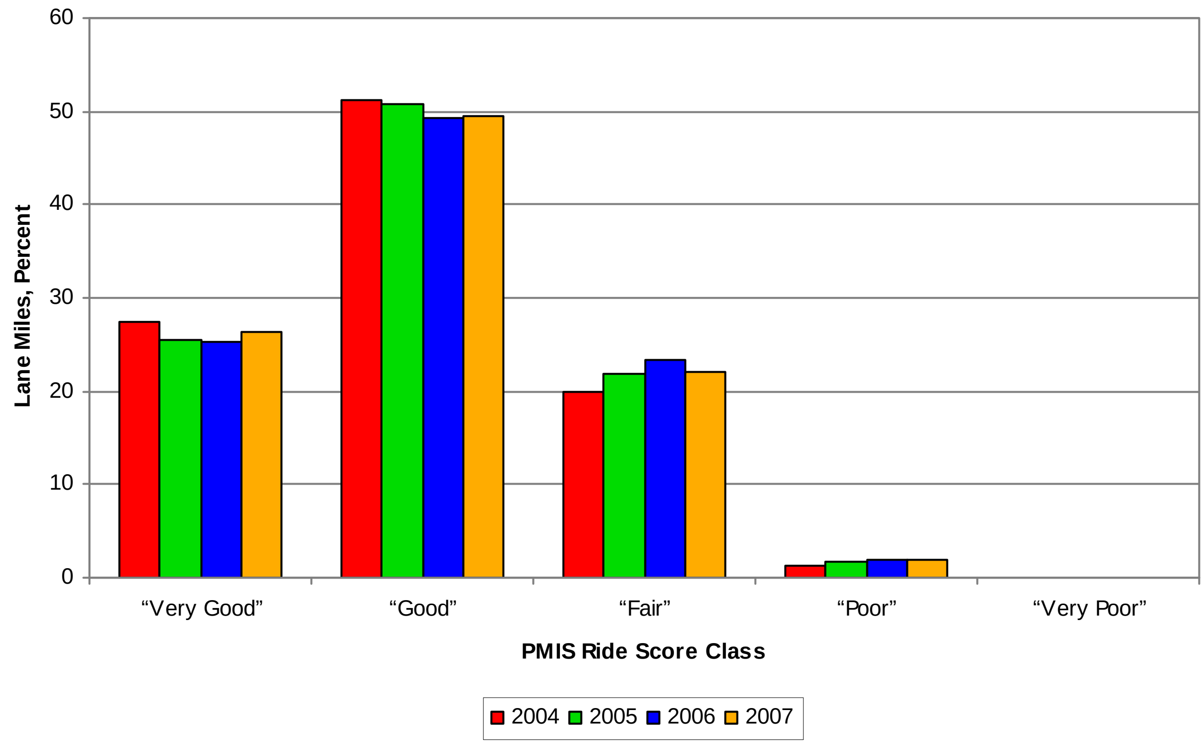


Figure 3.4 — Ride Score Classes for Flexible Pavement, FY 2004-2007.

The Ride Score Classes for Flexible Pavement shows that:

- "Very Good" mileage increased (from 25.34% in 2006 to 26.28% in 2007)
- "Good" mileage increased (from 49.31% in 2006 to 49.47% in 2007)
- "Fair" mileage decreased (from 23.43% in 2006 to 22.16% in 2007)
- "Poor" mileage increased (from 1.86% in 2006 to 2.02% in 2007)
- "Very Poor" mileage remained the same (0.07% in 2006 to 0.07% in 2007).

IRI Score Classes for Flexible Pavement

Figure 3.5 shows the statewide distribution of the IRI Score classes for flexible pavements for fiscal years 2004 through 2007. In general, the average person would consider 65.25 percent of the flexible pavements in Texas to be "rough," based on IRI. This is not the same as the 24.25 percent of "rough" flexible pavement mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

7.04 percent of the flexible lane miles had "Very Good" IRI Scores in FY 2007.

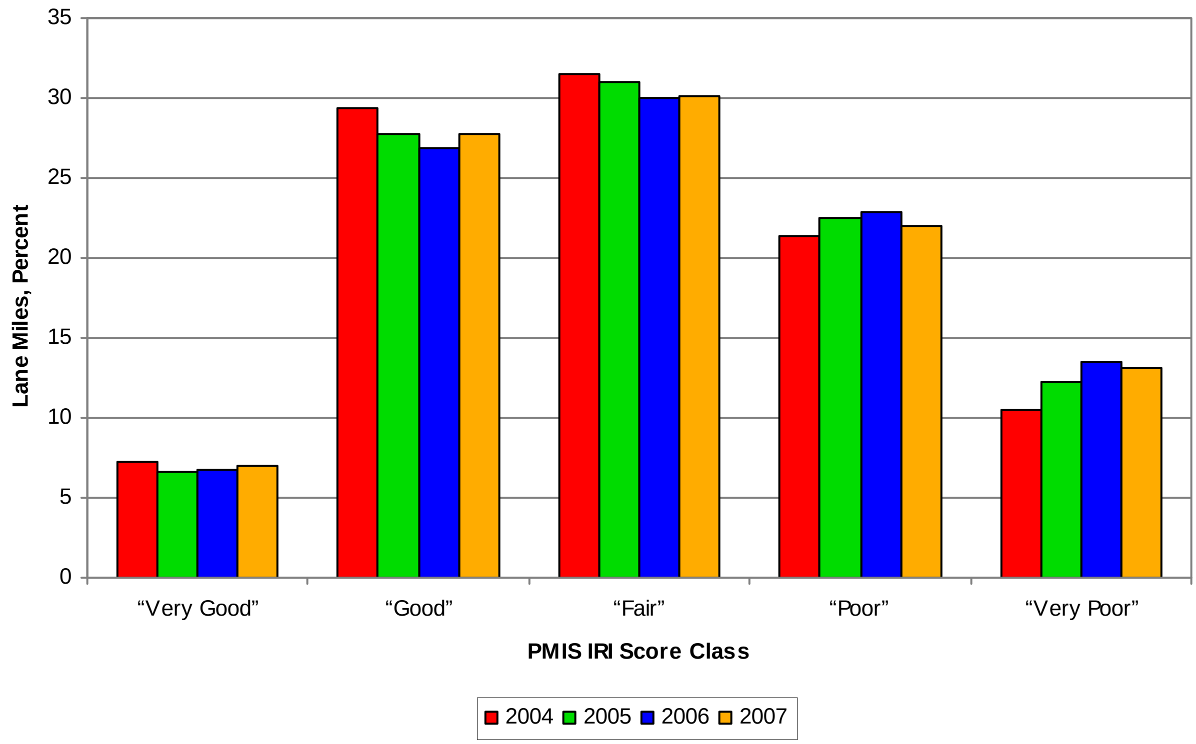


Figure 3.5 — IRI Score Classes for Flexible Pavement, FY 2004-2007.

The IRI Score Classes for Flexible Pavement shows that:

- "Very Good" mileage increased (from 6.70% in 2006 to 7.04% in 2007)
- "Good" mileage increased (from 26.90% in 2006 to 27.71% in 2007)
- "Fair" mileage increased (from 30.04% in 2006 to 30.11% in 2007)
- "Poor" mileage decreased (from 22.90% in 2006 to 22.01% in 2007)
- "Very Poor" mileage decreased (from 13.46% in 2006 to 13.13% in 2007).

What are those roads that parallel the Interstate mainlanes?

TxDOT officially calls them "frontage roads," but several cities have their own names for them. In Houston, they are called "feeder" roads; in Dallas-Fort Worth, "service" roads; in San Antonio, "access" roads; and in El Paso, "gateway" roads.

Source: Texas Transportation Institute.

Shallow Rutting

Figure 3.6 shows the percentage of PMIS sections with Shallow Rutting for fiscal years 2004 through 2007. Shallow Rutting is a "shallow" distress type. It is defined as a depression in the wheelpath of ¼- to ½-inch in depth.

47.91 percent of the flexible pavement sections had Shallow Rutting in FY 2007.

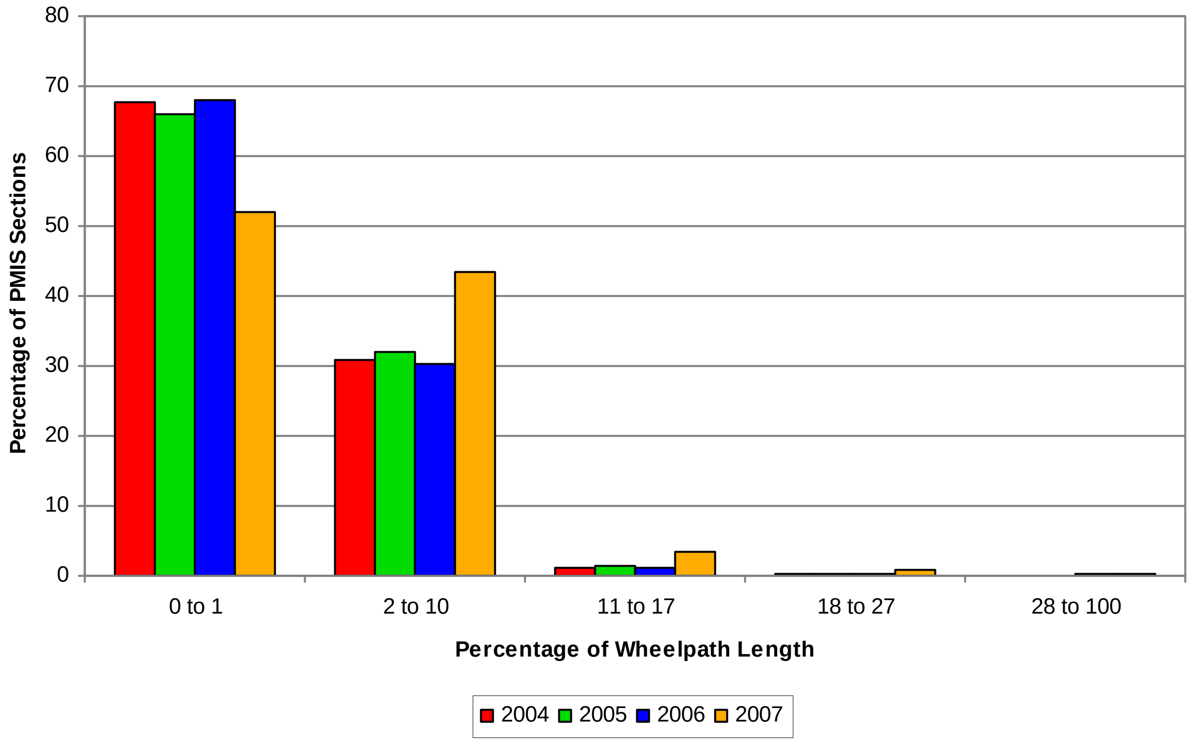


Figure 3.6 — Shallow Rutting, FY 2004-2007.

The Wheelpath Length of Shallow Rutting for Flexible Pavement shows that the:

- "0 to 1" decreased (from 67.86% in 2006 to 52.09% in 2007)
- "2 to 10" increased (from 30.34% in 2006 to 43.38% in 2007)
- "11 to 17" increased (from 1.27% in 2006 to 3.29% in 2007)
- "18 to 27" increased (from 0.34% in 2006 to 0.95% in 2007)
- "28 to 100" increased (from 0.18% in 2006 to 0.29% in 2007).

TxDOT experience with the automated rut-measuring equipment ("Rutbar") suggests that these PMIS results do not show all of the Shallow Rutting that actually exists on the road. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some Shallow Rutting on the road is not shown in these PMIS measurements, and some of the Shallow Rutting shown here might actually be Deep Rutting on the road.

Maps 3.1 and 3.2 show the average measurement for Shallow Rutting, weighted by lane miles, in each county. The average in this case is the percentage of wheelpath length with Shallow Rutting. For example, if a county has 100 lane miles, it has 200 total miles of wheelpath that could have Shallow Rutting; an average measurement of 10 percent would mean that the county has 20 miles of Shallow Rutting.

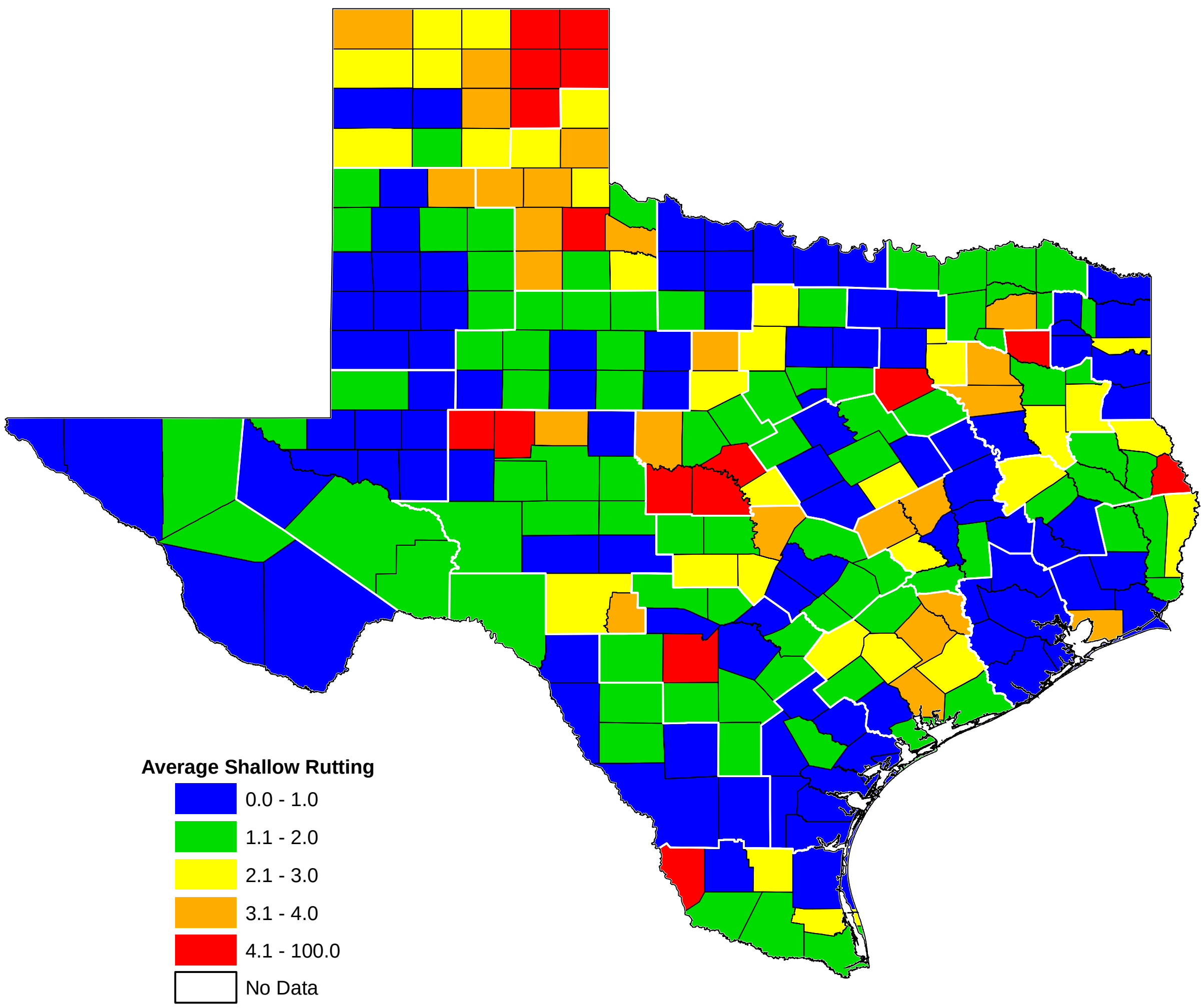
Shallow Rutting got worse in FY 2007, after improving slightly in FY 2006. It must be noted that the FY 2006-2007 Shallow Rutting data in PMIS had to be adjusted by subtracting 0.1 inches from each rut depth measurement. This was done to compensate for a change in the Rutbar dynamic calibration procedure which produced a very large increase in the amount of Shallow Rutting.

Additional information about the rut data changes may be found in "Description of FY 2006-2007 Rutbar Changes" on page iii.

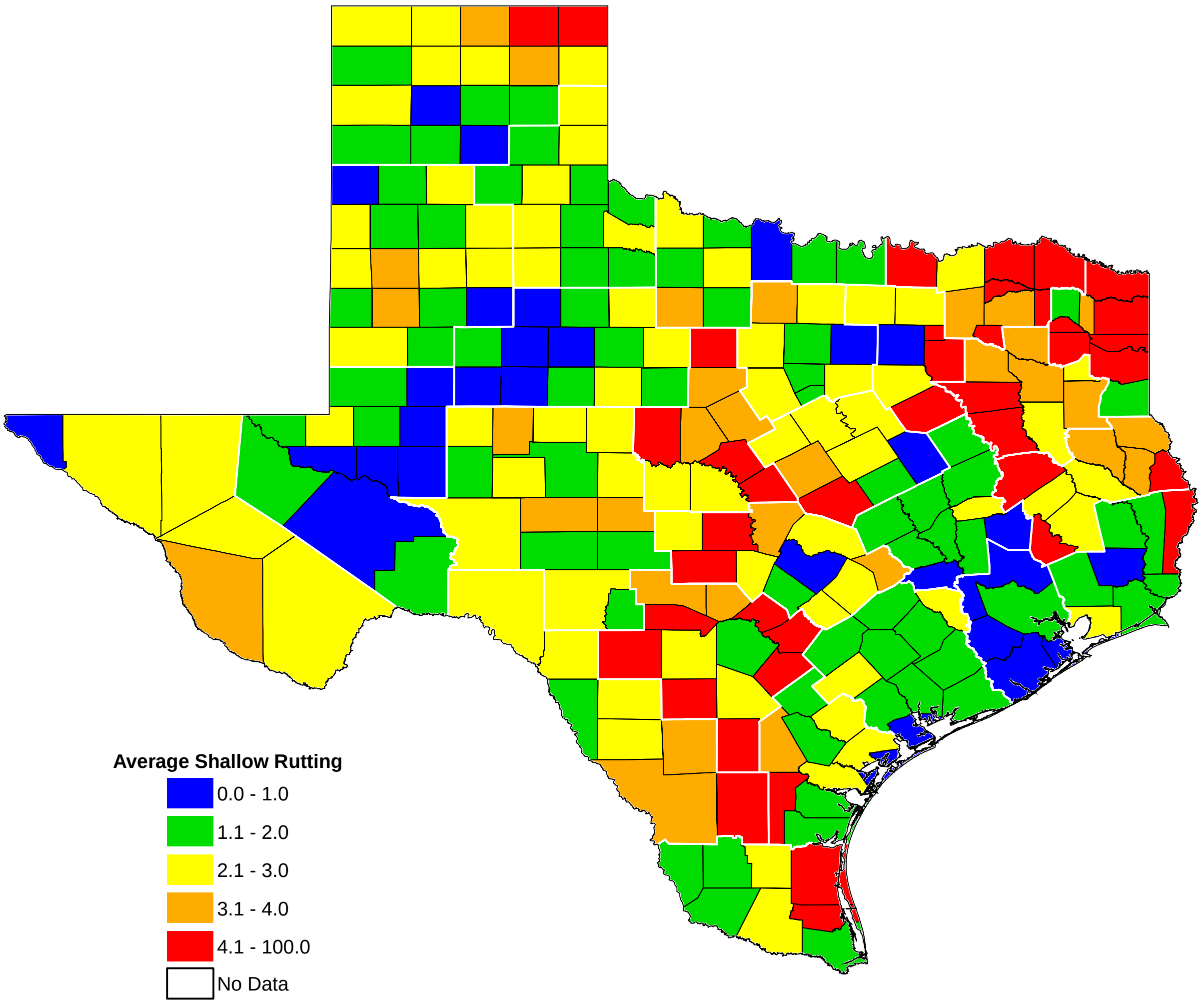
Coarse aggregate seal coats and surface treatments often show up as having higher amounts of Rutting in PMIS because the coarse texture of the surface scatters some of the signal from the Rutbar sensors – this "loss" of signal is interpreted as Rutting (either Shallow or Deep). This is an operational characteristic of the ultrasonic sensors used in the Rutbar device.

Shallow Rutting (depth = ¼- to ½-inch)
Measurement Based on Percentage of Wheelpath Length

Map 3.1 — Average Shallow Rutting, FY 2006.



Map 3.2 — Average Shallow Rutting, FY 2007.



Deep Rutting

Figure 3.7 shows the percentage of PMIS sections with Deep Rutting for fiscal years 2004 through 2007. Deep Rutting is a "deep" distress type. It is defined as a depression in the wheelpath of ½- to 1-inch in depth.

11.55 percent of the flexible pavement sections had Deep Rutting in FY 2007.

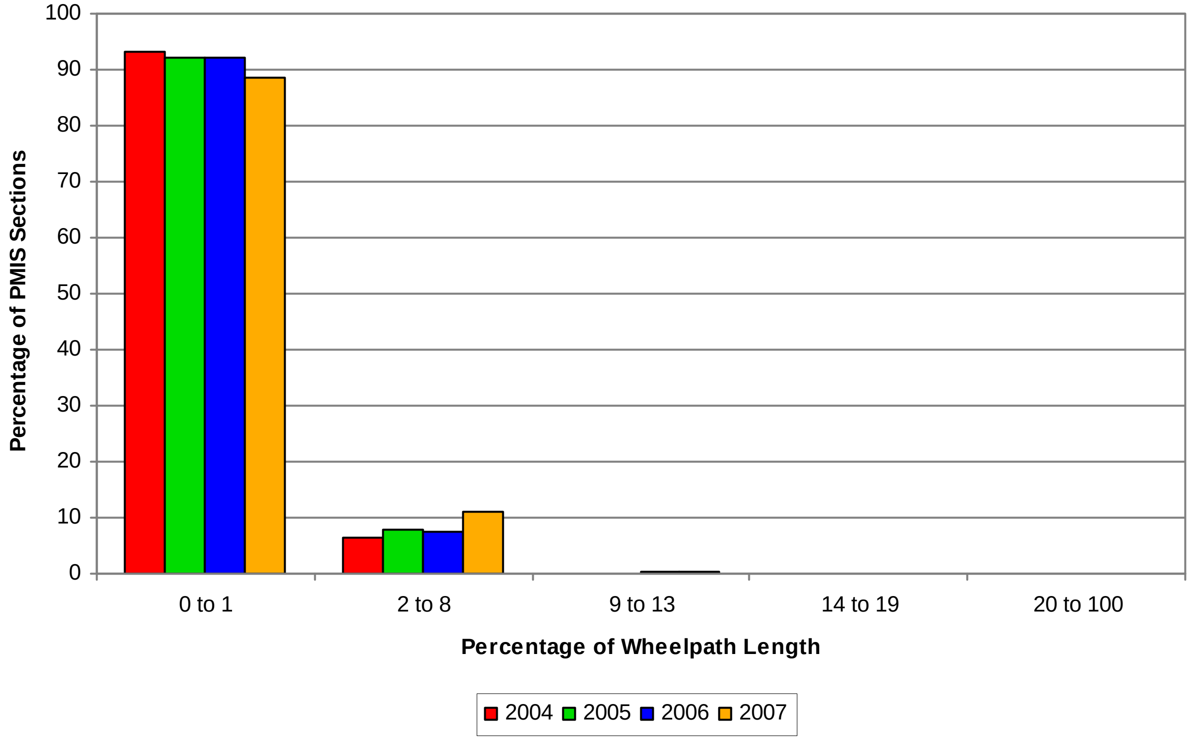


Figure 3.7 — Deep Rutting, FY 2004-2007.

The Wheelpath Length of Deep Rutting for Flexible Pavement shows that the:

- "0 to 1" decreased (from 92.03% in 2006 to 88.45% in 2007)
- "2 to 8" increased (from 7.66% in 2006 to 11.07% in 2007)
- "9 to 13" increased (from 0.27% in 2006 to 0.40% in 2007)
- "14 to 19" increased (from 0.04% in 2006 to 0.07% in 2007)
- "20 to 100" increased (from 0.01% in 2006 to 0.02% in 2007).

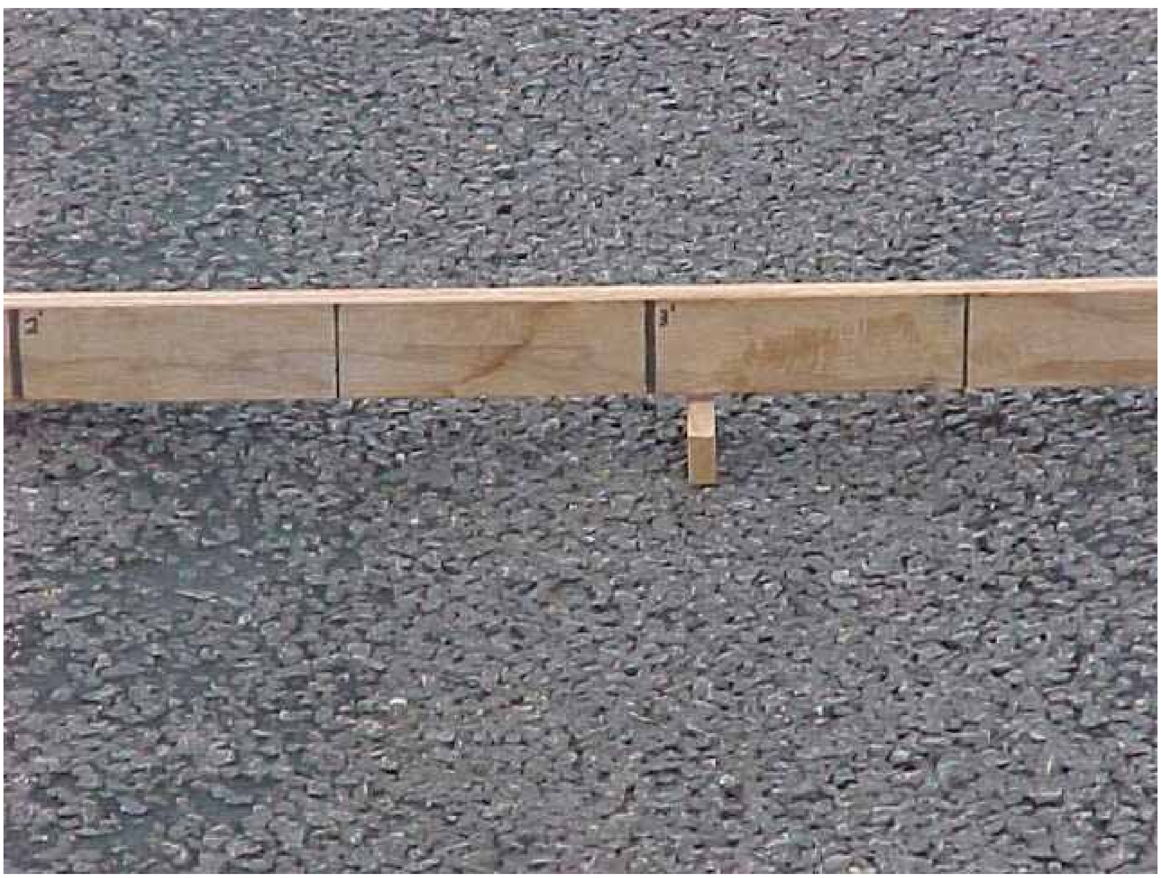
TxDOT experience with the automated rut-measuring equipment ("Rutbar") suggests that these PMIS results do not show all of the Deep Rutting that actually exists on the road. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some Deep Rutting on the road is not shown in these PMIS measurements.

Maps 3.3 and 3.4 show the average measurement for Deep Rutting, weighted by lane miles, in each county. The average in this case is the percentage of wheelpath length with Deep Rutting. For example, if a county has 100 lane miles, it has 200 total miles of wheelpath that could have Deep Rutting; an average measurement of 10 percent would mean that the county has 20 miles of Deep Rutting.

Deep Rutting got worse in FY 2007, as it did in FY 2006. It must be noted that the FY 2006-2007 Deep Rutting data in PMIS had to be adjusted by subtracting 0.1 inches from each rut depth measurement. This was done to compensate for a change in the Rutbar dynamic calibration procedure which produced a very large increase in the amount of Deep Rutting.

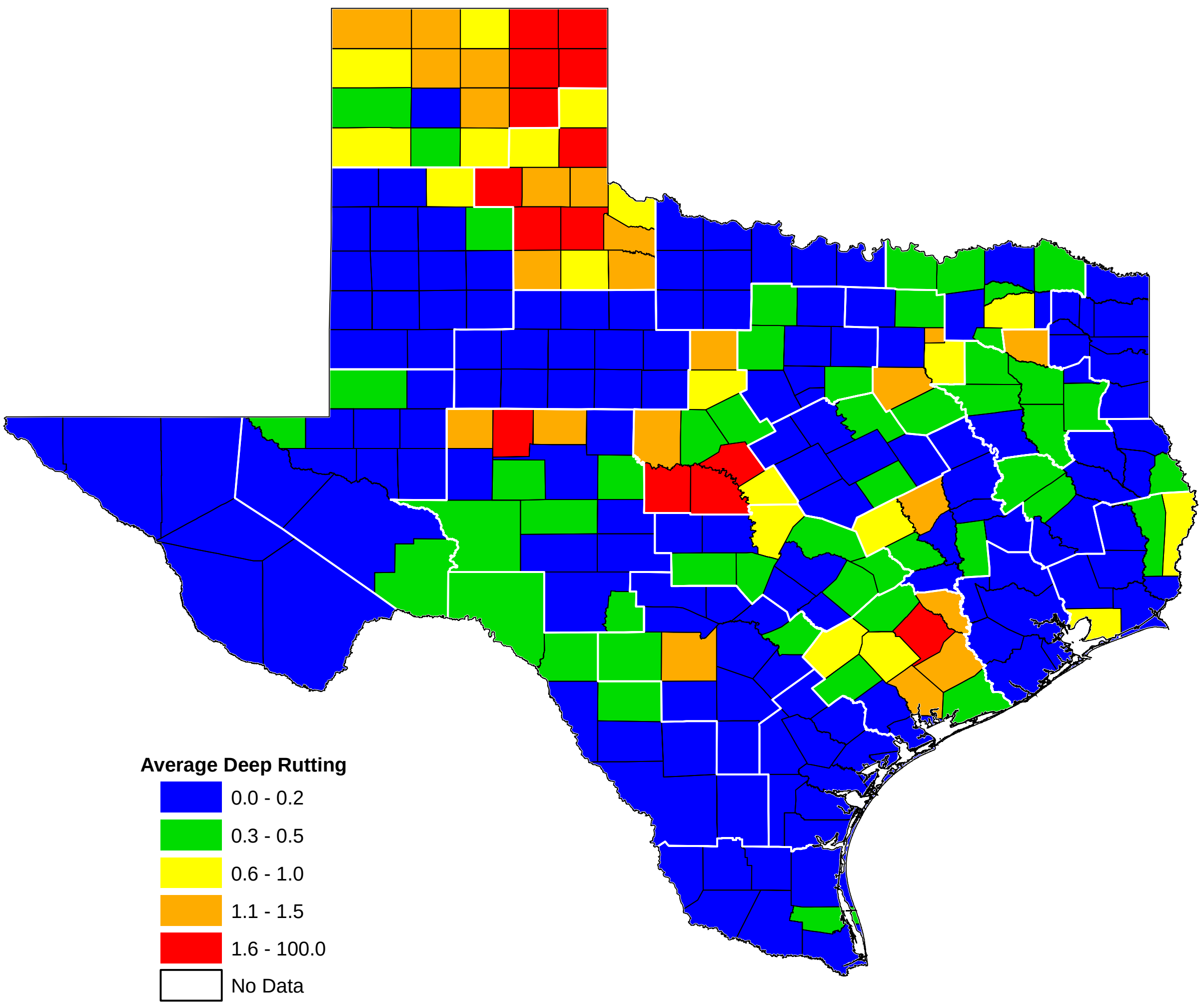
Additional information about the rut data changes may be found in "Description of FY 2006-2007 Rutbar Changes" on page iii.

Coarse aggregate seal coats and surface treatments often show up as having higher amounts of Rutting in PMIS because the coarse texture of the surface scatters some of the signal from the Rutbar sensors – this "loss" of signal is interpreted as Rutting (either Shallow or Deep). This is an operational characteristic of the ultrasonic sensors used in the Rutbar device.

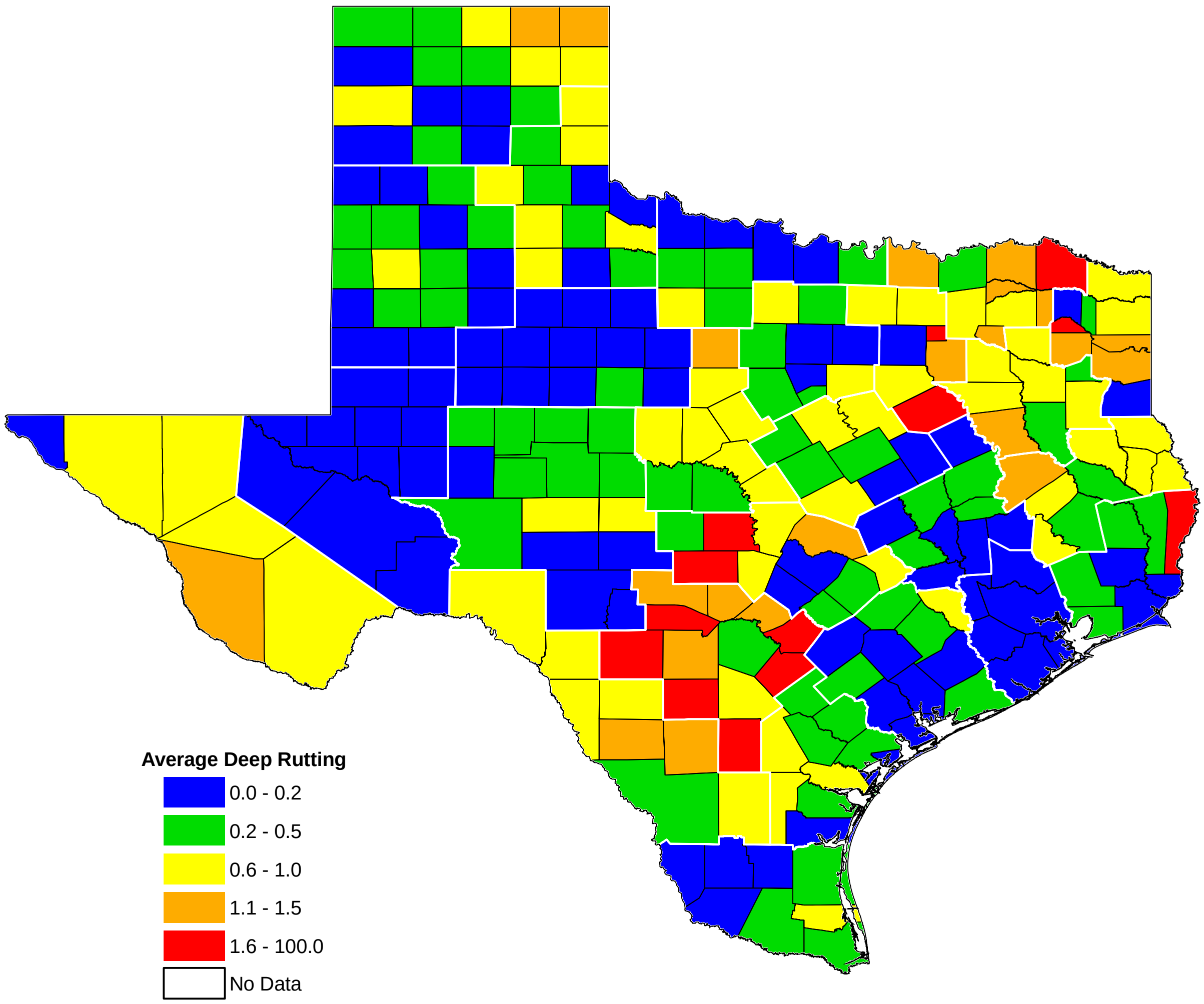


Deep Rutting (depth = ½- to 1-inch) – "Deep" Distress Type
Measurement Based on Percentage of Wheelpath Length

Map 3.3 — Average Deep Rutting, FY 2006.



Map 3.4 — Average Deep Rutting, FY 2007.



Alligator Cracking

Figure 3.8 shows the percentage of PMIS sections with Alligator Cracking for fiscal years 2004 through 2007. Alligator Cracking is a "deep" distress type. It is defined as interconnecting cracks that form small irregularly shaped blocks (less than one foot by one foot) which resemble an alligator's skin.

Alligator Cracking is sometimes also referred to as "fatigue cracking."

14.25 percent of the flexible pavement sections had Alligator Cracking in FY 2007.

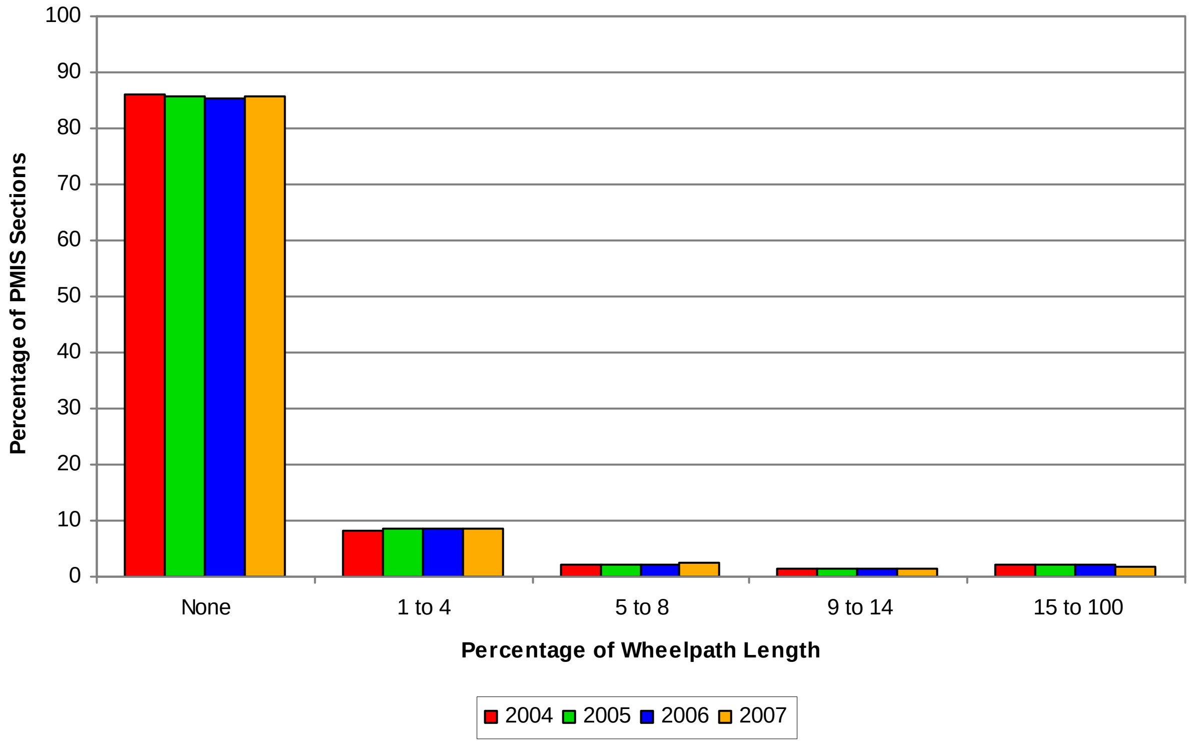


Figure 3.8 — Alligator Cracking, FY 2004-2007.

The Wheelpath Length of Alligator Cracking for Flexible Pavement shows that the:

- "None" category increased (from 85.47% in 2006 to 85.75% in 2007)
- "1 to 4" percent category increased (from 8.72% in 2006 to 8.74% in 2007)
- "5 to 8" percent category increased (from 2.25% in 2006 to 2.36% in 2007)
- "9 to 14" percent category decreased (from 1.33% in 2006 to 1.32% in 2007)
- "15 to 100" percent category decreased (from 2.23% in 2006 to 1.83% in 2007).

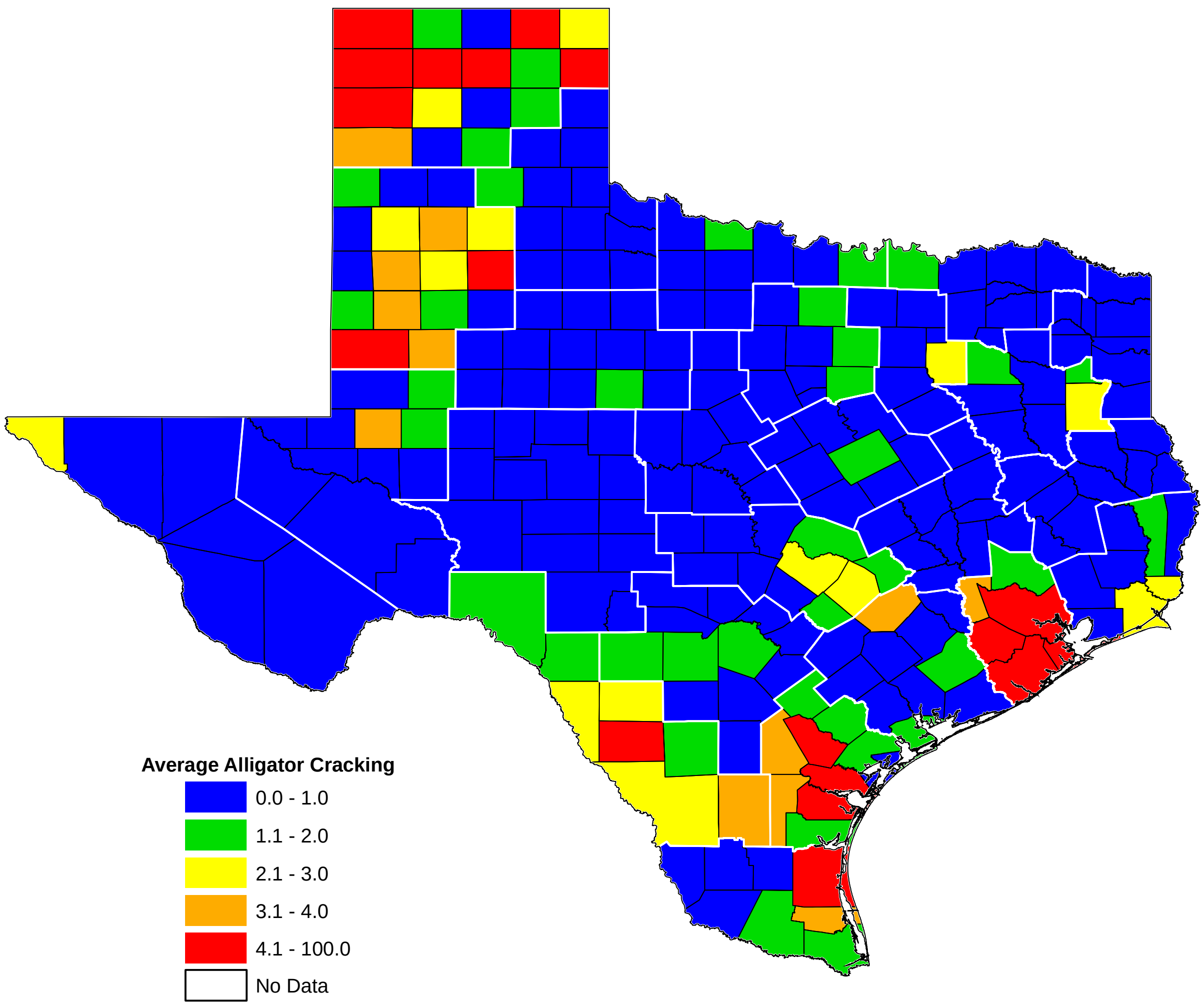
Maps 3.5 and 3.6 show the average rating for Alligator Cracking, weighted by lane miles, in each county. The average in this case is the percentage of wheelpath length with Alligator Cracking. For example, if a county has 100 lane miles, it has 200 total miles of wheelpath that could have Alligator Cracking; an average rating of 10 percent would mean that the county has 20 miles of Alligator Cracking.

Alligator Cracking improved in FY 2007, after having gotten worse in FY 2006.

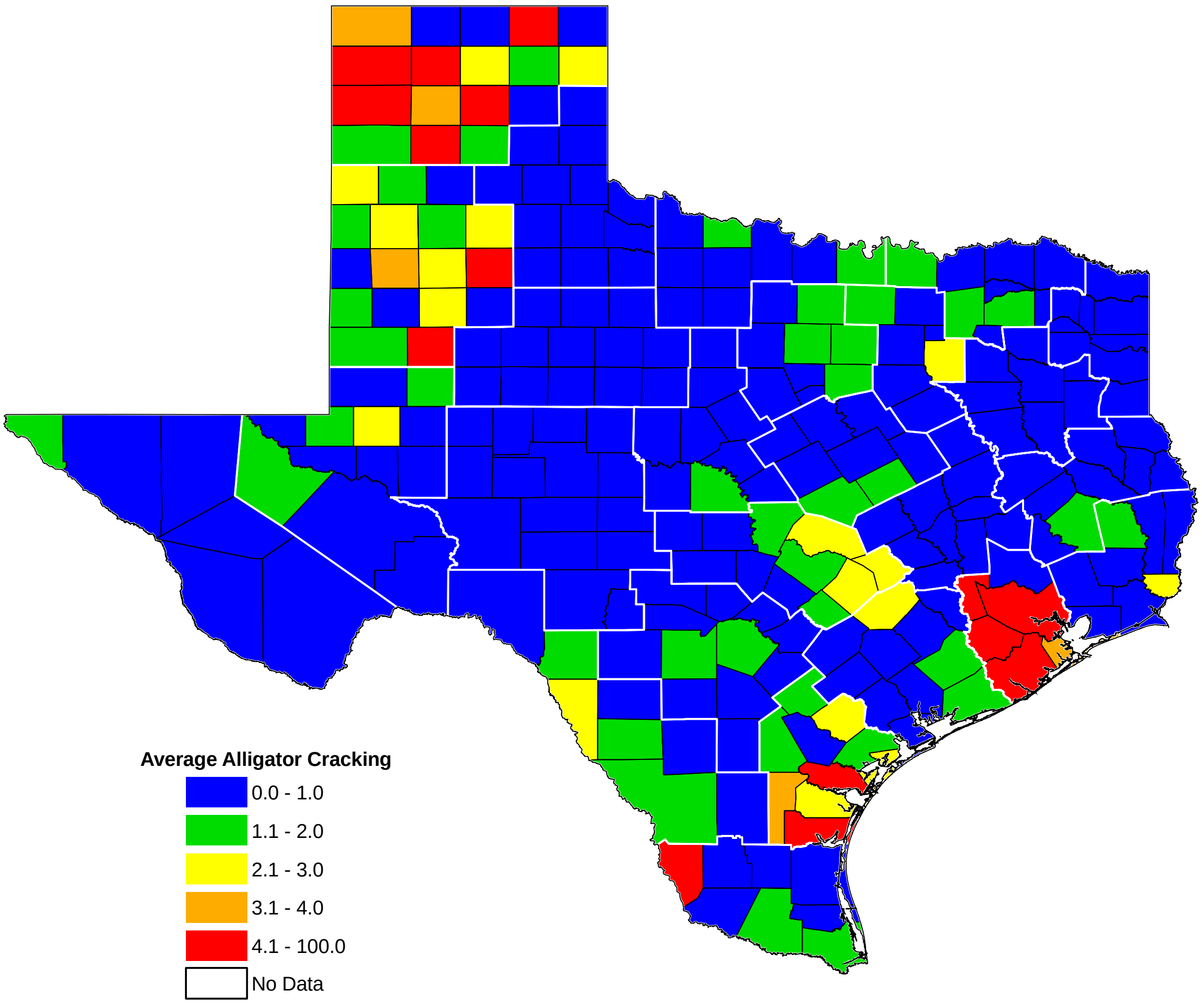
Maintenance patching and spot resurfacing can reduce Alligator Cracking and thus reduce the threat of water seeping into the base and subgrade, but these treatments can give the misleading impression that the pavement's structural strength has been restored. Areas which previously had Alligator Cracking need to be watched carefully because the underlying structural problems can cause pavement failure very rapidly, especially when heavy traffic loads occur unexpectedly.

Alligator Cracking (or "fatigue cracking") – "Deep" Distress Type
Rating Based on Percentage of Wheelpath Length

Map 3.5 — Average Alligator Cracking, FY 2006.



Map 3.6 — Average Alligator Cracking, FY 2007.



Failures

Figure 3.9 shows the percentage of PMIS sections with Failures for fiscal years 2004 through 2007. Failures are a "deep" distress type. Failures are defined as localized sections of pavement where the surface and base have been severely eroded, badly cracked, depressed, or severely shoved. PMIS also considers potholes greater than one foot in diameter as Failures.

Beginning in FY 2001, the definition of Failures was expanded to include ruts greater than two inches deep and some types of faulted longitudinal cracks.

4.88 percent of the flexible pavement sections had Failures in FY 2007.

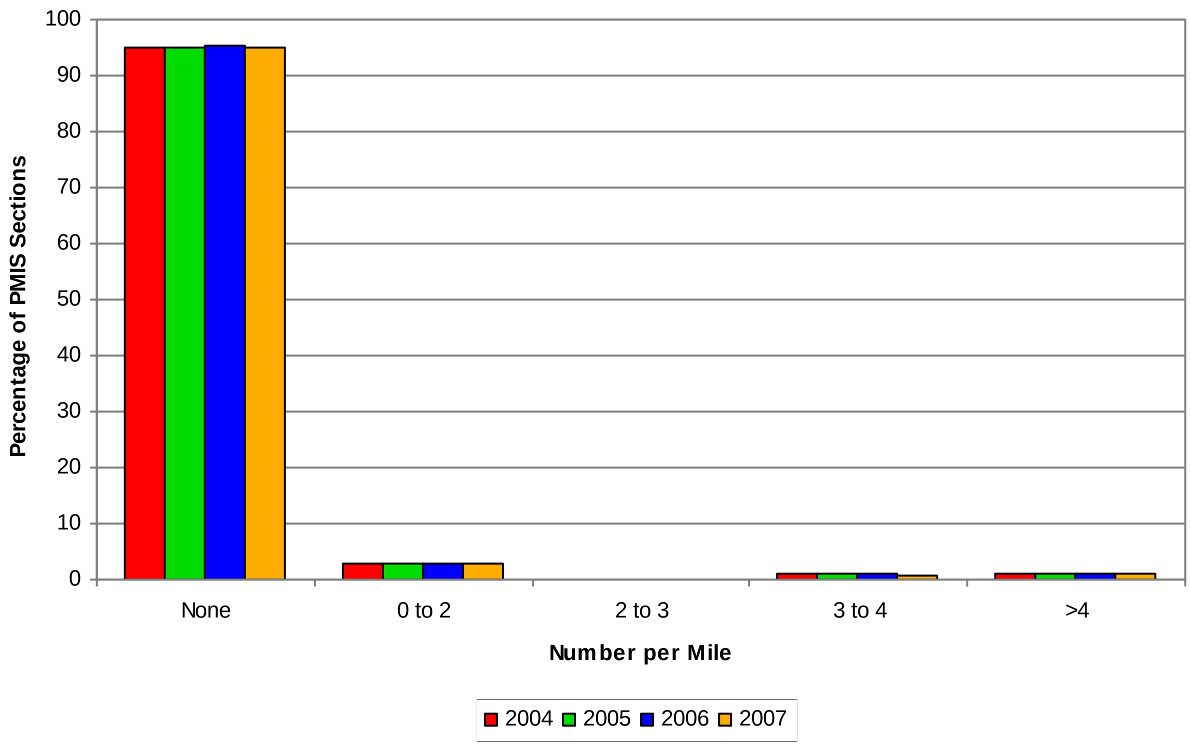


Figure 3.9 — Failures, FY 2004-2007.

The Number of Failures per Mile for Flexible Pavement shows that the:

- "None" category decreased (from 95.23% in 2006 to 95.12% in 2007)
- "0 to 2" category increased (from 2.83% in 2006 to 2.88% in 2007)
- "2 to 3" category increased (from 0.14% in 2006 to 0.15% in 2007)
- "3 to 4" category decreased (from 0.90% in 2006 to 0.89% in 2007)
- ">4" category increased (from 0.90% in 2006 to 0.95% in 2007).

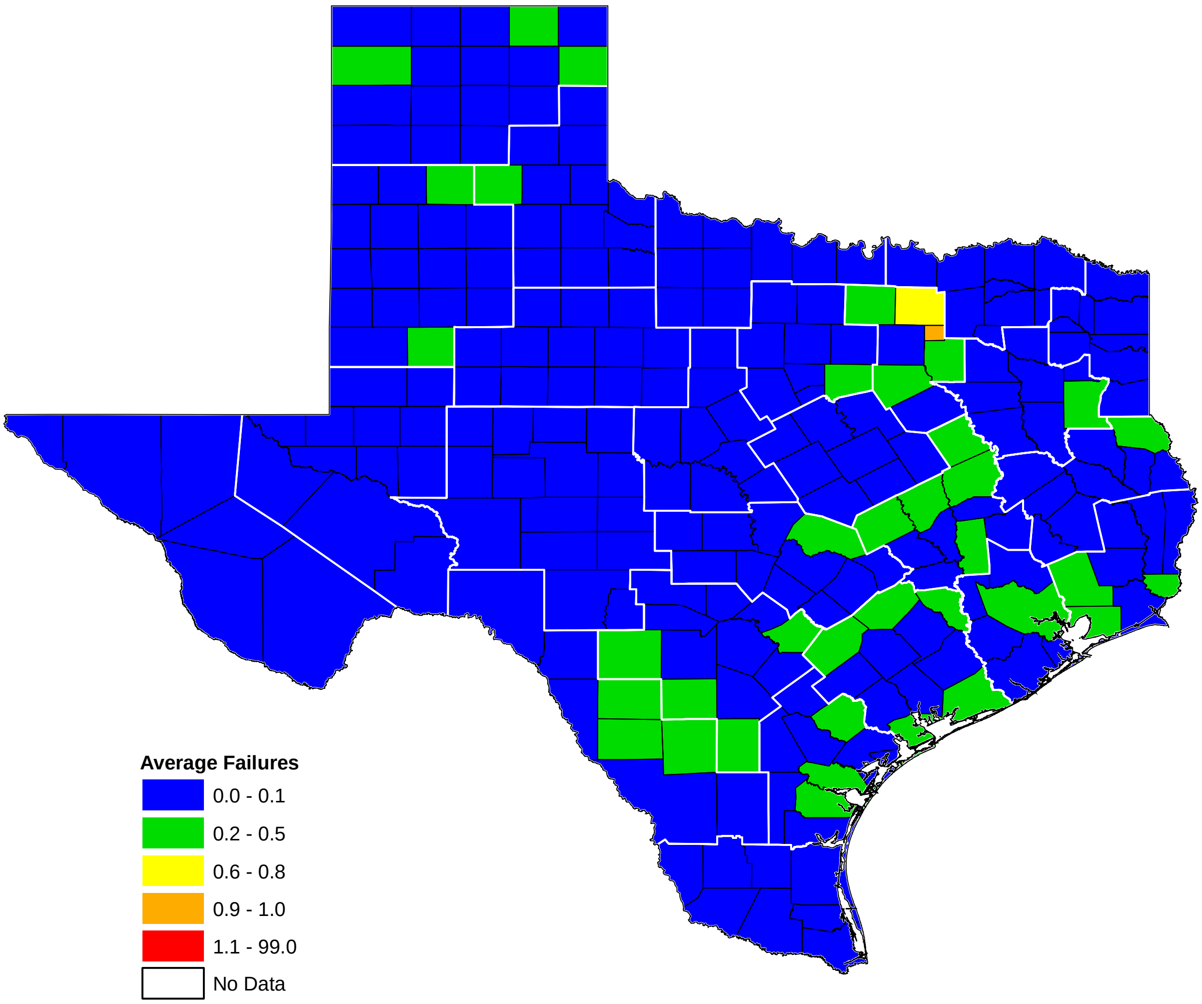
Maps 3.7 and 3.8 show the average rating for Failures, weighted by lane miles, in each county. The average in this case is the total number of Failures in a PMIS section. For example, if a county has 1000 PMIS sections, an average rating of 1 Failure per section means that the county has 1000 Failures.

Failures got worse in FY 2007, after having improved in FY 2004-2006. Failures can be eliminated through extensive routine maintenance (especially patching), but they can also develop rapidly when necessary maintenance or rehabilitation has been delayed for too long. Also, regions tend to have either many Failures or very few, because Failures are usually caused by adverse regional materials, climate, or load.

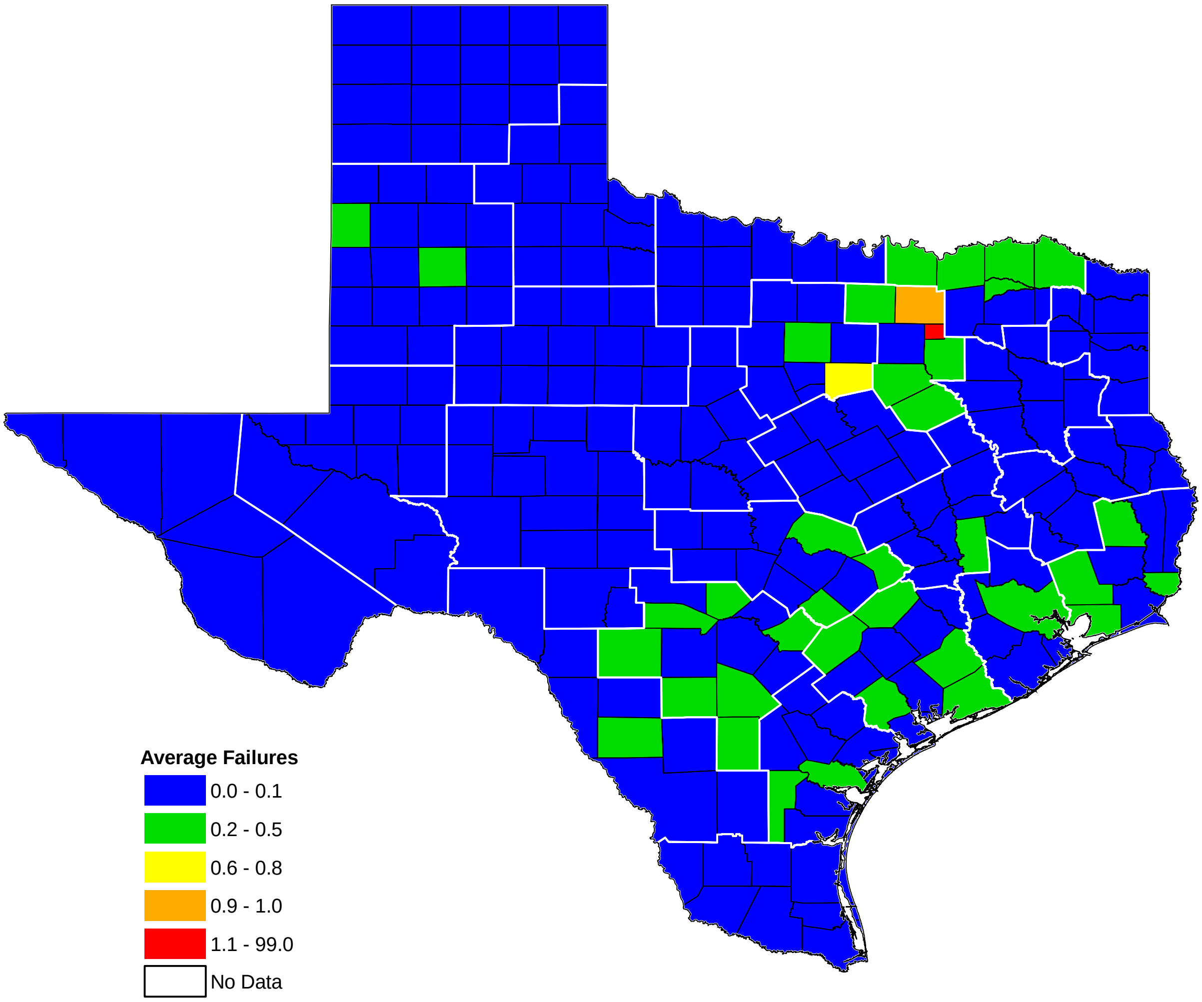
Failures are relatively uncommon in Texas because they are usually patched as soon as possible. In some cases, an area with Alligator Cracking will turn into a Failure when the cracks become wide enough to expose the base material. In other cases, cracks (especially Longitudinal Cracks) are defined as Failures if they are spalled or faulted.

Failures – "Deep" Distress Type
Rating Based on Number of Occurrences

Map 3.7 — Average Failures, FY 2006.



Map 3.8 — Average Failures, FY 2007.



Longitudinal Cracking

Figure 3.10 shows the percentage of PMIS sections with Longitudinal Cracking for fiscal years 2004 through 2007. Longitudinal Cracking is a "deep" distress type. The cracks run parallel to the pavement centerline (for example, reflective cracking, edge cracking, or wheelpath cracking).

It should be noted that PMIS does not distinguish between sealed and unsealed cracks. Thus crack sealing will not change the rating of a PMIS section with Longitudinal Cracking. A seal coat or thin overlay, of course, will eliminate the Longitudinal Cracking in PMIS.

37.68 percent of the flexible pavement sections had Longitudinal Cracking in FY 2007.

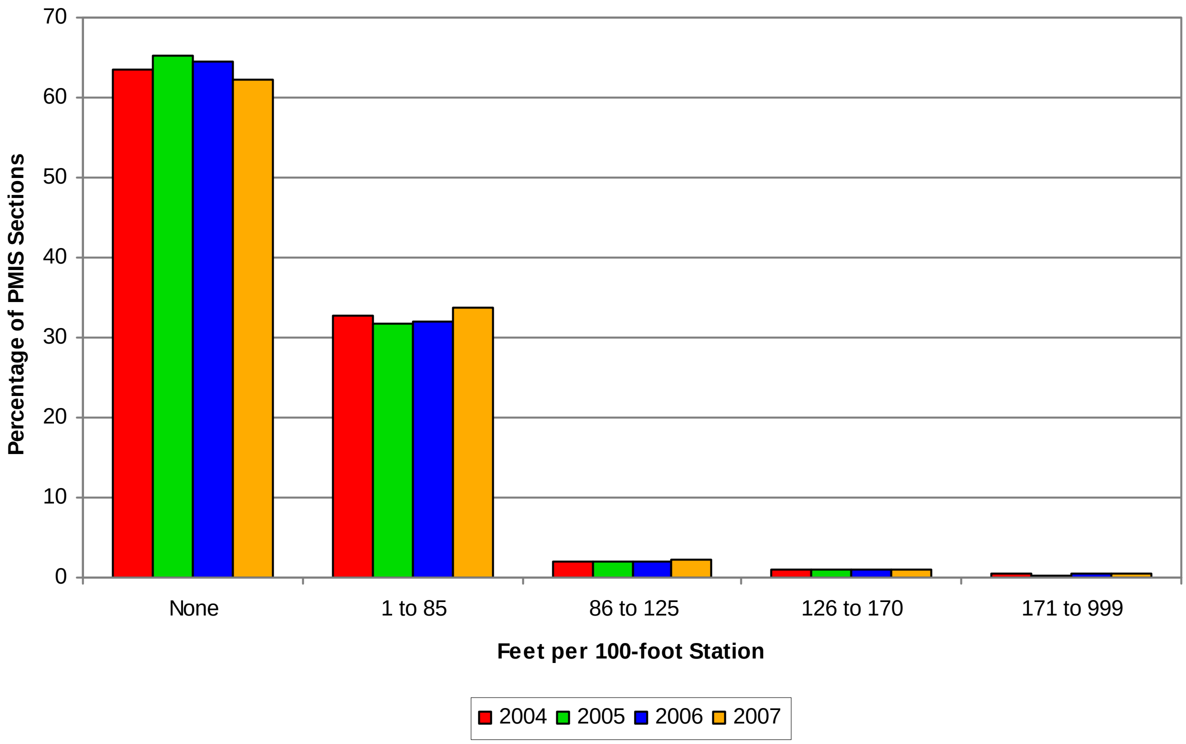


Figure 3.10 — Longitudinal Cracking, FY 2004-2007.

The Longitudinal Cracking per 100-foot Station for Flexible Pavement shows that the:

- "None" category decreased (from 64.52% in 2006 to 62.32% in 2007)
- "1 to 85" feet category increased (from 31.91% in 2006 to 33.87% in 2007)
- "86 to 125" feet category increased (from 2.12% in 2006 to 2.22% in 2007)
- "126 to 170" feet category increased (from 0.99% in 2006 to 1.00% in 2007)
- "171 to 999" feet category increased (from 0.46% in 2006 to 0.59% in 2007).

Maps 3.9 and 3.10 show the average rating for Longitudinal Cracking, weighted by lane miles, in each county. The average in this case is the total length of Longitudinal Cracking per 100-foot station. For example, if a county has 100 lane miles, it has 528,000 feet of travel lanes, and 5280 100-foot stations that could have Longitudinal Cracking; an average rating of 1 foot per 100-foot station would mean that the county has 5280 feet of Longitudinal Cracking.

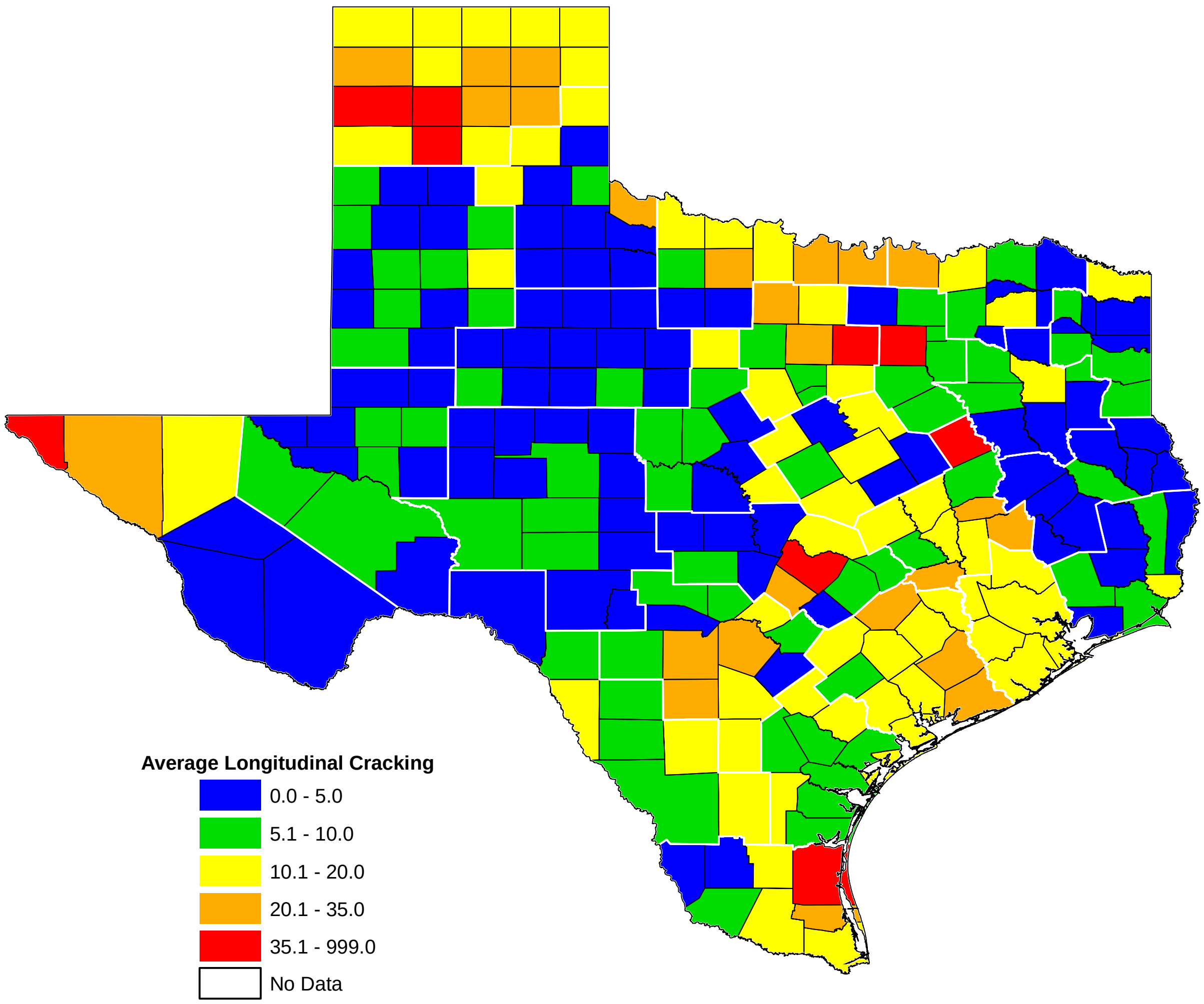
Longitudinal Cracking got worse in FY 2007, as it did in FY 2006. Some of the increase in Longitudinal Cracking was caused by shrinkage cracks produced by the prolonged drought that began in Spring 2005 and continued through all of FY 2006.

Typically, only the central and western regions of Texas can tolerate Longitudinal Cracking without progression to more serious distresses. This is because of the high-grade limestone materials locally available for the pavement structure, and because of the relatively warm and dry climate. Local paving practices also affect the amount of Longitudinal Cracking, especially in areas that have large amounts of overlaid concrete pavement. If the concrete pavement was in poor condition when it was overlaid – which is usually the case – reflective Longitudinal Cracking in the asphalt surface occurs rapidly.

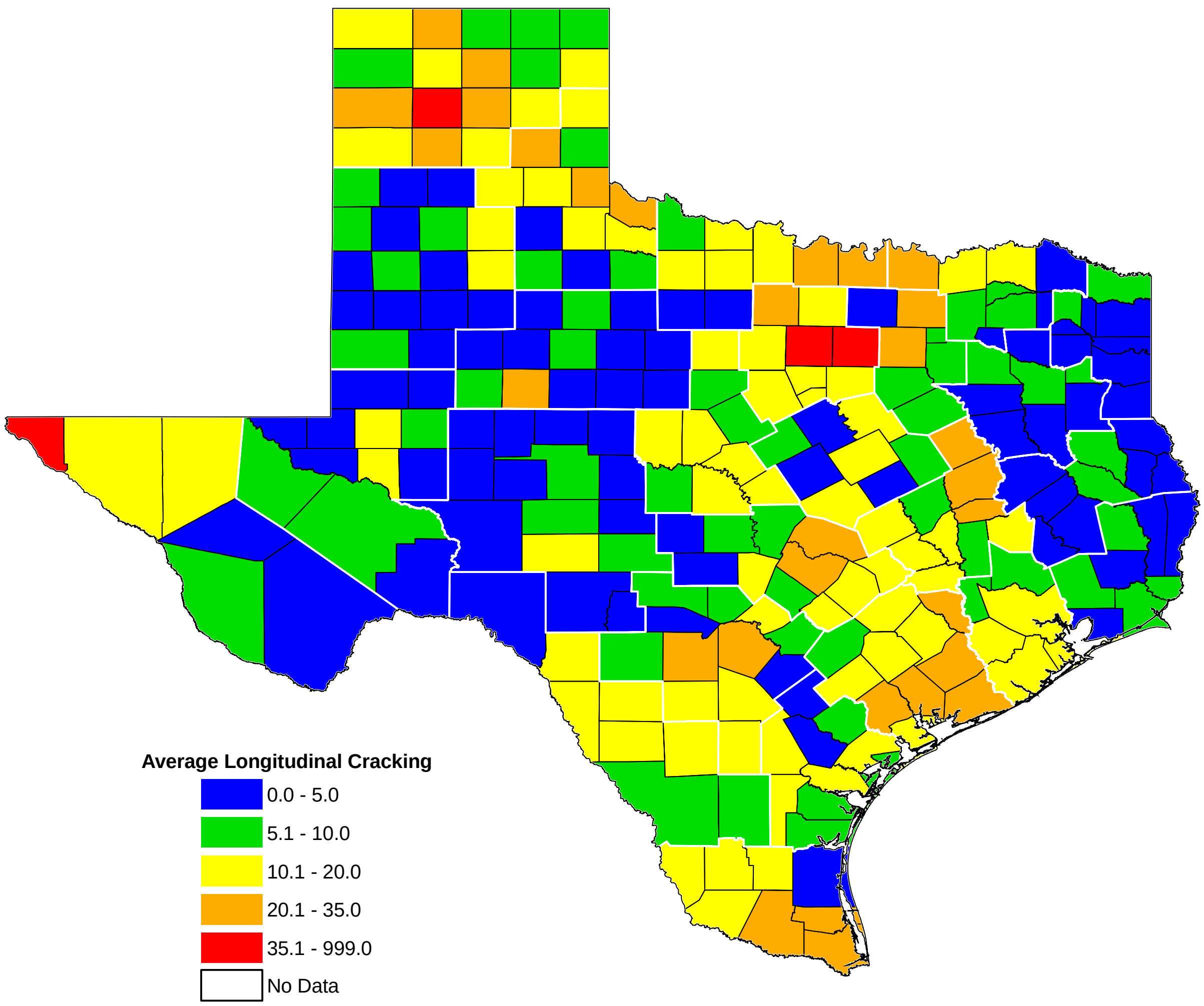
It should be noted that sealed Longitudinal Cracks are still rated in PMIS. This causes a problem in some areas because the PMIS ratings give the impression that there is more cracking than there really is. If the sealed cracks remain sealed, then water cannot seep in to erode the pavement structure. But if the sealed cracks open up again, they must be resealed.

Longitudinal Cracking – "Deep" Distress Type
Rating Based on Length (in feet) per 100-foot Station

Map 3.9 — Average Longitudinal Cracking, FY 2006.



Map 3.10 — Average Longitudinal Cracking, FY 2007.



Transverse Cracking

Figure 3.11 shows the percentage of PMIS sections with Transverse Cracking for fiscal years 2004 through 2007. Transverse Cracking is a "shallow" distress type. Transverse Cracking travels at right angles to the road's centerline, and generally occurs as reflective cracking from overlaid concrete pavements (spalled cracks from overlaid CRCP or joints from overlaid JCP). These overlaid concrete pavements are sometimes called "composite pavements."

It should be noted that PMIS does not distinguish between sealed and unsealed cracks. Thus crack sealing will not change the rating of a PMIS section with Transverse Cracking. A seal coat or thin overlay, of course, will eliminate the Transverse Cracking in PMIS.

9.27 percent of the flexible pavement sections had Transverse Cracking in FY 2007.

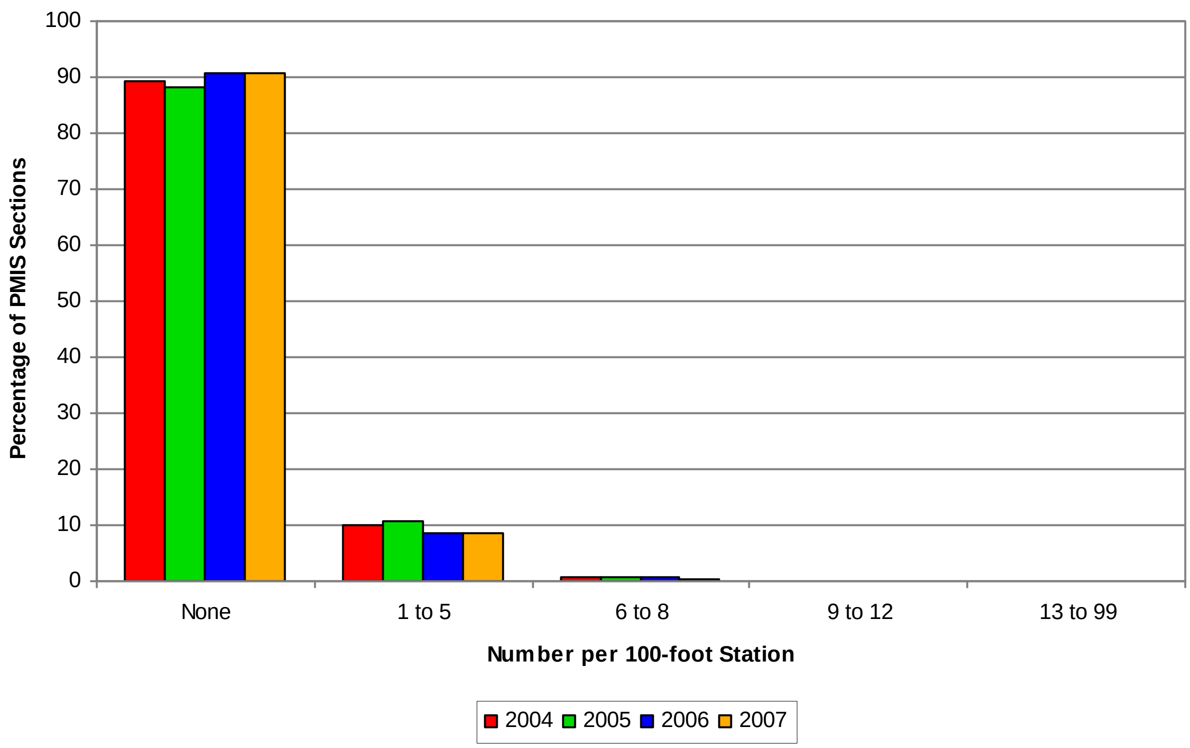


Figure 3.11— Transverse Cracking, FY 2004-2007.

The Number of Transverse Cracks per 100-foot Station for Flexible Pavement shows that the:

- "None" increased (from 90.67% in 2006 to 90.73% in 2007)
- "1 to 5" increased (from 8.56% in 2006 to 8.64% in 2007)
- "6 to 8" decreased (from 0.54% in 2006 to 0.50% in 2007)
- "9 to 12" decreased (from 0.15% in 2006 to 0.10% in 2007)
- "13 to 99" decreased (from 0.07% in 2006 to 0.03% in 2007).

Maps 3.11 and 3.12 show the average rating for Transverse Cracking, weighted by lane miles, in each county. The average in this case is the number of Transverse Cracks per 100-foot station. For example, if a county has 100 lane miles, it has 528,000 feet of travel lanes, and 5280 100-foot stations that could have Transverse Cracks; an average rating of 1 per 100-foot station would mean that the county has 5280 full-lane width Transverse Cracks.

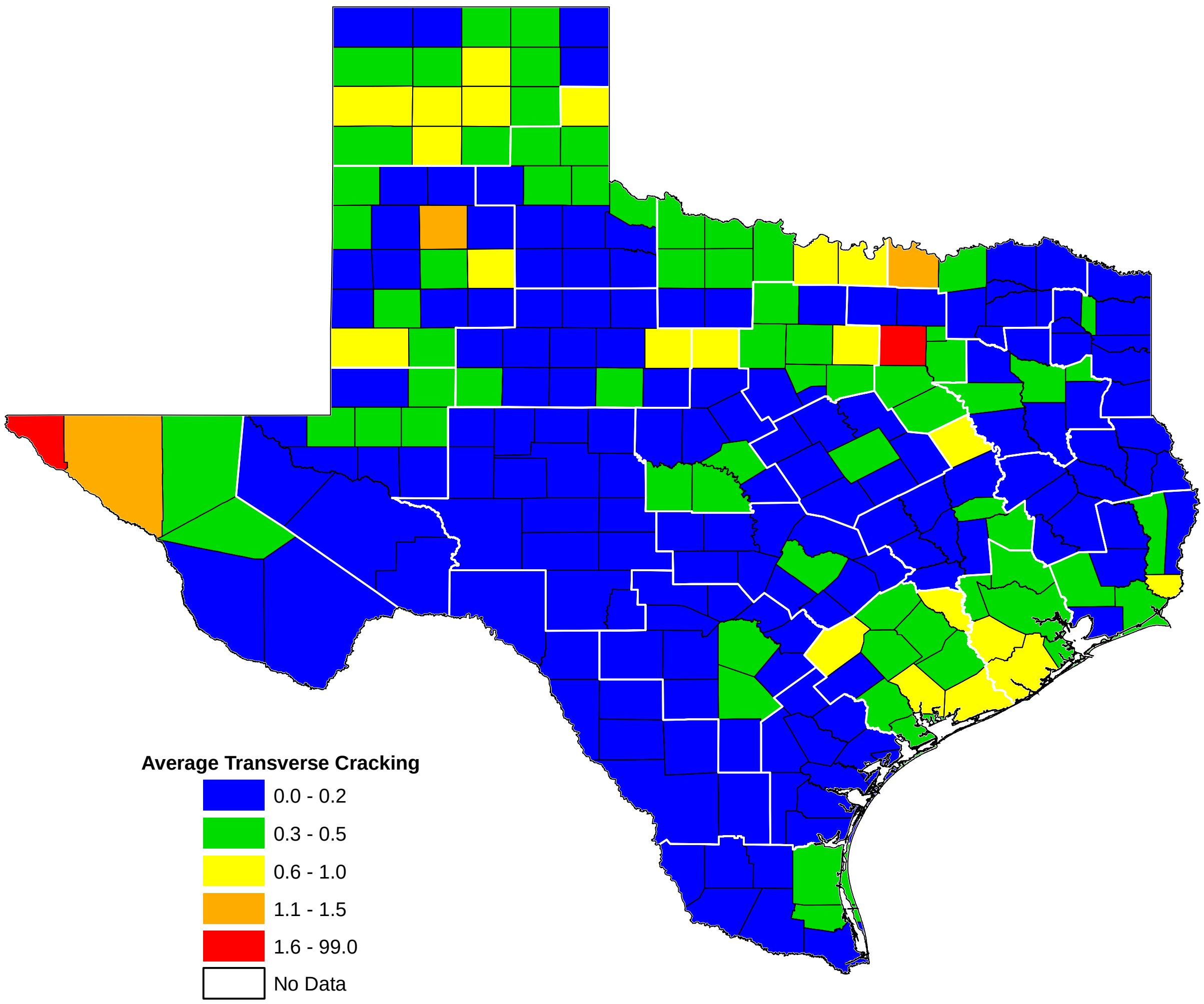
Transverse Cracking improved in FY 2007, as it did in FY 2006.

In north Texas, Transverse Cracking is aggravated by the extreme changes in temperature. In southeast Texas, Transverse Cracking is generally caused by the use of cement-treated bases. Transverse Cracks that are wide and deep – which often occurs with cement-treated base – cause serious ride quality problems, even when the cracks are sealed. Local paving practices also affect the amount of Transverse Cracking, especially in areas that have large amounts of overlaid concrete pavement. If the concrete pavement was in poor condition when it was overlaid – which is most often the case – reflective Transverse Cracking in the asphalt surface occurs rapidly.

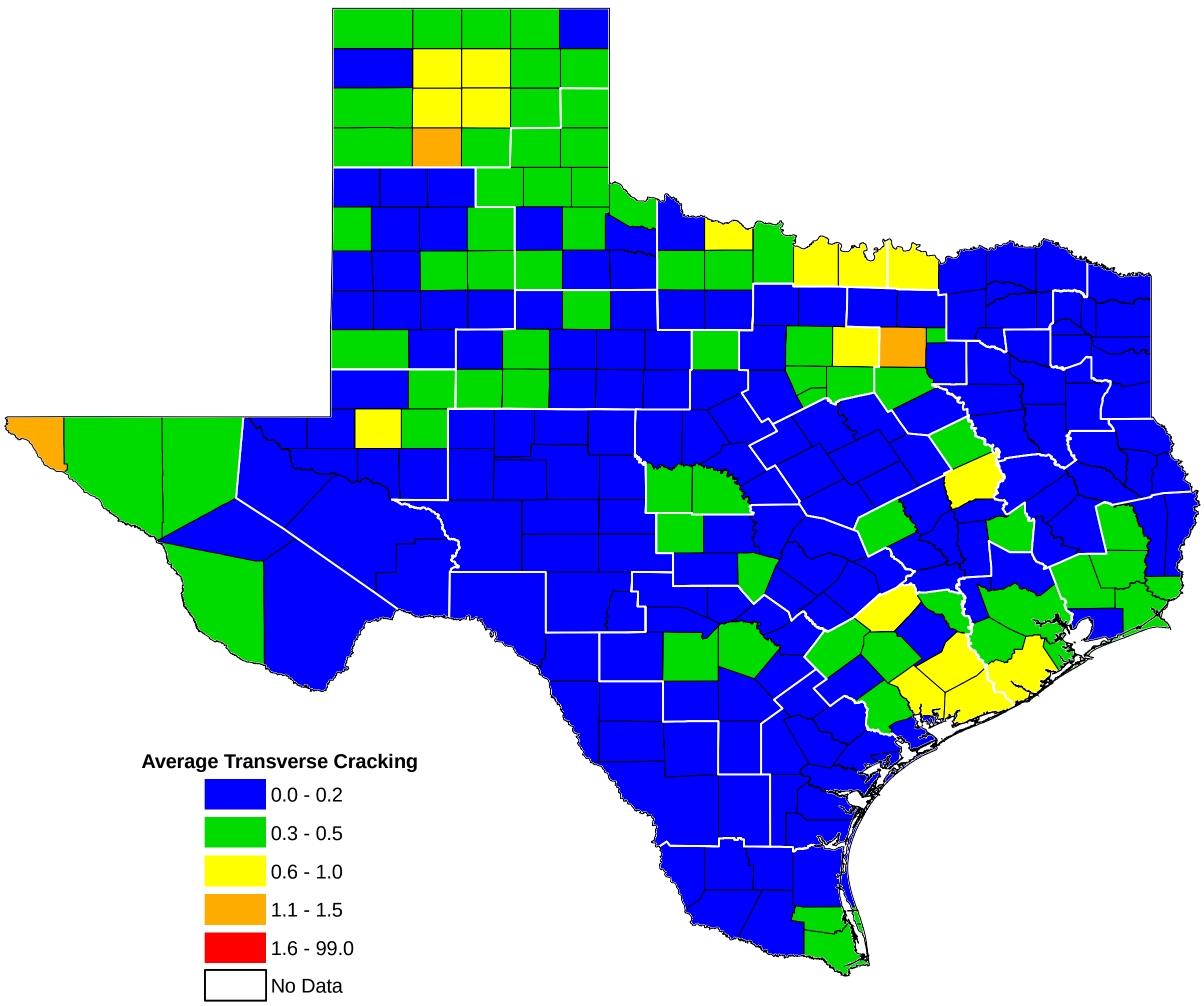
It should be noted that sealed Transverse Cracks are still rated in PMIS. This causes a problem in some areas because the PMIS ratings give the impression that there is more cracking than there really is. If the sealed cracks remain sealed, then water cannot seep in to erode the pavement structure. But if the sealed cracks open up again, they must be resealed.

Transverse Cracking
Rating Based on Number (of Occurrences) per 100-foot Station

Map 3.11 — Average Transverse Cracking, FY 2006.



Map 3.12 — Average Transverse Cracking, FY 2007.



Block Cracking

Figure 3.12 shows the percentage of PMIS sections with Block Cracking for fiscal years 2004 through 2007. Block Cracking is a "shallow" distress type. Block Cracking is 1-10 feet on each side, instead of less than one foot on each side (which is defined as Alligator Cracking).

0.48 percent of the flexible pavement sections had Block Cracking in FY 2007.

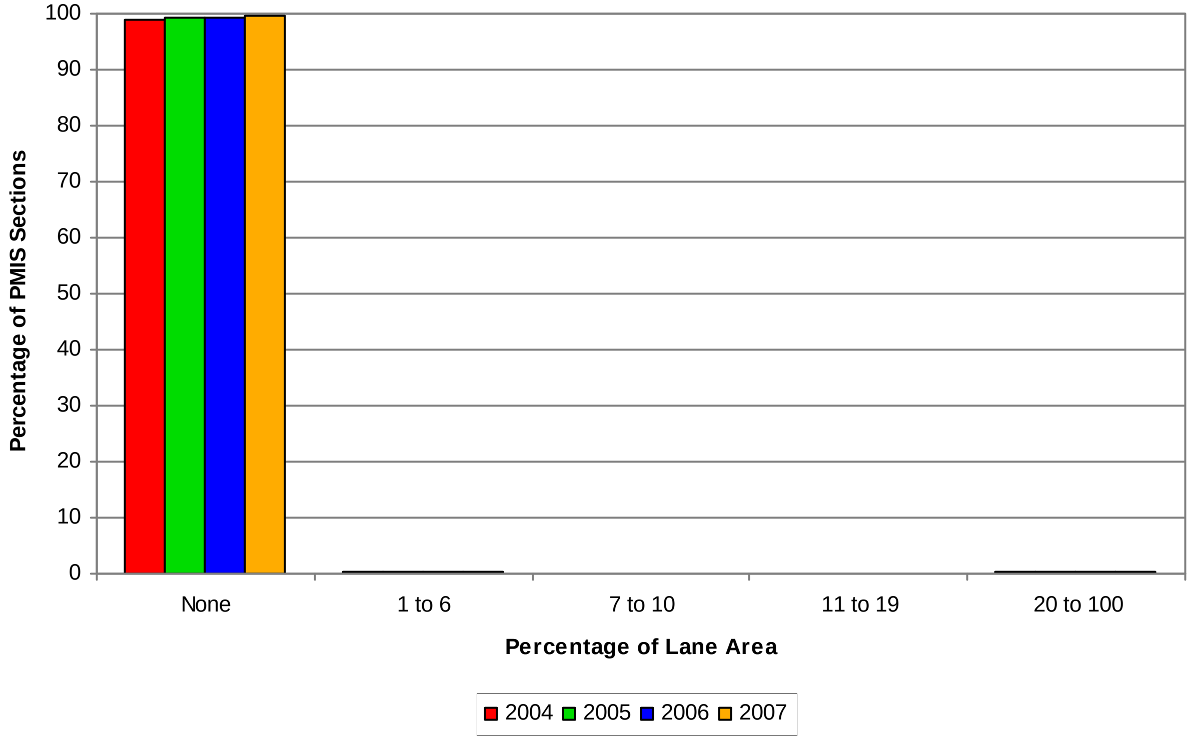


Figure 3.12— Block Cracking, FY 2004-2007.

The Lane Area of Block Cracking for Flexible Pavement shows that the:

- "None" category increased (from 99.38% in 2006 to 99.52% in 2007)
- "1 to 6" percent category decreased (from 0.25% in 2006 to 0.19% in 2007)
- "7 to 10" percent category decreased (from 0.09% in 2006 to 0.05% in 2007)
- "11 to 19" percent category decreased (from 0.08% in 2006 to 0.07% in 2007)
- "20 to 100" percent category decreased (from 0.20% in 2006 to 0.18% in 2007).

Maps 3.13 and 3.14 show the average rating for Block Cracking, weighted by lane miles, in each county. The average in this case is the percentage of lane area covered by Block Cracking. For example, if a county has 100 lane miles, it has 100 total miles of lane area that could have Block Cracking; an average rating of 10 percent would mean that the county has 10 miles of full-lane width Block Cracking.

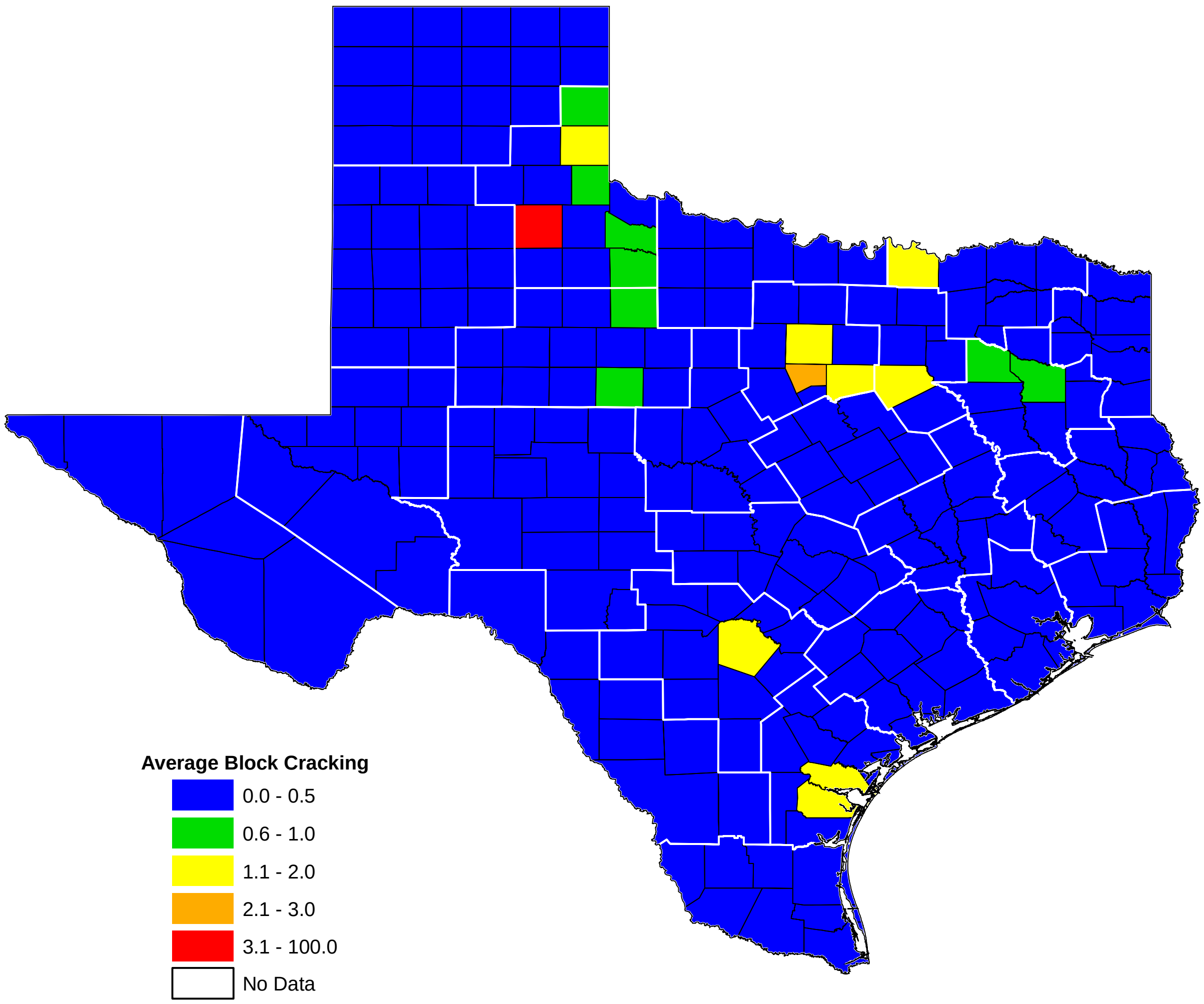
Block Cracking improved in FY 2007, as it did in FY 2005 and FY 2006. It is found only in isolated areas. It is easy to confuse Block Cracking with Longitudinal and Transverse Cracking, so it is possible that PMIS underestimates the amount of Block Cracking on Texas pavements.

Block Cracking is mainly caused by extreme changes in temperature, but it can also be caused by shrinkage related to the use of cement-treated base. Although Block Cracking is not a load-associated distress, it can cause structural failure if it is left untreated for too long, especially in areas of high rainfall and freezing temperatures.

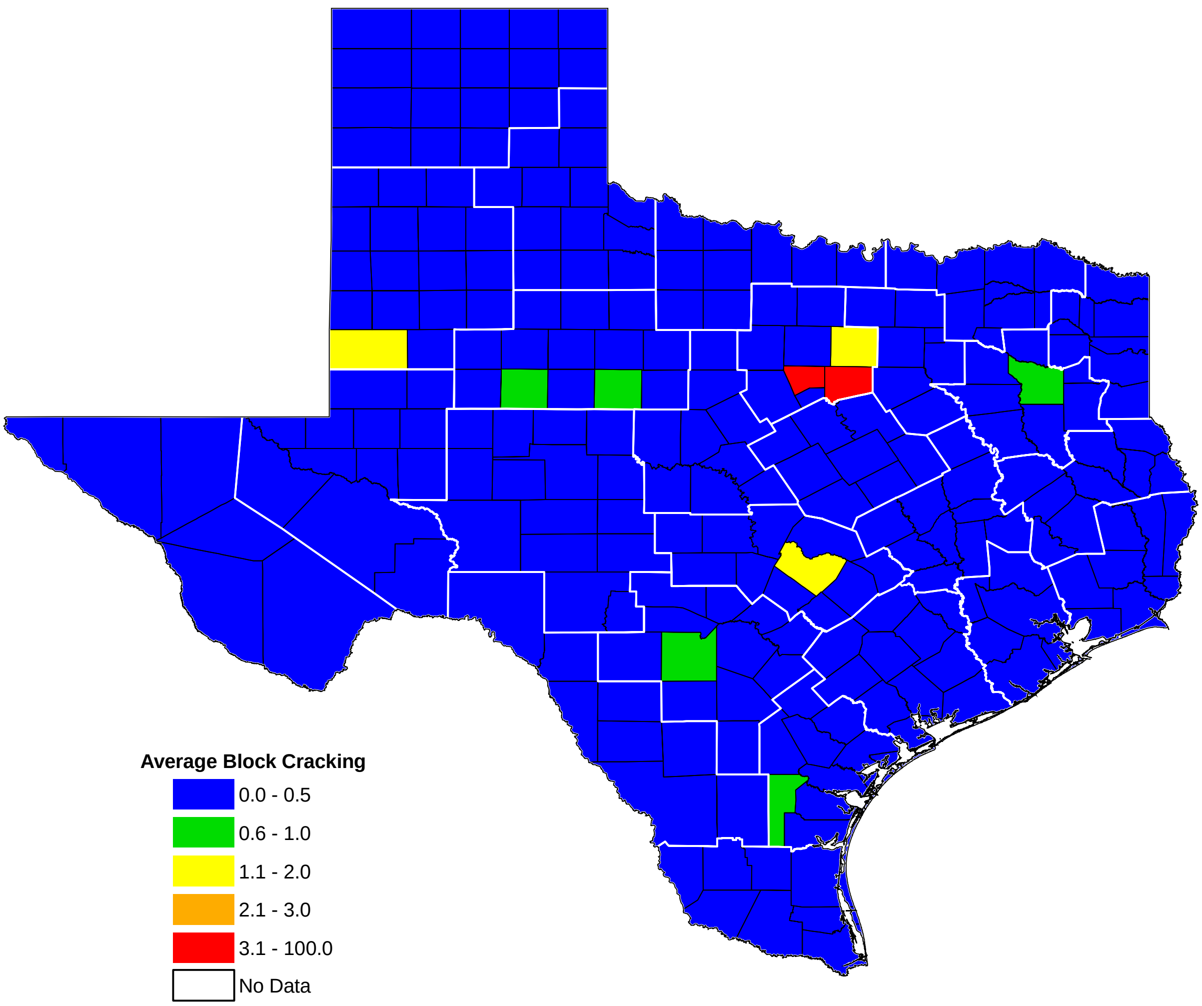
It should be noted that sealed Block Cracks are still rated in PMIS. This causes a problem in some areas because the PMIS ratings give the impression that there is more cracking than there really is. If the sealed cracks remain sealed, then water cannot seep in to erode the pavement structure. But if the sealed cracks open up again, they must be resealed.

Block Cracking
Rating Based on Percentage of Lane Area

Map 3.13 — Average Block Cracking, FY 2006.



Map 3.14 — Average Block Cracking, FY 2007.



Patching

Figure 3.13 shows the percentage of PMIS sections with Patching for fiscal years 2004 through 2007. Patching is a “shallow” distress type. Patches are repairs made to pavement distress. They indicate prior maintenance activity, and can be used as a general measure of pavement age (maintenance tends to increase as a pavement ages).

Patching is not a “deep” distress, but it can be caused by repair of “deep” distress. It can also be used to repair other “shallow” distress types.

15.09 percent of the flexible pavement sections had Patching in FY 2007.

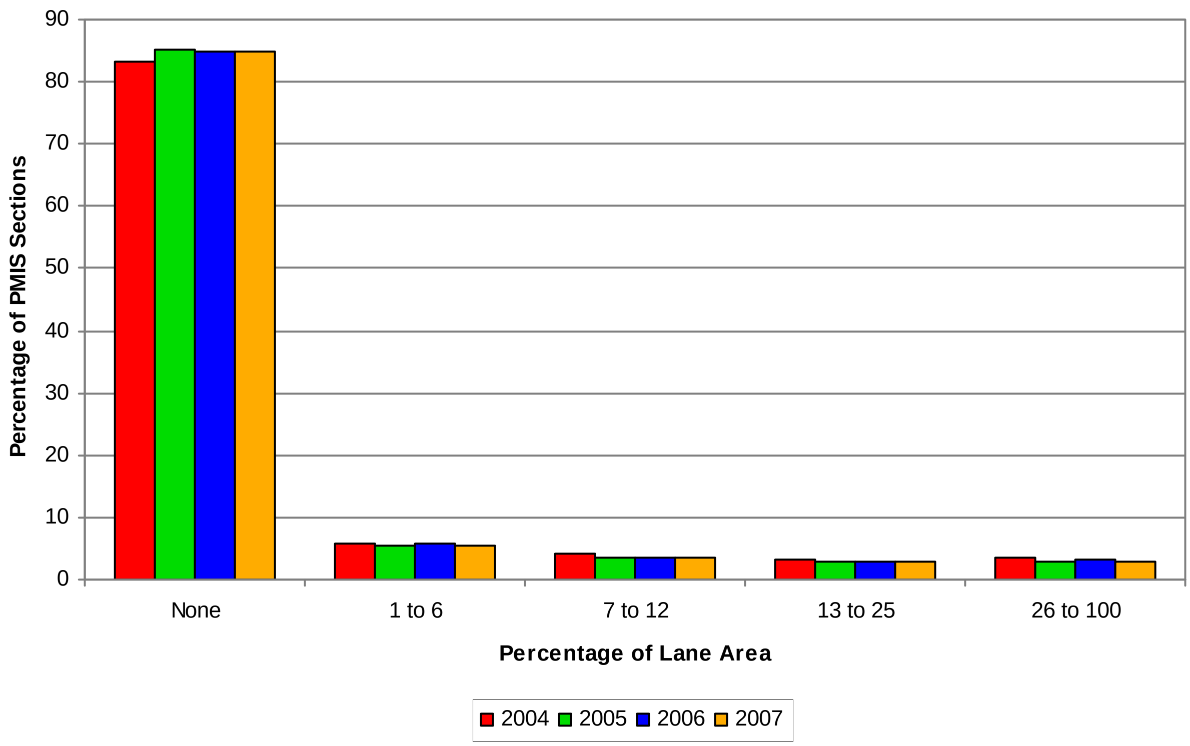


Figure 3.13— Patching, FY 2004-2007.

The Lane Area of Patching for Flexible Pavement shows that the:

- “None” category increased (from 84.83% in 2006 to 84.91% in 2007)
- “1 to 6” percent category decreased (from 5.64% in 2006 to 5.59% in 2007)
- “7 to 12” percent category increased (from 3.47% in 2006 to 3.48% in 2007)
- “13 to 25” percent category increased (from 2.97% in 2006 to 2.98% in 2007)
- “26 to 100” percent category decreased (from 3.10% in 2006 to 3.03% in 2007).

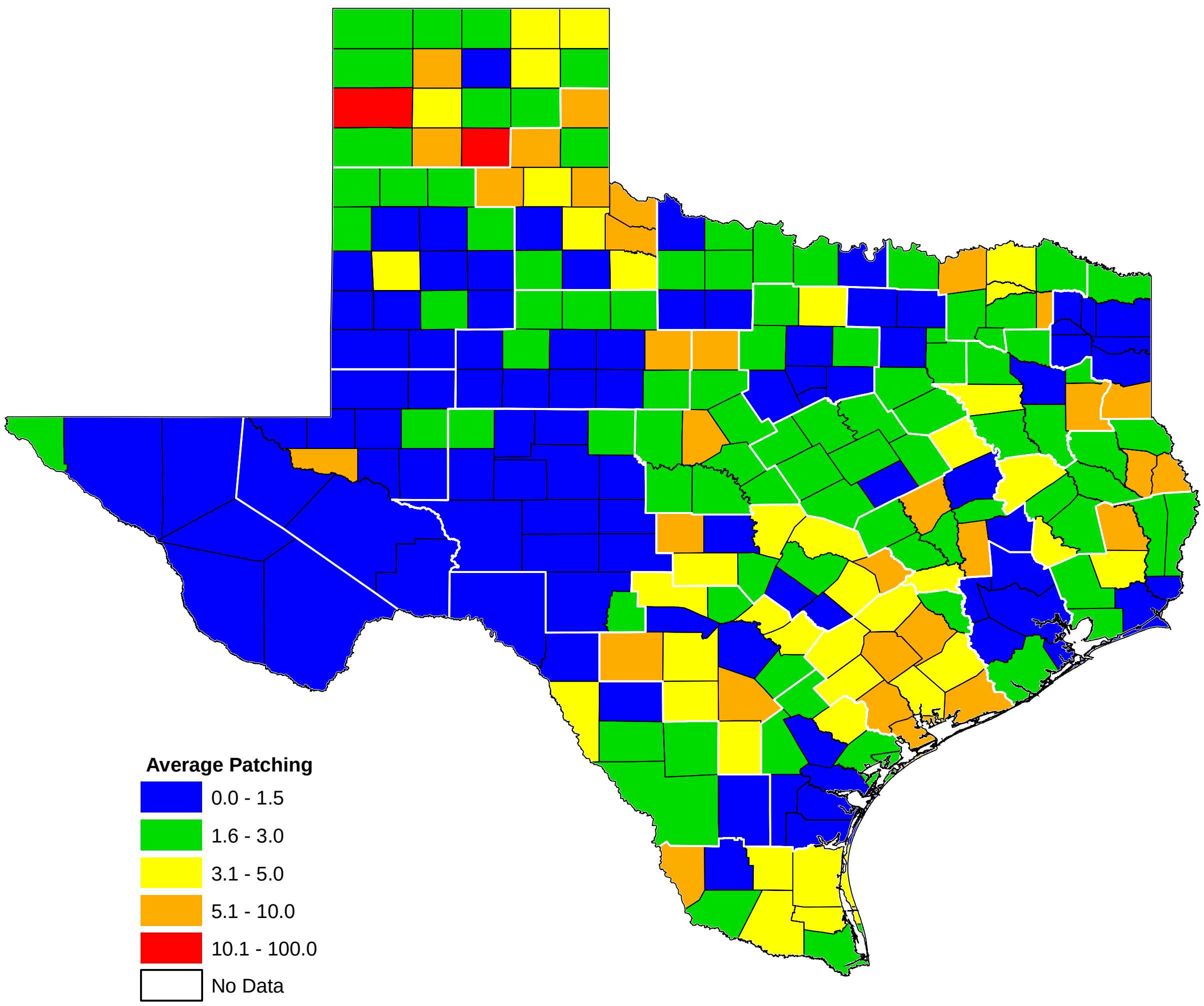
Maps 3.15 and 3.16 show the average rating for Patching, weighted by lane miles, in each county. The average in this case is the percentage of lane area covered by Patching. For example, if a county has 100 lane miles, it has 100 total miles of lane area that could have Patching; an average rating of 10 percent would mean that the county has 10 miles of full-lane width Patching.

Patching improved in FY 2007, after having gotten slightly worse in FY 2006.

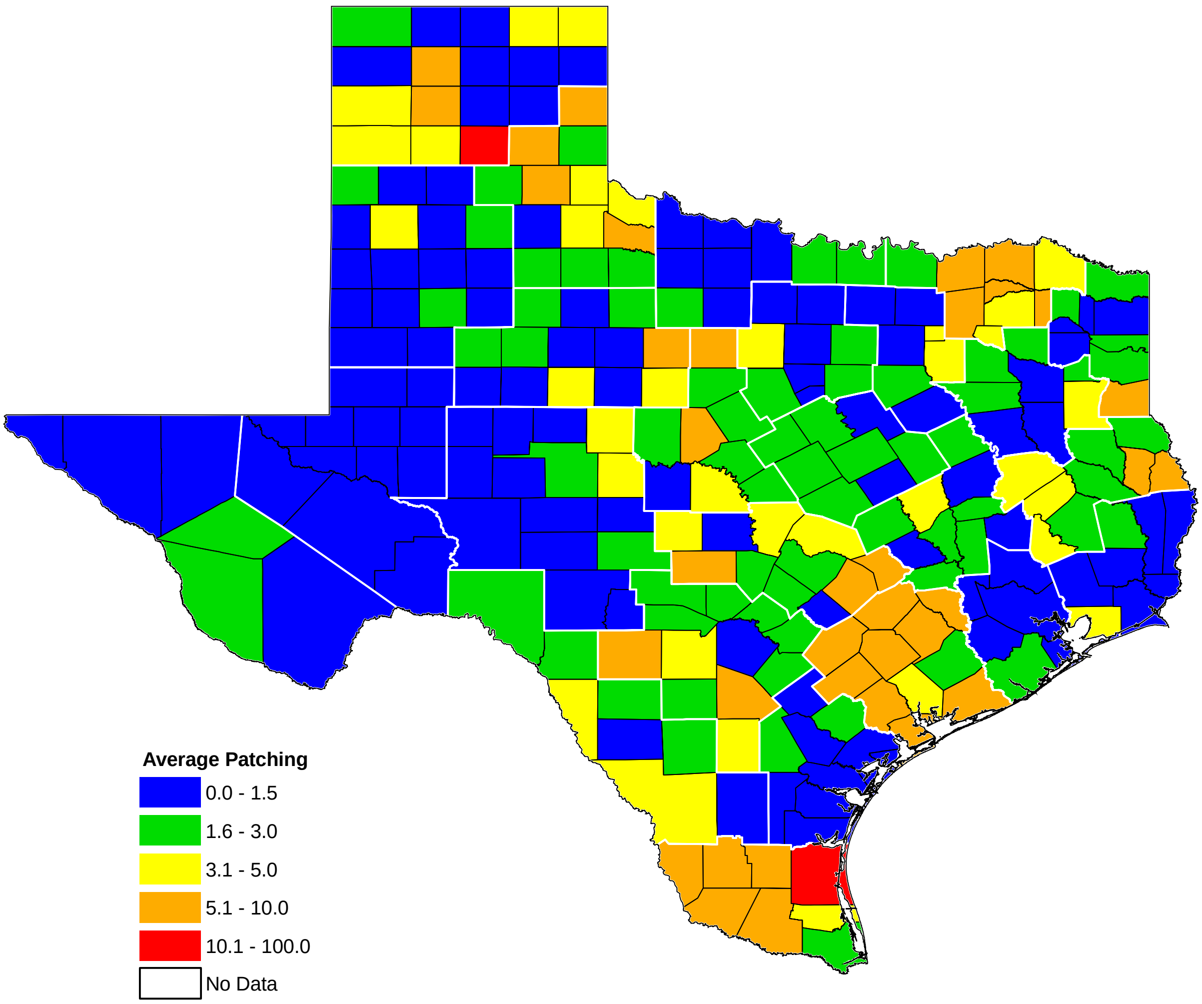
It should be noted that local maintenance practices can drastically affect the amount of Patching in PMIS. Flexible pavement material used to fill in ruts will be rated as Patching. Preventive maintenance edge stabilization that encroaches into the travel lane will be rated as Patching, even if it continues for several miles. Strip-type surface treatments and microsurfacing to improve surface texture will also be rated as Patching, even though the underlying material might still be structurally sound. Not all Patching in PMIS is caused by filling in potholes or digging up base material to repair "deep" distress.

Patching
Rating Based on Percentage of Lane Area

Map 3.15 — Average Patching, FY 2006.



Map 3.16 — Average Patching, FY 2007.



The Texas portion of IH 10 (878.614 miles) makes up more than one-third of its total cross-country length of 2,460.34 miles.

Discussion

In FY 2007, ACP condition and distress got worse, but ride quality improved. "Deep" distress on ACP mileage also improved. ACP had the best overall condition and ride quality of the three major pavement types in FY 2007.

Four of the eight ACP distress types got worse in FY 2007: Shallow Rutting, Deep Rutting, Failures, and Longitudinal Cracking. The other four distress ACP distress types – Alligator Cracking, Transverse Cracking, Block Cracking, and Patching – improved in FY 2007.

Three ACP "deep" distress types – Deep Rutting, Failures, and Longitudinal Cracking – got worse in FY 2007. Improved Alligator Cracking offest these other distress types and improved the overall "deep" distress for ACP.

ACP mileage was hit hard by the prolonged drought that began in the middle of FY 2005 and continued through all of FY 2006. Large increases in pavement material costs also affected flexible (asphalt) pavements by reducing the amount of mileage that could be resurfaced with existing maintenance and rehabilitation budgets. As mentioned in Chapter 1, overall construction costs rose by more than 21 percent in FY 2005 and by another 17 percent in FY 2006. Hot-mix asphalt rose by more than 27 percent in FY 2005 and by 34 percent in FY 2006. Asphalt cement for seal coats rose by more than 38 percent in FY 2005 and by 41 percent in FY 2006.

It must be noted that PMIS rut data for FY 2006-2007 had to be adjusted by subtracting 0.1 inches from each rut depth measurement. This was done to compensate for a change in the Rutbar dynamic calibration procedure which produced very large increases in the amount of Shallow Rutting and Deep Rutting.

Additional information about the rut data changes may be found in "Description of FY 2006-2007 Rutbar Changes" on page iii.

As in previous years, the flexible pavement condition, distress, and ride quality trends drove the statewide trends. This is because flexible pavement makes up almost all (92.31 percent) of the TxDOT-maintained mileage, but this percentage is slowly dropping as more rigid pavement (especially CRCP) is being built.

Summary

In FY 2007, ACP condition and distress got worse, but ride quality improved. "Deep" distress on ACP mileage also improved because of a large reduction in Alligator Cracking. ACP had the best overall condition and ride quality of the three major pavement types in FY 2007. Shallow Rutting, Deep Rutting, Failures, and Longitudinal Cracking got worse in FY 2007; while Alligator Cracking, Transverse Cracking, Block Cracking, and Patching improved in FY 2007.

At 223 miles, IH 30 is the shortest even-numbered Interstate highway in the nation. Source: Texas Transportation Institute.

Chapter 4 Condition of Rigid Pavements — CRCP

This chapter describes the condition of Continuously Reinforced Concrete Pavements (CRCP) in Texas. They make up approximately 5.44 percent of the TxDOT-maintained lane mileage but carry 22.36 percent of the vehicle miles traveled.

CRCP Distress Types

The following distress type ratings are analyzed in this chapter:

- Spalled Cracks
- Punchouts
- Asphalt Patches
- Concrete Patches
- Average Crack Spacing.

NOTE: Due to the relatively small amount of mileage available when analyzing CRCP distresses by county, there are no maps shown in this chapter.

Definition of "Shallow" and "Deep" Pavement Distress Types

Rigid pavement distress can be caused by many factors, and local conditions have a major impact. As with flexible pavements in Chapter 3, it is helpful to think of the CRCP distress types in PMIS in terms of:

- "Shallow" Distress Types – Spalled Cracks and Concrete Patches. Spalled Cracks usually indicate wear and tear of the concrete mix, or problems with weak or reactive aggregate. Concrete Patches are assumed to be near-permanent repairs of distress (whether load-associated or not), that restore the structural strength of the concrete slab; thus they are not considered to be load-related.
- "Deep" Distress Types – Punchouts and Asphalt Patches. Punchouts indicate loss of structural load-carrying capacity. Asphalt Patches are assumed to be temporary repairs of distress (whether load-associated or not), that do not restore the structural strength of the concrete slab; thus they are considered to be load-related.

Distinguishing "Shallow" and "Deep" distress types can suggest how current funding needs to be distributed between preventive maintenance and rehabilitation. It can also identify regions of the state where load-related structural problems are prevalent.

Please note that Average Crack Spacing is not classified as "shallow" or "deep." It is used as a predictor of Punchouts for older CRCP sections less than about ten inches thick. Experience with Texas pavements indicates that CRCP slabs greater than ten inches thick are not very sensitive to Average Crack Spacking.

IH 37 from San Antonio to Corpus Christi was begun in the 1960s and completed in the 1980s. It roughly parallels US 181. Source: Texas Transportation Institute.

CRCP Distress Examples

PMIS rates five types of CRCP distress, as shown in the pictures below:

Spalled Cracks
(Number of Occurrences)

Punchouts – "Deep" Distress Type
(Number of Occurrences)

Asphalt Patches – "Deep" Distress Type
(Number of Occurrences)

Concrete Patches
(Number of Occurrences)

Average Crack Spacing
(Spacing, in Feet)

Condition Score Classes for CRCP

Figure 4.1 shows the statewide distribution of Condition Score classes for CRCP pavements for fiscal years 2004 through 2007.

70.97 percent of the CRCP lane miles were in “Very Good” condition in FY 2007.

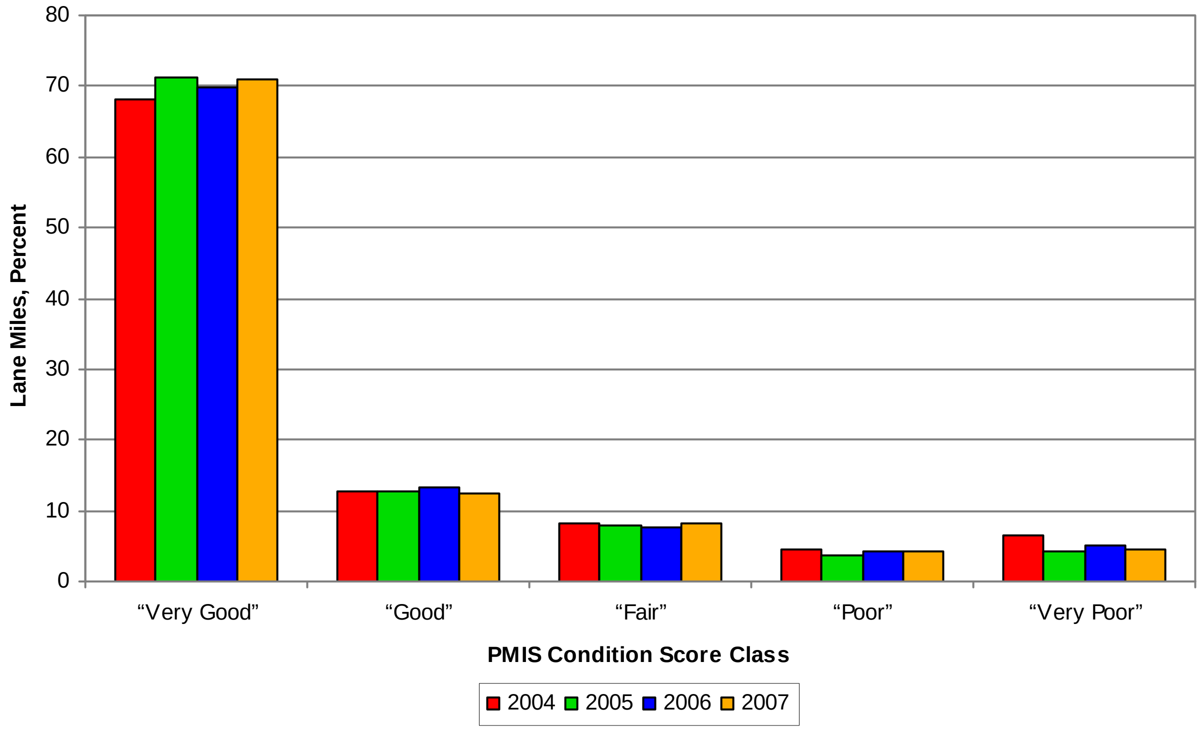


Figure 4.1 — Condition Score Classes for CRCP, FY 2004-2007.

The Condition Score Classes for CRCP show that:

- “Very Good” mileage increased (from 69.95% in 2006 to 70.97% in 2007)
- “Good” mileage decreased (from 13.17% in 2006 to 12.32% in 2007)
- “Fair” mileage increased (from 7.64% in 2006 to 8.06% in 2007)
- “Poor” mileage increased (from 4.13% in 2006 to 4.17% in 2007)
- “Very Poor” mileage decreased (from 5.12% in 2006 to 4.48% in 2007).

Distress Score Classes for CRCP

Figure 4.2 shows the statewide distribution of Distress Score classes for CRCP pavements for fiscal years 2004 through 2007.

84.86 percent of the CRCP lane miles were "Very Good" in terms of pavement distress in FY 2007.

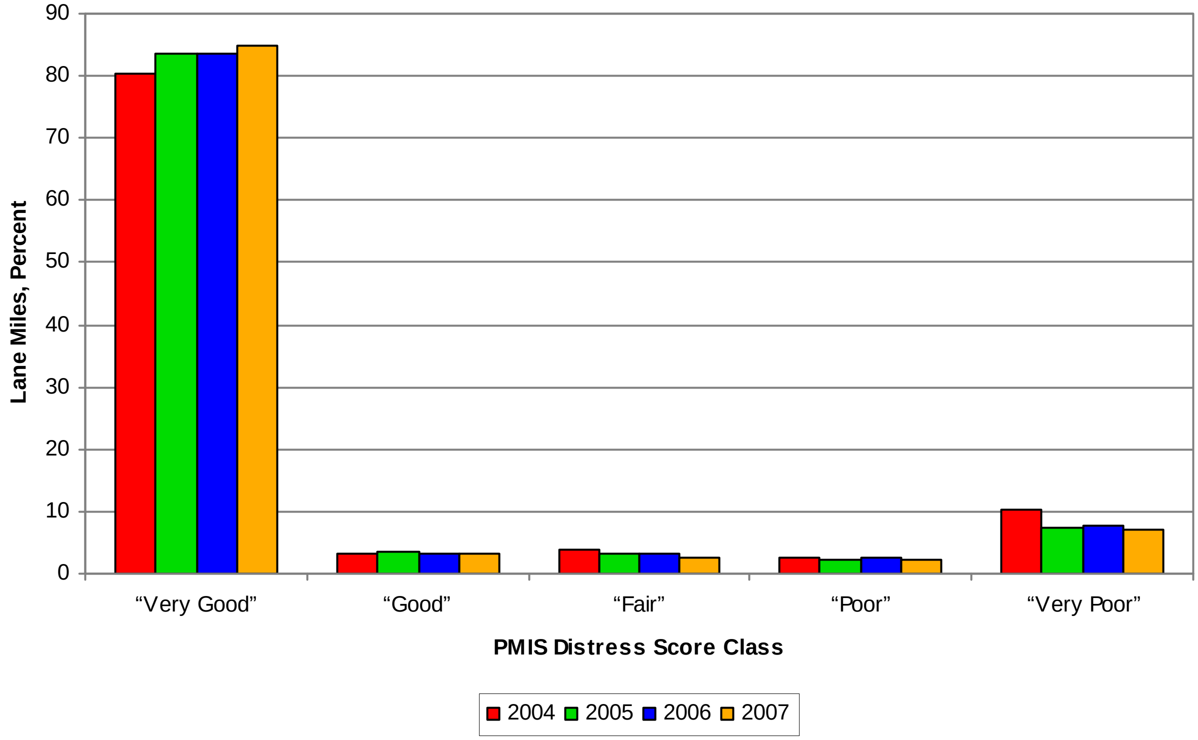


Figure 4.2 — Distress Score Classes for CRCP, FY 2004-2007.

The Distress Score Classes for CRCP show that:

- "Very Good" mileage increased (from 83.50% in 2006 to 84.86% in 2007)
- "Good" mileage increased (from 3.11% in 2006 to 3.28% in 2007)
- "Fair" mileage decreased (from 3.23% in 2006 to 2.45% in 2007)
- "Poor" mileage decreased (from 2.55% in 2006 to 2.40% in 2007)
- "Very Poor" mileage decreased (from 7.62% in 2006 to 7.01% in 2007).

Deep Distress Score Classes for CRCP

Figure 4.3 shows the statewide distribution of Deep Distress Score classes for CRCP pavements for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

94.96 percent of the CRCP lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

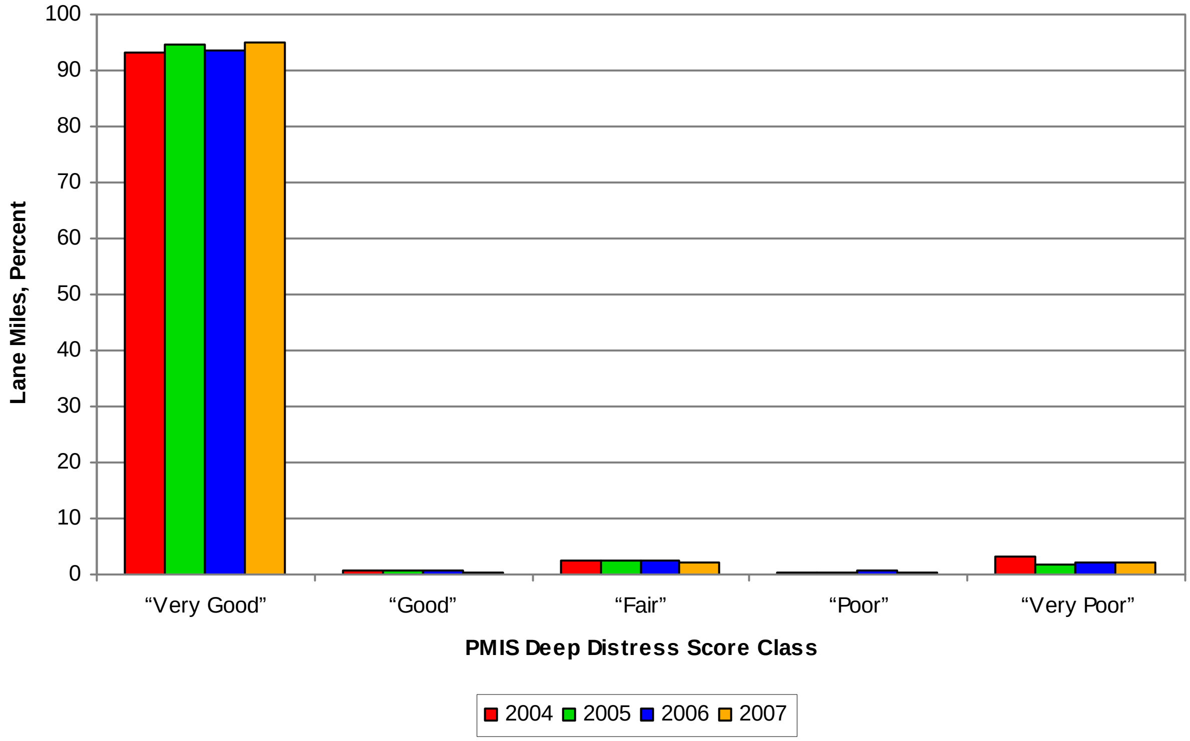


Figure 4.3 — Deep Distress Score Classes for CRCP, FY 2004-2007.

The Deep Distress Score Classes for CRCP show that:

- "Very Good" mileage increased (from 93.73% in 2006 to 94.96% in 2007)
- "Good" mileage decreased (from 0.89% in 2006 to 0.49% in 2007)
- "Fair" mileage decreased (from 2.33% in 2006 to 2.23% in 2007)
- "Poor" mileage decreased (from 0.76% in 2006 to 0.29% in 2007)
- "Very Poor" mileage decreased (from 2.30% in 2006 to 2.02% in 2007).

Ride Score Classes for CRCP

Figure 4.4 shows the statewide distribution of Ride Score classes for CRCP pavements for fiscal years 2004 through 2007. In general, the average person would consider 17.96 percent of the continuously-reinforced concrete pavements to be "rough."

It should be noted that if an asphalt overlay is used to improve CRCP ride quality, PMIS considers that mileage to be "flexible," and thus does not include it in these figures.

17.04 percent of the CRCP lane miles had "Very Good" ride quality in FY 2007.

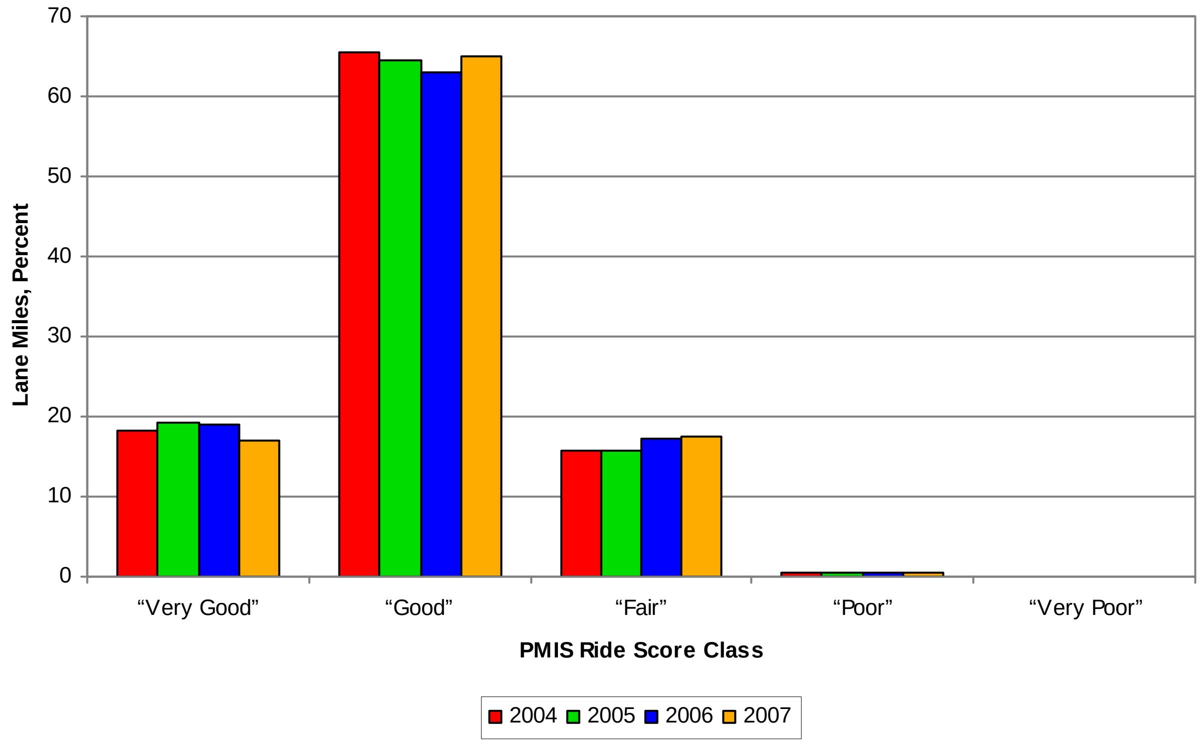


Figure 4.4 — Ride Score Classes for CRCP, FY 2004-2007.

The Ride Score Classes for CRCP show that:

- "Very Good" mileage decreased (from 18.98% in 2006 to 17.04% in 2007)
- "Good" mileage increased (from 63.05% in 2006 to 65.01% in 2007)
- "Fair" mileage increased (from 17.36% in 2006 to 17.39% in 2007)
- "Poor" mileage decreased (from 0.57% in 2006 to 0.49% in 2007)
- "Very Poor" mileage increased (from 0.03% in 2006 to 0.08% in 2007).

IRI Score Classes for CRCP

Figure 4.5 shows the statewide distribution of IRI Score classes for CRCP pavements for fiscal years 2004 through 2007. In general, the average person would consider 72.32 percent of the continuously-reinforced concrete pavements to be “rough,” based on IRI. This is not the same as the 17.96 percent of “rough” CRCP mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

It should be noted that if an asphalt overlay is used to improve CRCP ride quality, PMIS considers that mileage to be “flexible,” and thus does not include it in these figures.

1.46 percent of the CRCP lane miles had “Very Good” IRI Scores in FY 2007.

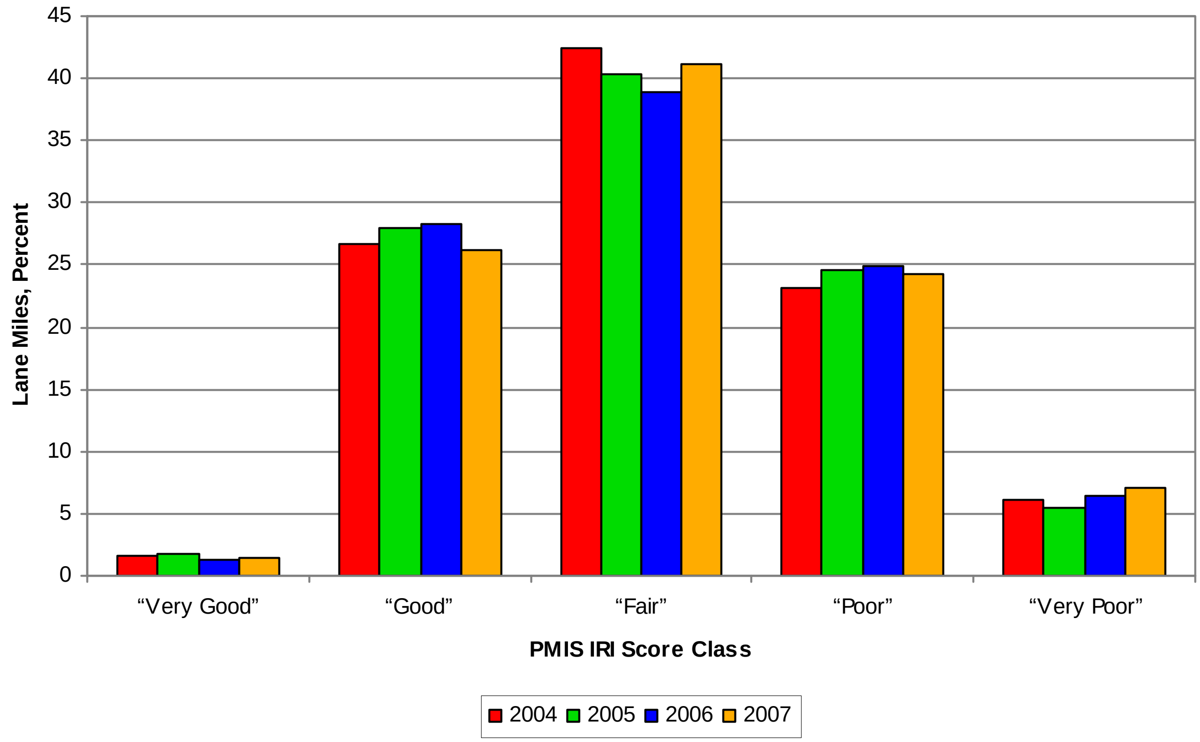


Figure 4.5 — IRI Score Classes for CRCP, FY 2004-2007.

The IRI Score Classes for CRCP show that:

- “Very Good” mileage increased (from 1.31% in 2006 to 1.46% in 2007)
- “Good” mileage decreased (from 28.30% in 2006 to 26.22% in 2007)
- “Fair” mileage increased (from 38.97% in 2006 to 41.12% in 2007)
- “Poor” mileage decreased (from 24.98% in 2006 to 24.21% in 2007)
- “Very Poor” mileage increased (from 6.43% in 2006 to 6.99% in 2007).

Spalled Cracks

Figure 4.6 shows the percentage of PMIS sections with Spalled Cracks for fiscal years 2004 through 2007.

Spalled Cracks are transverse cracks that have widened, showing signs of chipping on either side, along some or all of their length. If left untreated (or if they are spaced too closely together), Spalled Cracks can turn into Punchouts, which are much more serious to treat.

19.43 percent of the CRCP sections had Spalled Cracks in FY 2007.

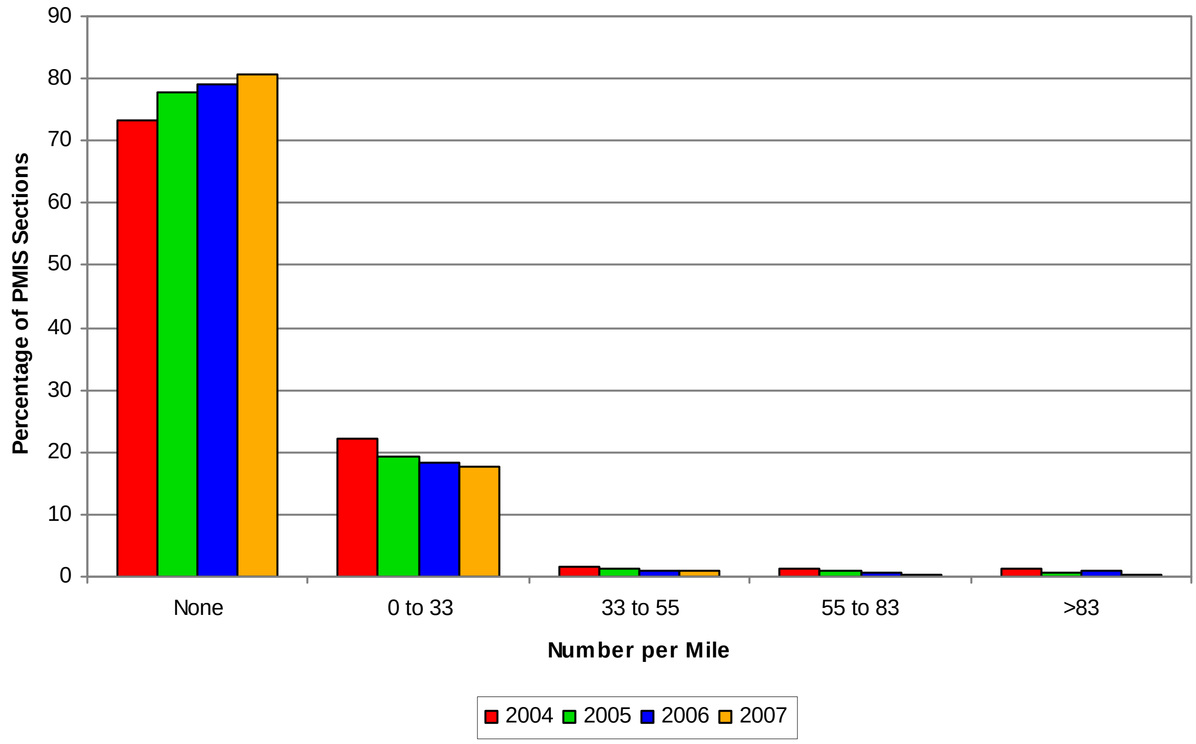


Figure 4.6 — Spalled Cracks, FY 2004-2007.

The Number of Spalled Cracks per Mile for CRCP show that the:

- "None" category increased (from 79.16% in 2006 to 80.57% in 2007)
- "0 to 33" category decreased (from 18.23% in 2006 to 17.64% in 2007)
- "33 to 55" category decreased (from 0.98% in 2006 to 0.87% in 2007)
- "55 to 83" category decreased (from 0.68% in 2006 to 0.47% in 2007)
- ">83" category decreased (from 0.95% in 2006 to 0.46% in 2007).

Punchouts

Figure 4.7 shows the percentage of PMIS sections with Punchouts for fiscal years 2004 through 2007.

A Punchout is a full-depth block of pavement formed when one longitudinal crack crosses two transverse cracks. Although usually rectangular in shape, Punchouts can appear in other shapes. Punchouts can be "removed" from the PMIS ratings by patching, so they must be looked at in combination with patches (especially Concrete Patches) to get a complete picture of concrete slab condition.

8.65 percent of the CRCP sections had Punchouts in FY 2007.

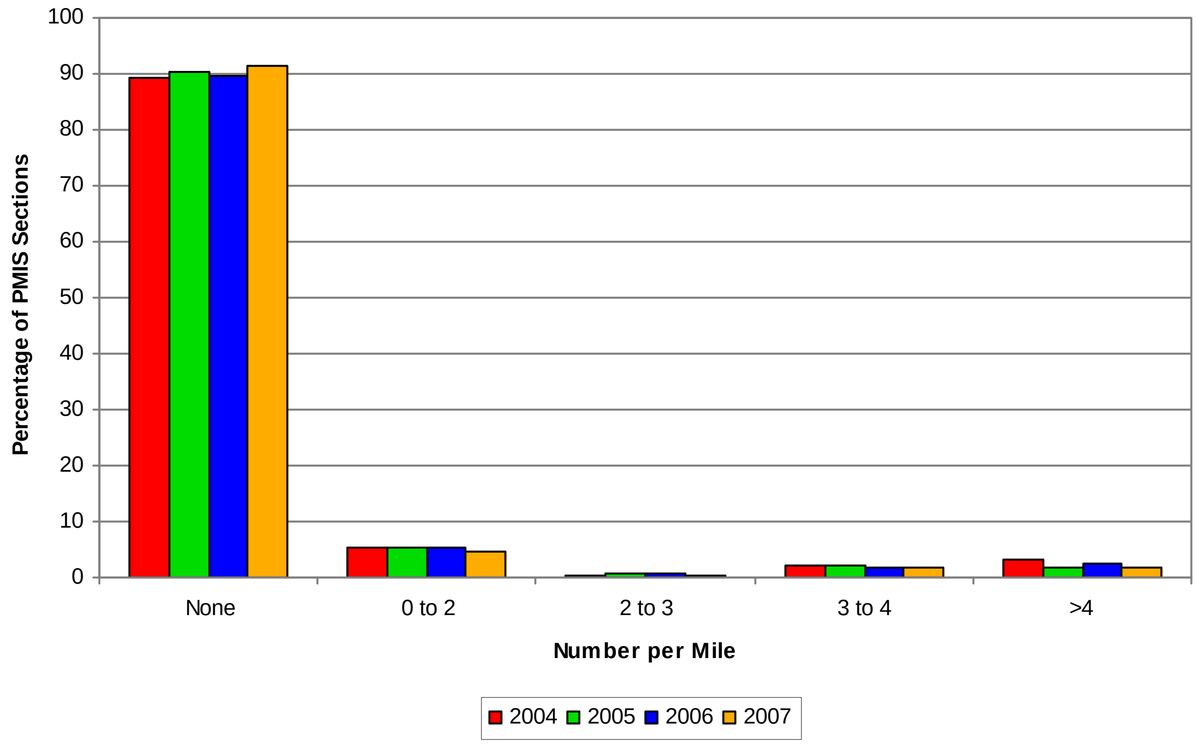


Figure 4.7 — Punchouts, FY 2004-2007.

The Number of Punchouts per Mile for CRCP show that the:

- "None" category increased (from 89.56% in 2006 to 91.35% in 2007)
- "0 to 2" category decreased (from 5.31% in 2006 to 4.49% in 2007)
- "2 to 3" category decreased (from 0.62% in 2006 to 0.44% in 2007)
- "3 to 4" category decreased (from 1.94% in 2006 to 1.80% in 2007)
- ">4" category decreased (from 2.57% in 2006 to 1.92% in 2007).

Asphalt Patches

Figure 4.8 shows the percentage of PMIS sections with Asphalt Patches for fiscal years 2004 through 2007.

An Asphalt Patch is a localized area of asphalt concrete that has been placed to the full depth of the surrounding concrete slab, as a temporary method of correcting surface or structural defects. These patches are usually placed to repair Punchouts, and the choice of material (asphalt or concrete) seems to depend on how quickly the repair must be made, with concrete being preferred if at all possible. Asphalt patches of CRCP tend to be temporary repairs at best and thus have the same effect as Punchouts on the PMIS Distress Score.

1.11 percent of the CRCP sections had Asphalt Patches in FY 2007.

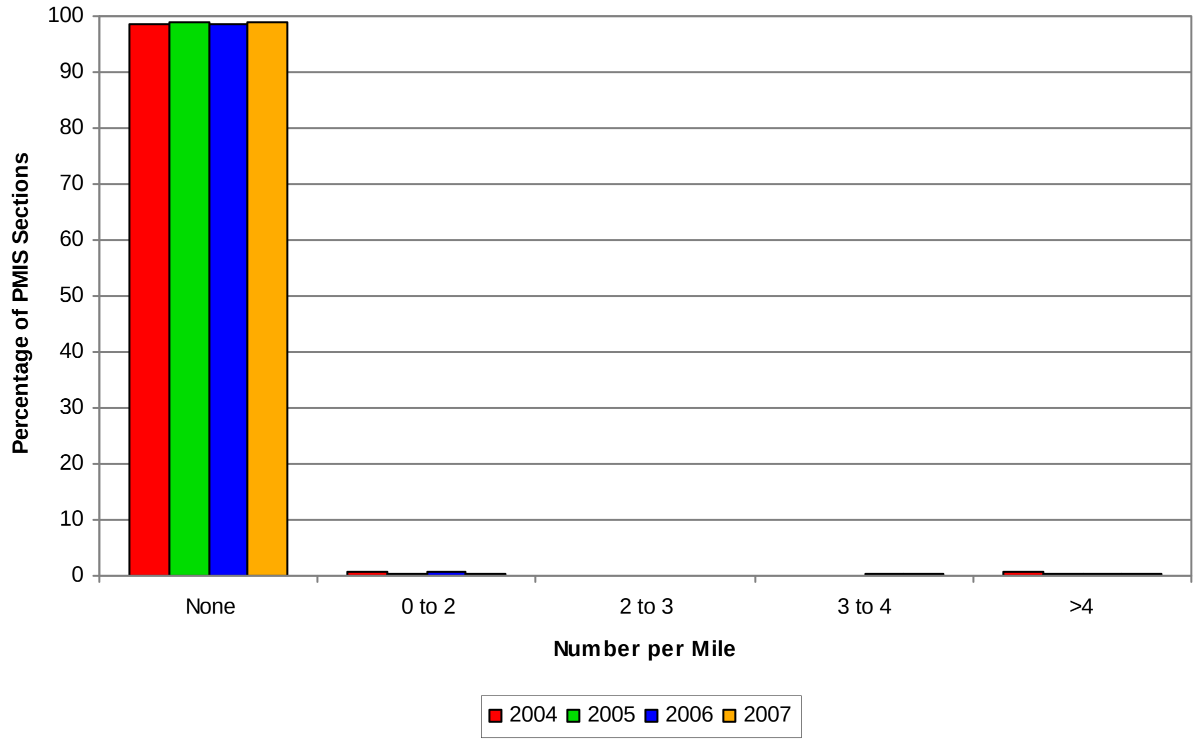


Figure 4.8 — Asphalt Patches, FY 2004-2007.

The Number of Asphalt Patches per Mile for CRCP show that the:

- "None" category increased (from 98.58% in 2006 to 98.89% in 2007)
- "0 to 2" category decreased (from 0.65% in 2006 to 0.40% in 2007)
- "2 to 3" category decreased (from 0.04% in 2006 to 0.03% in 2007)
- "3 to 4" category decreased (from 0.35% in 2006 to 0.21% in 2007)
- ">4" category increased (from 0.37% in 2006 to 0.47% in 2007).

Concrete Patches

Figure 4.9 shows the percentage of PMIS sections with Concrete Patches for fiscal years 2004 through 2007.

A Concrete Patch is a localized area of newer concrete that has been placed to the full depth of the existing slab as a method of correcting surface or structural defects. These patches are usually placed to repair Punchouts, and the choice of material (asphalt or concrete) seems to depend on how quickly the repair must be made, with concrete being preferred if at all possible. Concrete patches of CRCP tend to be long-lasting repairs.

15.56 percent of the CRCP sections had Concrete Patches in FY 2007.

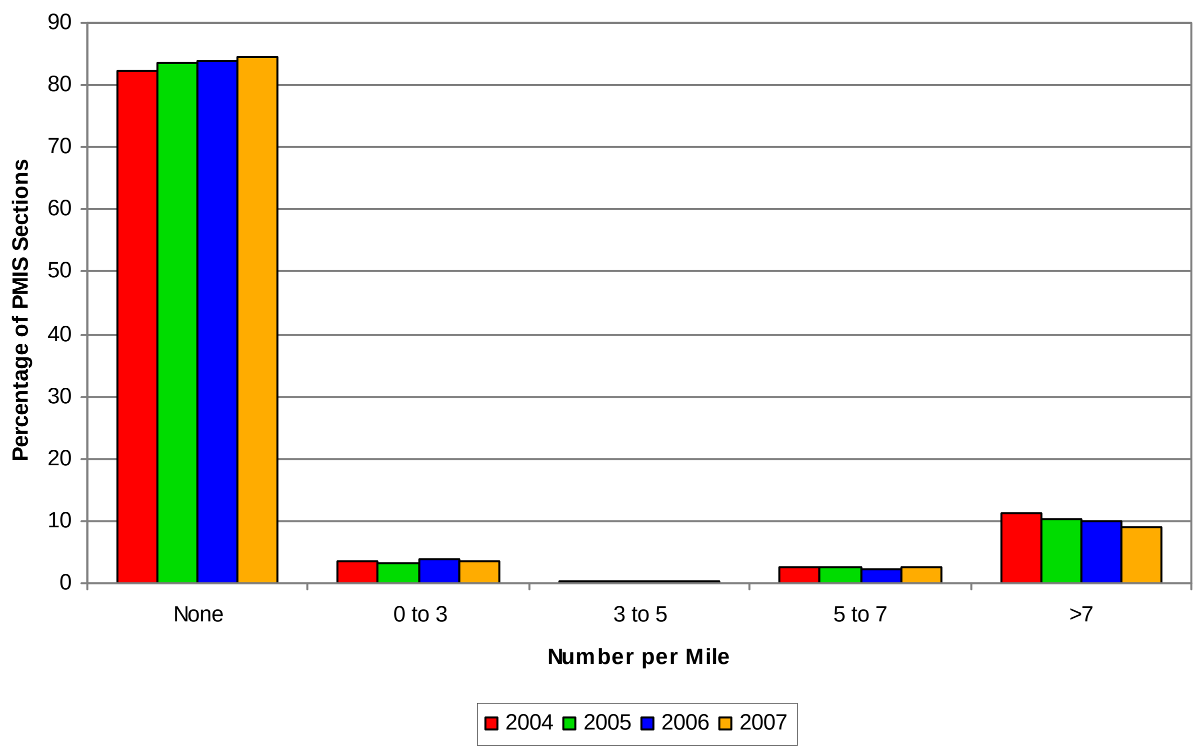


Figure 4.9 — Concrete Patches, FY 2004-2007.

The Number of Concrete Patches per Mile for CRCP show that the:

- "None" category increased (from 83.81% in 2006 to 84.44% in 2007)
- "0 to 3" category decreased (from 3.74% in 2006 to 3.63% in 2007)
- "3 to 5" category decreased (from 0.38% in 2006 to 0.27% in 2007)
- "5 to 7" category increased (from 2.16% in 2006 to 2.64% in 2007)
- ">7" category decreased (from 9.91% in 2006 to 9.02% in 2007).

Average Crack Spacing

Figure 4.10 shows the distribution of Average Crack Spacing on PMIS sections for fiscal years 2004 through 2007.

Average Crack Spacing in PMIS is defined as the average distance between transverse cracks, in feet. Typically, CRCP starts out with transverse cracks about ten feet apart, and then the spacing decreases steadily as the pavement ages. Research and field experience suggest that Punchouts tend to appear when the Average Crack Spacing drops below three feet, but thicker slabs — such as those being built today — seem to be able to tolerate smaller transverse crack spacing without developing Spalled Cracks or Punchouts.

0.93 percent of PMIS sections had an Average Crack Spacing less than three feet in FY 2007.

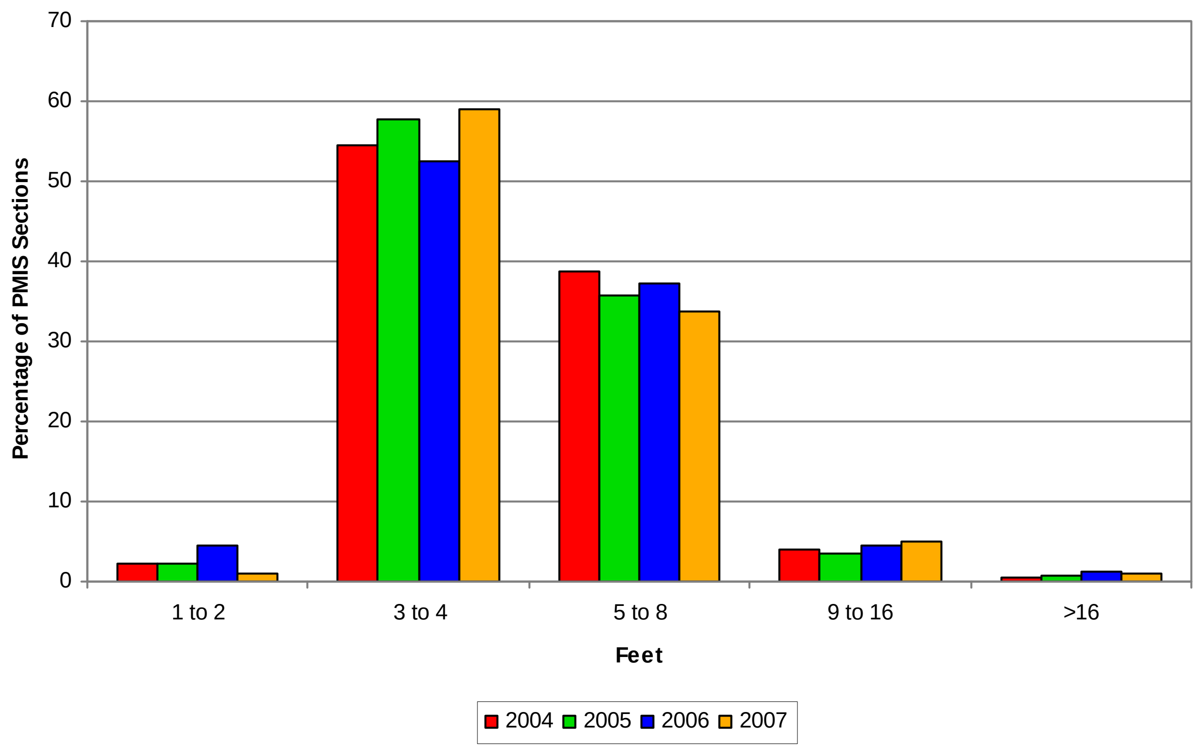


Figure 4.10 — Average Crack Spacing, FY 2004-2007.

The Average Crack Spacing for CRCP show that the:

- "1 to 2" feet decreased (from 4.54% in 2006 to 0.93% in 2007)
- "3 to 4" feet increased (from 52.43% in 2006 to 59.11% in 2007)
- "5 to 8" feet decreased (from 37.37% in 2006 to 33.87% in 2007)
- "9 to 16" feet increased (from 4.47% in 2006 to 5.03% in 2007)
- ">16" feet decreased (from 1.20% in 2006 to 1.07% in 2007).

Unlike most Interstates ending in "5," IH 45 is not a border-to-border highway. It is also the shortest Interstate in the country that ends in "5." Source: Texas Transportation Institute.

Discussion

In FY 2007, CRCP condition and distress improved, but ride quality got worse. “Deep” distress (Spalled Cracks and Asphalt Patches) on CRCP improved in FY 2007.

All CRCP distress types – Spalled Cracks, Punchouts, Asphalt Patches, and Concrete Patches – improved in FY 2007.

CRCP ride quality got worse in FY 2007, as it did in FY 2006. As a result, CRCP no longer has the best overall ride quality of the three major pavement types.

As mentioned in Chapter 1, the cost of concrete pavement rose 11 percent in FY 2005 and 13 percent in FY 2006, but these cost increases did not seem to have much effect on CRCP condition. Concrete costs tend to be absorbed as part of the much larger cost of building new CRCP, which should be in very good condition, anyway. For existing CRCP, concrete is typically used in smaller amounts for patching, so rapid increases in the cost of “paving” concrete are not as important.

CRCP is often used in metropolitan areas and for routes carrying very high volumes of truck traffic. Pavement problems on CRCP can thus seriously detract from the overall quality of service provided by Texas pavements, and need to be monitored carefully. Although well-designed and well-built CRCP can provide many years of maintenance-free service, it can be very difficult to repair once distress and roughness appear with age. As a result, overall condition on CRCP in Texas tends to be lower than that on ACP, but the gap has been closing in recent years, especially as more new CRCP has been built.

Summary

In FY 2007, CRCP condition and distress improved, but ride quality got worse. “Deep” distress (Spalled Cracks and Asphalt Patches) on CRCP also improved in FY 2007. All CRCP distress types – Spalled Cracks, Punchouts, Asphalt Patches, and Concrete Patches – improved in FY 2007. CRCP no longer has the best overall ride quality of the three major pavement types.

Several portions of PMIS were prototyped in the mid-1980s as part of a maintenance/pavement management system used in the Pharr district. The Pharr system used 0.5-mile rating sections instead of the 2-mile sections used in the Pavement Evaluation System (PES). The 0.5-mile section idea was later adopted as part of PMIS. The Pharr system also had three area levels and three severity levels for each distress type, but these were not adopted as part of PMIS.

Chapter 5 Condition of Rigid Pavements — JCP

This chapter describes the condition of Jointed Concrete Pavements (JCP) in Texas. They make up approximately 2.26 percent of the TxDOT-maintained lane mileage but carry 5.25 percent of the vehicle miles traveled.

JCP Distress Types

The following distress type ratings are analyzed in this chapter:

- Failed Joints and Cracks
- JCP Failures
- Shattered Slabs
- Slabs with Longitudinal Cracks
- Concrete Patches.

NOTE: Due to the relatively small amount of mileage available when analyzing JCP distresses by county, there are no maps shown in this chapter.

Causes of JCP Distress Types

Rigid pavement distress can be caused by many factors, and local conditions have a major impact. As with CRCP pavements in Chapter 4, it is helpful to think of the JCP distress types in PMIS in terms of:

- "Shallow" Distress Types – Failed Joints and Cracks and Concrete Patches. Failed Joints and Cracks can indicate loss of load transfer at the joints, but they identify areas of simple wear and tear of the concrete mix. Concrete Patches are assumed to be near-permanent repairs of distress (whether load-associated or not), that restore the structural strength of the concrete slab; thus they are not considered to be load-related.
- "Deep" Distress Types – Failures, Shattered Slabs, and Slabs with Longitudinal Cracks. These distress types indicate loss of structural load-carrying capacity that require extensive repair or even slab replacement to restore the pavement structure.

Distinguishing "Shallow" and "Deep" distress types can suggest how current funding needs to be distributed between preventive maintenance and rehabilitation. It can also identify regions of the state where load-related structural problems are prevalent.

In 1930, the "Texas Highway Department" had only 18 districts (known then as "Divisions"), numbered 1 through 18. Districts numbered 19 through 25 (today's Atlanta, Beaumont, Pharr, Laredo, Brownwood, El Paso, and Childress districts) were established later.

JCP Distress Examples

PMIS rates five types of JCP distress, as shown below:

Failed Joints and Cracks (Number of Occurrences)

JCP Failures – "Deep" Distress Type (Number of Occurrences)

Shattered Slabs – "Deep" Distress Type (Number of Slabs)

Slabs with Longitudinal Cracks – "Deep" Distress Type (Number of Slabs)

Concrete Patches (Number of Occurrences)

Condition Score Classes for JCP

Figure 5.1 shows the statewide distribution of Condition Score classes for JCP pavements for fiscal years 2004 through 2007.

43.14 percent of the JCP lane miles were in "Very Good" condition in FY 2007.

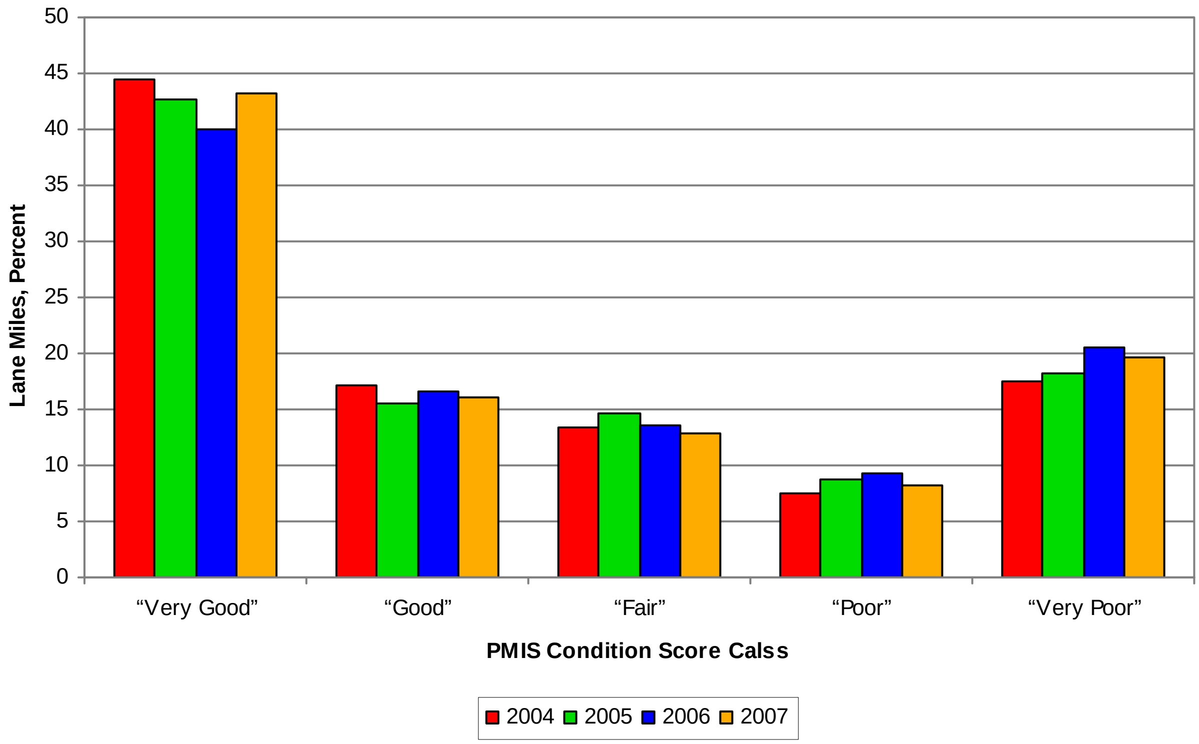


Figure 5.1 — Condition Score Classes for JCP, FY 2004-2007.

The Condition Score Classes for JCP show that:

- "Very Good" mileage increased (from 39.99% in 2006 to 43.14% in 2007)
- "Good" mileage decreased (from 16.56% in 2006 to 16.03% in 2007)
- "Fair" mileage decreased (from 13.58% in 2006 to 12.90% in 2007)
- "Poor" mileage decreased (from 9.36% in 2006 to 8.20% in 2007)
- "Very Poor" mileage decreased (from 20.51% in 2006 to 19.72% in 2007).

Distress Score Classes for JCP

Figure 5.2 shows the statewide distribution of Distress Score classes for JCP pavements for fiscal years 2004 through 2007.

72.12 percent of the JCP lane miles were "Very Good" in terms of pavement distress in FY 2007.

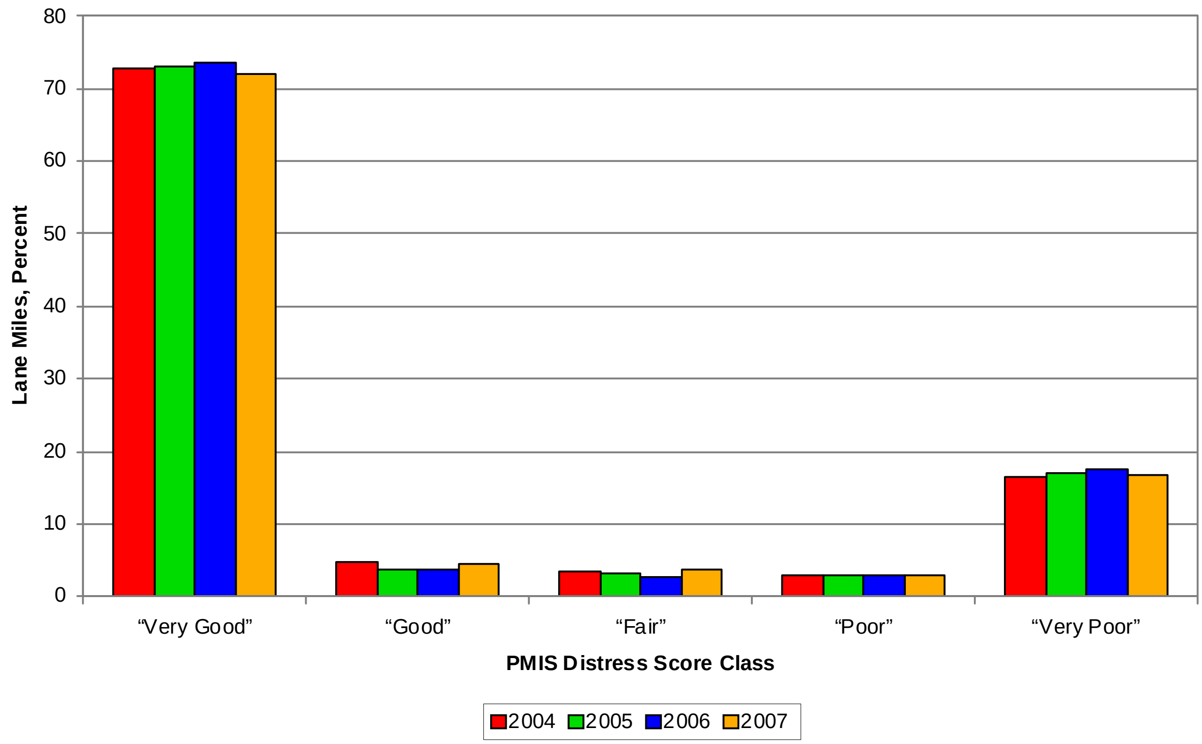


Figure 5.2 — Distress Score Classes for JCP, FY 2004-2007.

The Distress Score Classes for JCP show that:

- "Very Good" mileage decreased (from 73.47% in 2006 to 72.12% in 2007)
- "Good" mileage increased (from 3.56% in 2006 to 4.57% in 2007)
- "Fair" mileage increased (from 2.78% in 2006 to 3.69% in 2007)
- "Poor" mileage increased (from 2.79% in 2006 to 2.80% in 2007)
- "Very Poor" mileage decreased (from 17.40% in 2006 to 16.81% in 2007).

Deep Distress Score Classes for JCP

Figure 5.3 shows the statewide distribution of Deep Distress Score classes for JCP pavements for fiscal years 2004 through 2007. Deep Distress Scores are based on specific distress types that suggest the need for sub-surface rehabilitation.

88.33 percent of the JCP lane miles were "Very Good" in terms of pavement deep distress in FY 2007.

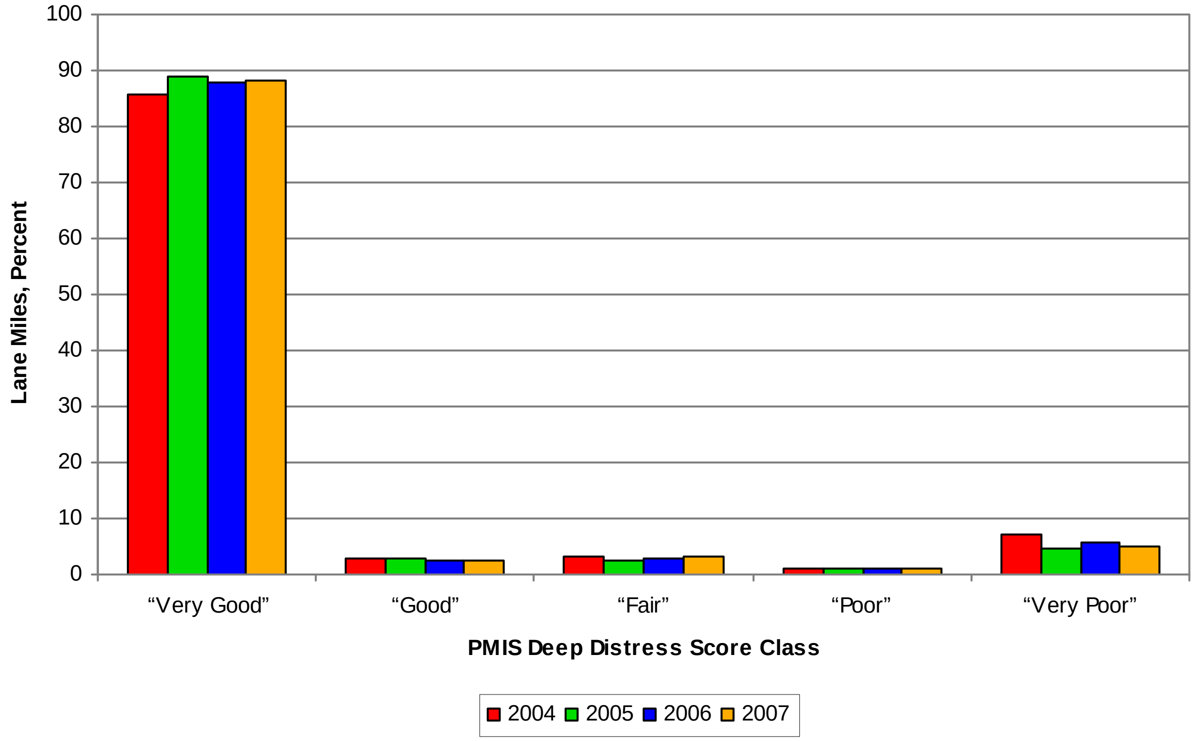


Figure 5.3 — Deep Distress Score Classes for JCP, FY 2004-2007.

The Deep Distress Score Classes for JCP show that:

- "Very Good" mileage increased (from 88.01% in 2006 to 88.33% in 2007)
- "Good" mileage increased (from 2.59% in 2006 to 2.68% in 2007)
- "Fair" mileage increased (from 2.69% in 2006 to 3.16% in 2007)
- "Poor" mileage decreased (from 1.08% in 2006 to 0.99% in 2007)
- "Very Poor" mileage decreased (from 5.63% in 2006 to 4.84% in 2007).

Ride Score Classes for JCP

Figure 5.4 shows the statewide distribution of Ride Score classes for JCP pavements for fiscal years 2004 through 2007. In general, the average person would consider 50.94 percent of the jointed concrete pavements to be "rough."

It should be noted that if an asphalt overlay is used to improve JCP ride quality, PMIS considers that mileage to be "flexible," and thus does not include it in these figures.

7.32 percent of the JCP lane miles had "Very Good" ride quality in FY 2007.

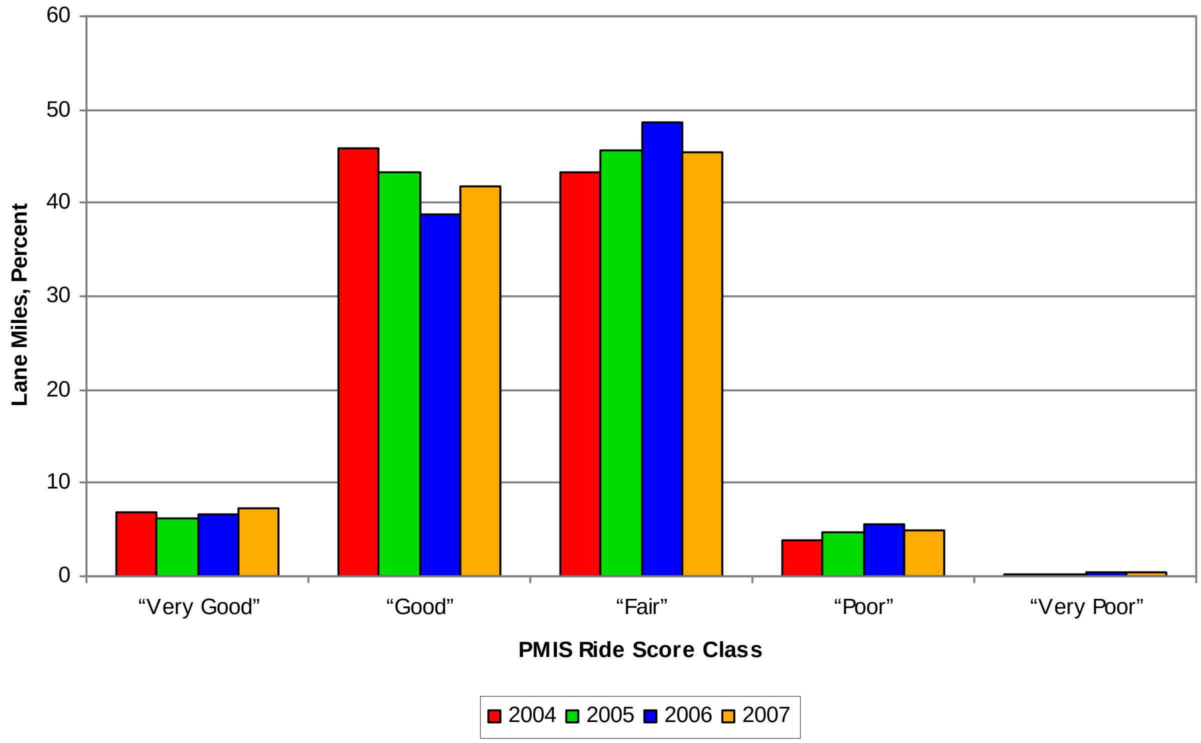


Figure 5.4 — Ride Score Classes for JCP, FY 2004-2007.

The Ride Score Classes for JCP show that:

- "Very Good" mileage increased (from 6.68% in 2006 to 7.32% in 2007)
- "Good" mileage increased (from 38.85% in 2006 to 41.73% in 2007)
- "Fair" mileage decreased (from 48.62% in 2006 to 45.48% in 2007)
- "Poor" mileage decreased (from 5.47% in 2006 to 5.01% in 2007)
- "Very Poor" mileage increased (from 0.38% in 2006 to 0.45% in 2007).

IRI Score Classes for JCP

Figure 5.5 shows the statewide distribution of IRI Score classes for JCP pavements for fiscal years 2004 through 2007. In general, the average person would consider 87.51 percent of the jointed concrete pavements to be “rough,” based on IRI. This is not the same as the 50.94 percent of “rough” JCP mileage based on Ride Score because the IRI categories are based on the construction specification for ride quality, and are not the same as the PMIS Ride Score categories.

It should be noted that if an asphalt overlay is used to improve JCP ride quality, PMIS considers that mileage to be “flexible,” and thus does not include it in these figures.

0.37 percent of the JCP lane miles had “Very Good” IRI Scores in FY 2007.

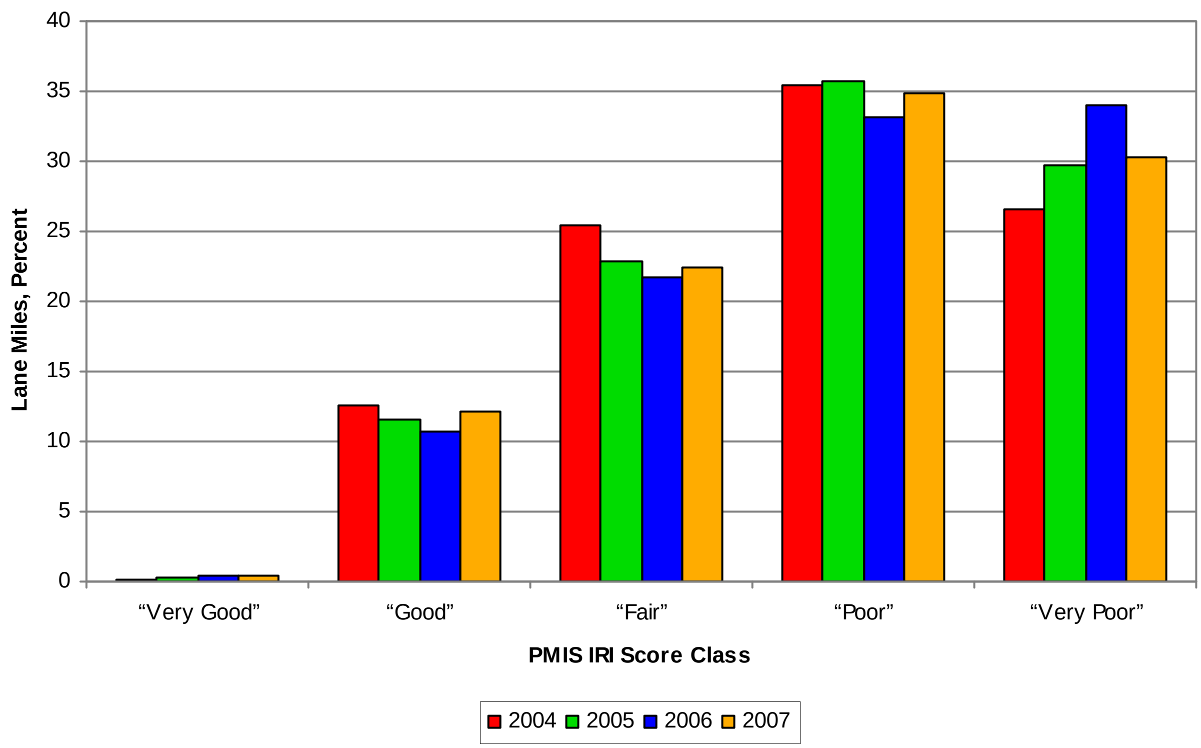


Figure 5.5 — IRI Score Classes for JCP, FY 2004-2007.

The IRI Score Classes for JCP show that:

- “Very Good” mileage decreased (from 0.49% in 2006 to 0.37% in 2007)
- “Good” mileage increased (from 10.67% in 2006 to 12.11% in 2007)
- “Fair” mileage increased (from 21.67% in 2006 to 22.49% in 2007)
- “Poor” mileage increased (from 33.11% in 2006 to 34.81% in 2007)
- “Very Poor” mileage decreased (from 34.07% in 2006 to 30.22% in 2007).

Failed Joints and Cracks

Figure 5.6 shows the percentage of PMIS sections with Failed Joints and Cracks for fiscal years 2004 through 2007.

Failed Joints and Cracks looks at joints and transverse cracks in terms of two items: Spalling and Asphalt Patches. Joints or transverse cracks that are not spalled or have been adequately repaired with concrete are not rated.

40.63 percent of the JCP sections had Failed Joints and Cracks in FY 2007.

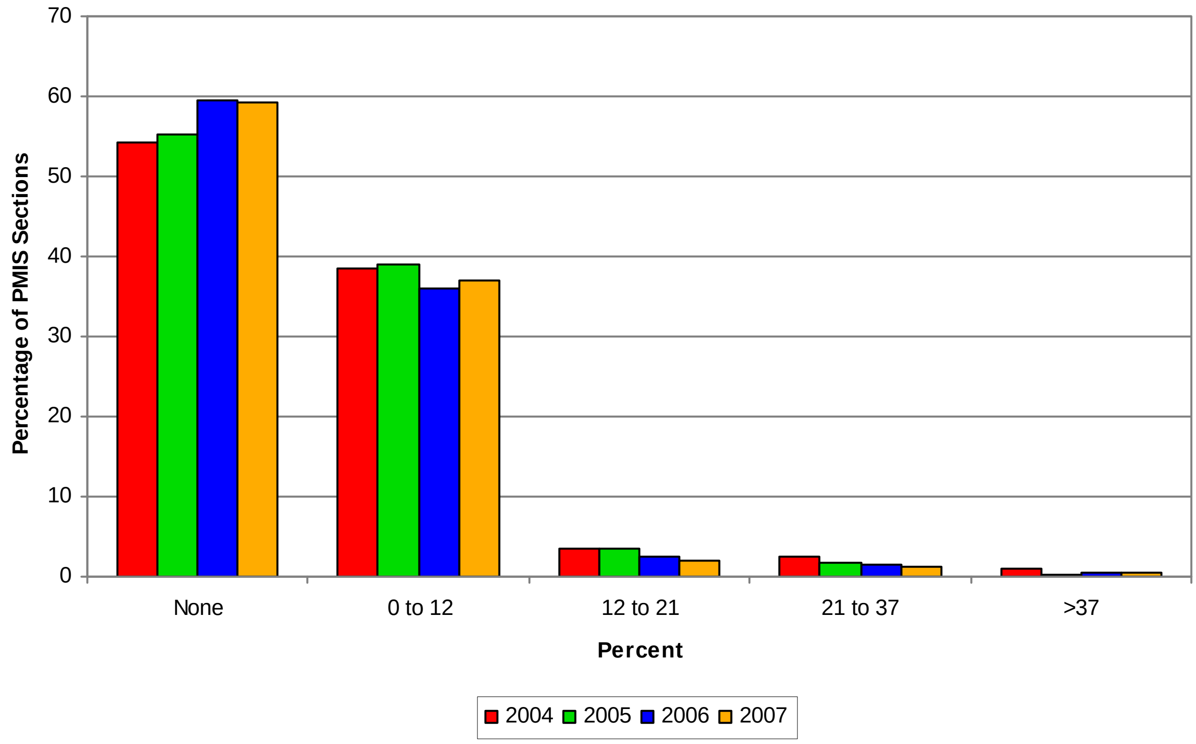


Figure 5.6 — Failed Joints and Cracks, FY 2004-2007.

The Percent of Failed Joints and Cracks for JCP show that:

- "None" category decreased (from 59.55% in 2006 to 59.37% in 2007)
- "0 to 12" percent category increased (from 35.89% in 2006 to 36.94% in 2007)
- "12 to 21" percent category decreased (from 2.60% in 2006 to 2.02% in 2007)
- "21 to 37" percent category decreased (from 1.51% in 2006 to 1.15% in 2007)
- ">37" percent category increased (from 0.45% in 2006 to 0.52% in 2007).

JCP Failures

Figure 5.7 shows the percentage of PMIS sections with JCP Failures for fiscal years 2004 through 2007.

JCP Failures are localized areas of surface distortion or disintegration such as Corner Breaks, Punchouts, Asphalt Patches, failed Concrete Patches, D-shaped cracking at the joints (not commonly observed in Texas), spalled cracks, and popouts.

JCP Failures can be "removed" from the PMIS ratings if they are patched with concrete and the patch remains in good condition (asphalt patches are still rated as Failures).

37.06 percent of the JCP sections had JCP Failures in FY 2007.

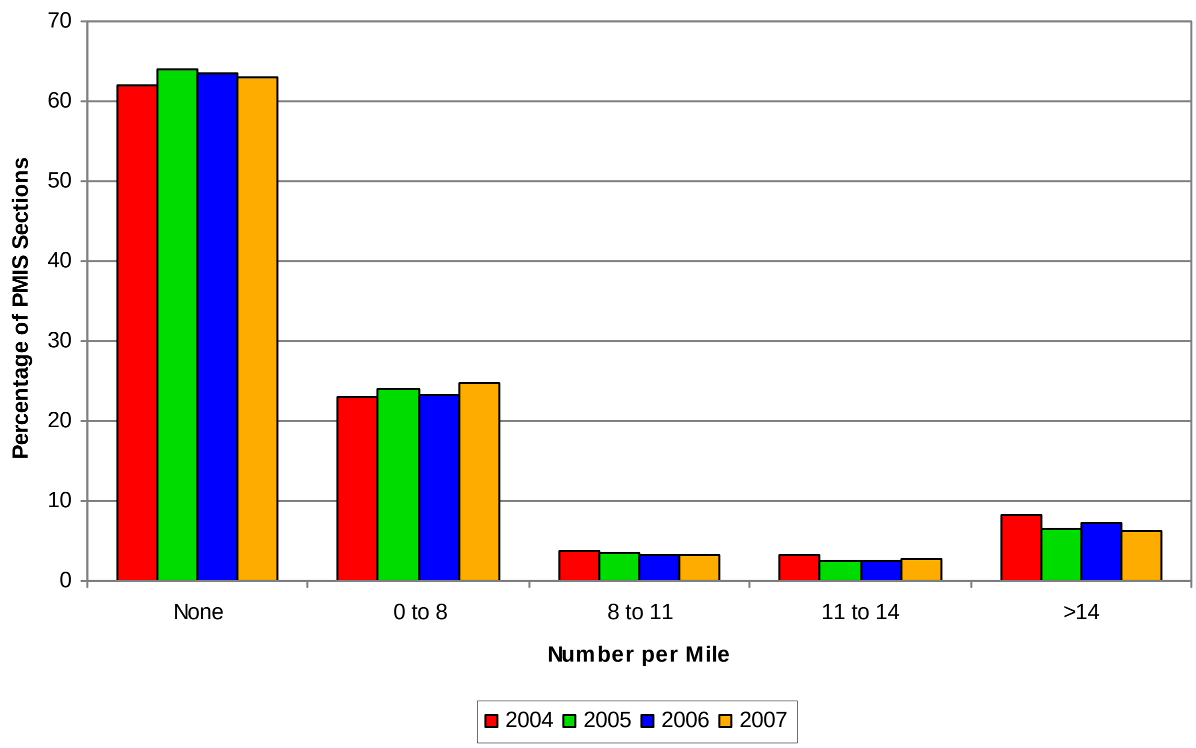


Figure 5.7 — JCP Failures, FY 2004-2007.

The Number of Failures per Mile for JCP show that:

- "None" category decreased (from 63.62% in 2006 to 62.94% in 2007)
- "0 to 8" percent category increased (from 23.28% in 2006 to 24.69% in 2007)
- "8 to 11" percent category decreased (from 3.32% in 2006 to 3.29% in 2007)
- "11 to 14" percent category increased (from 2.60% in 2006 to 2.73% in 2007)
- ">14" percent category decreased (from 7.17% in 2006 to 6.34% in 2007).

Shattered Slabs

Figure 5.8 shows the percentage of PMIS sections with Shattered Slabs for fiscal years 2004 through 2007.

Shattered Slabs are slabs that are so badly cracked that they warrant complete replacement.

0.32 percent of the JCP sections had Shattered Slabs in FY 2007.

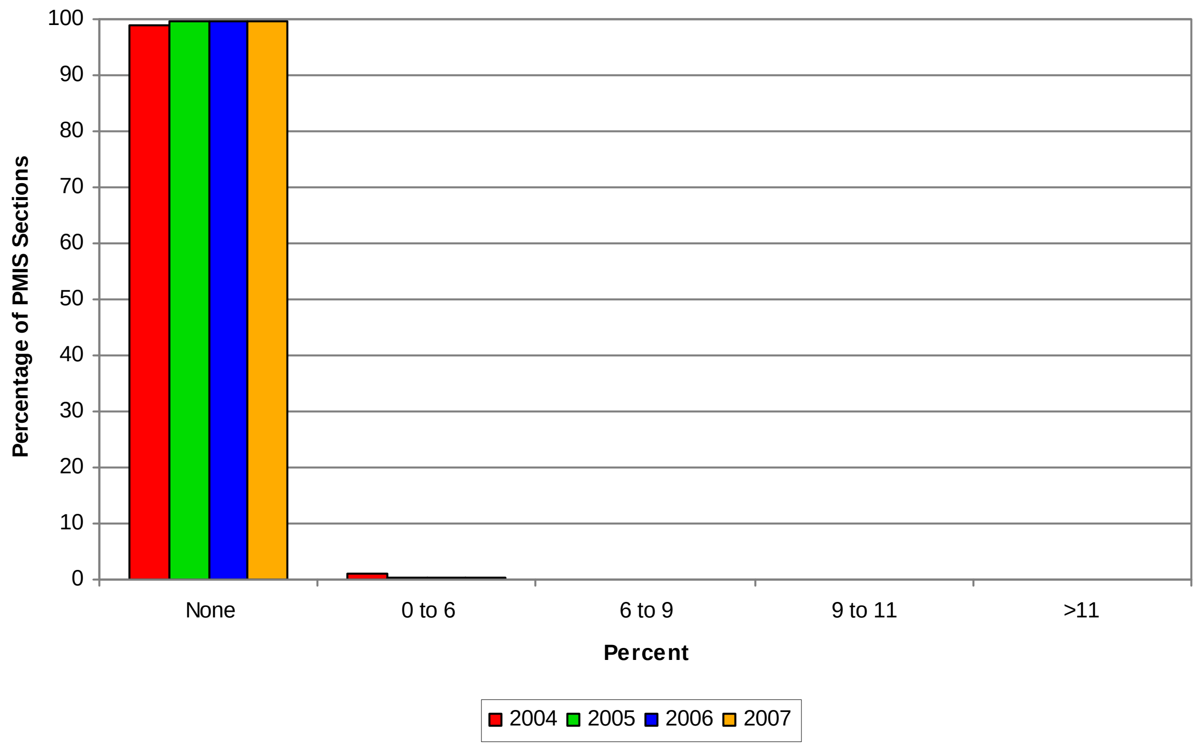


Figure 5.8 — Shattered Slabs, FY 2004-2007.

The Percent of Shattered Slabs for JCP show that:

- "None" category increased (from 99.51% in 2006 to 99.68% in 2007)
- "0 to 6" percent category decreased (from 0.49% in 2006 to 0.32% in 2007)
- "6 to 9" percent category remained the same (0.00% in 2006 to 0.00% in 2007)
- "9 to 11" percent category remained the same (0.00% in 2006 to 0.00% in 2007)
- ">11" percent category remained the same (0.00% in 2006 to 0.00% in 2007).

Slabs With Longitudinal Cracks

Figure 5.9 shows the percentage of PMIS sections having Slabs with Longitudinal Cracks for fiscal years 2004 through 2007.

Longitudinal Cracks are cracks that roughly parallel the roadbed centerline, but for PMIS purposes, the crack must be spalled or faulted to be included in the rating.

14.23 percent of the JCP sections had Slabs with Longitudinal Cracks in FY 2007.

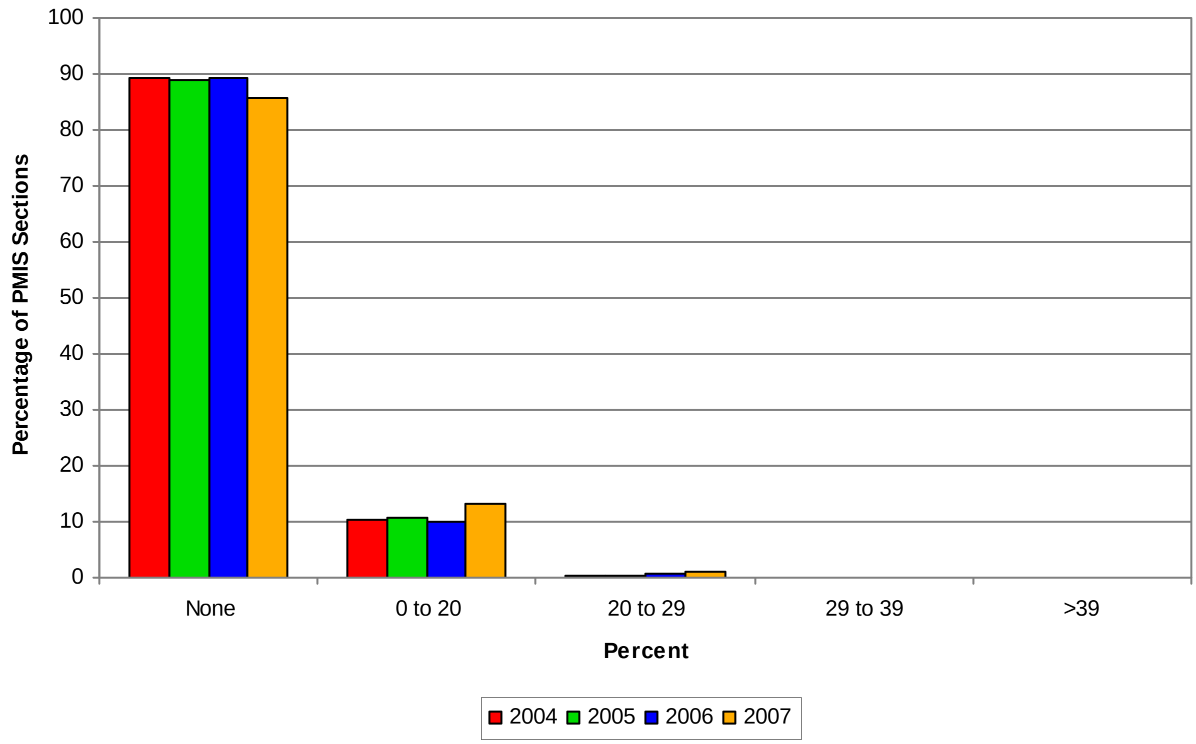


Figure 5.9 — Slabs with Longitudinal Cracks, FY 2004-2007.

The Percent of Slabs with Longitudinal Cracking for JCP show that:

- "None" category decreased (from 89.17% in 2006 to 85.77% in 2007)
- "0 to 20" percent category increased (from 10.04% in 2006 to 13.20% in 2007)
- "20 to 29" percent category increased (from 0.68% in 2006 to 0.99% in 2007)
- "29 to 39" percent category remained the same (0.04% in 2006 to 0.04% in 2007)
- ">39" percent category decreased (from 0.08% in 2006 to 0.00% in 2007).

Concrete Patches

Figure 5.10 shows the percentage of PMIS sections with Concrete Patches for fiscal years 2004 through 2007.

A Concrete Patch is a localized area of newer concrete that has been placed to the full depth of the existing slab as a method of correcting surface or structural defects. These patches are usually placed to repair JCP Failures, but they are also used to repair joints and cracks.

Concrete patches that have deteriorated with age are rated as JCP Failures in PMIS if the patch edges are spalled or faulted (similar in appearance to Punchouts on CRCP).

29.92 percent of the JCP sections had Concrete Patches in FY 2007.

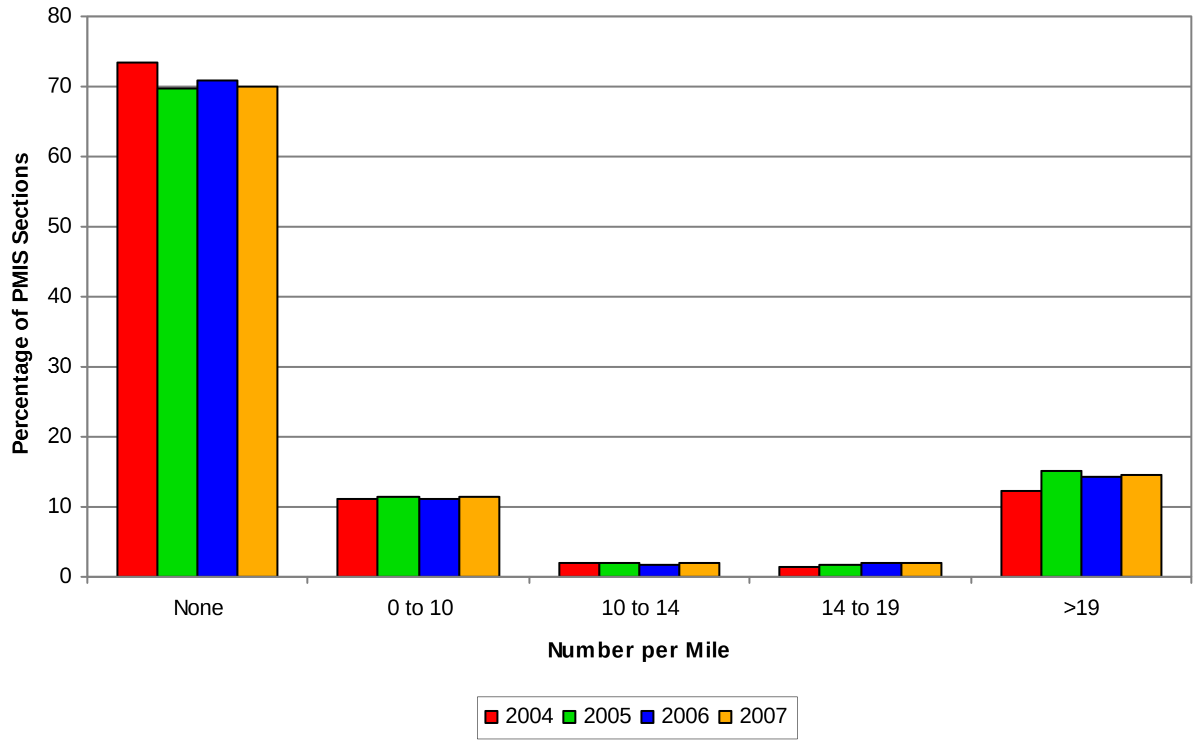


Figure 5.10 — Concrete Patches, FY 2004-2007.

The Number of Concrete Patches per Mile for JCP show that:

- "None" category decreased (from 70.83% in 2006 to 70.08% in 2007)
- "0 to 10" category increased (from 11.17% in 2006 to 11.34% in 2007)
- "10 to 14" category increased (from 1.77% in 2006 to 1.94% in 2007)
- "14 to 19" category increased (from 1.92% in 2006 to 2.14% in 2007)
- ">19" category increased (from 14.30% in 2006 to 14.51% in 2007).

A June 1917 map of the proposed Texas highway system identifies six state subdivisions, 26 state highways, and one "combination" highway - the Henry Exall Memorial Highway (from Denison to Dallas to Houston to Galveston).

Discussion

JCP condition and ride quality improved, but distress got very slightly worse in FY 2007. "Deep" distress (Failures, Shattered Slabs, and Slabs with Longitudinal Cracks) on JCP improved in FY 2007.

Three of the five JCP distress types improved in FY 2007: Failed Joints and Cracks, Failures, and Shattered Slabs. The other two distress types – Slabs with Longitudinal Cracks and Concrete Patches – got worse in FY 2007.

JCP ride quality continues to be a statewide problem, despite the improvement in FY 2007. The percentage of JCP lane miles with "Very Good" ride quality is only 7.32 percent and the average person would consider 50.94 percent of the JCP mileage "rough" in FY 2007. By comparison, the FY 2007 values for CRCP were 17.04 percent "Very Good" and 17.96 percent "rough," and the values for ACP were 26.28 percent "Very Good" and 24.25 percent "rough."

JCP roughness problems are aggravated by the fact that it is often used in metropolitan areas where traffic volumes are high and loads are heavy. The high traffic makes it more difficult to schedule and perform necessary maintenance on the slabs and joints. The poor ride quality on these pavements lowers the overall quality of service to the public and increases the likelihood of pavement (and truck) damage caused by roughness-induced dynamic loading.

Experience has shown that it is difficult to rate JCP distress in the field. Large fluctuations in ratings from year to year are common, especially on pavements with multiple distress types. The fluctuations since FY 2001 have not been as large, though, because many of the same raters have rated the pavements in all five years.

JCP continues to have the most overall distress, the most "deep" distress, the roughest ride quality, and the worst overall condition of the three major pavement types in Texas. Most JCP mileage is still in either in "Very Good" or "Very Poor" condition.

Summary

JCP condition and ride quality improved, but distress got very slightly worse in FY 2007. "Deep" distress (Failures, Shattered Slabs, and Slabs with Longitudinal Cracks) on JCP also improved. Failed Joints and Cracks, Failures, and Shattered Slabs improved in FY 2007, but Slabs with Longitudinal Cracks and Concrete Patches got worse.

TxDOT has been performing annual pavement evaluations since September 1982. The first ratings were done on a five percent random sample of asphalt pavements on the State-maintained network. Three districts - Lufkin, San Antonio, and Pharr (then known as Districts 11, 15, and 21, respectively) - chose to rate all of their mileage instead of using the five percent random sample. Concrete pavement ratings were not added until September 1984.

Chapter 6 Maintenance Level of Service

Previous chapters have described the condition of Texas pavements in terms of PMIS Scores (Distress, Ride, and Condition) and distress ratings. Another way of describing condition is to compare the PMIS results to pre-defined pavement maintenance standards.

Description of Maintenance Level of Service

In 1992, TxDOT Administration approved a set of internal standards of evaluating and tracking the level of service provided by pavement maintenance at any given amount of funding. These levels of service are defined as:

- "Desirable"
- "Acceptable"
- "Tolerable"
- "Intolerable."

These levels of service are based on PMIS data for:

- Rutting
- Alligator Cracking
- Ride Quality.

Traffic is a factor in the level of service definitions. A high-traffic road must have lower amounts of distress and smoother ride quality to provide the same level of service as a low-traffic road. Traffic categories for maintenance level of service are:

- "Low" (1-500 vehicles per day)
- "Medium" (501-10,000 vehicles per day)
- "High" (10,001 or more vehicles per day).

Each pavement section can have up to three levels of service, depending on the PMIS data. For example, a pavement section can be "Desirable" in terms of Rutting, "Acceptable" in terms of Alligator Cracking, and "Tolerable" in terms of Ride Quality.

There is a fourth level of service — "Combined" — that describes the overall level of service that a pavement section provides. This is defined as the worst of the three other levels of service. In the example above, the pavement section's "Combined" level of service would be "Tolerable" because of the ride quality.

> **NOTE:** Maintenance levels of service are only defined for flexible pavements (ACP) at this time, thus this chapter only analyzes flexible pavements. Rigid pavement (CRCP and JCP) levels of service have not been defined.

PMIS began with an approximately 50-percent sample for distress ratings and ride quality measurements. The sample was all IH mileage and half of the non-IH mileage. The non-IH mileage was not sampled randomly, though, but was selected from county line to county line, with half of a district's non-IH mileage getting new data in even-numbered years and the other half getting data in odd-numbered years.

Maintenance Level of Service Definitions

Table 6.1 shows the maintenance levels of service definitions, by traffic category, for Rutting, Alligator Cracking, and Ride Quality.

Table 6. 1 — Level of Service Definitions for Pavement Maintenance.

PMIS Distress Type	Traffic Category (ADT)	LEVEL OF SERVICE			
		"Desirable"	"Acceptable"	"Tolerable"	"Intolerable"
RUTTING	Low (0-500)	**0-1% shallow & 0-1% deep**	2-50% shallow & **0-1% deep**	51-100% shallow & **0-1% deep** OR 0-50% shallow & 2-25% deep	51-100% shallow & 2-25% deep OR 26-100% deep
	Medium (501-10,000)	**0-1% shallow & 0-1% deep**	2-50% shallow & **0-1% deep**	51-100% shallow & **0-1% deep** OR 0-50% shallow & 2-25% deep	51-100% shallow & 2-25% deep OR 26-100% deep
	High (over 10,000)	**0-1% shallow & 0-1% deep**	2-25% shallow & **0-1% deep**	26-50% shallow & **0-1% deep**	51-100% shallow & **0-1% deep** OR 2-100% deep
ALLIGATOR CRACKING	All Traffic	0%	1-10%	11-50%	51-100%
RIDE QUALITY	Low (0-500)	2.6-5.0	2.1-2.5	1.6-2.0	0.1-1.5
	Medium (501-10,000)	3.1-5.0	2.6-3.0	2.1-2.5	0.1-2.0
	High (over 10,000)	3.6-5.0	3.1-3.5	2.6-3.0	01.-2.5

Reference: *TxDOT Administrative Circular 5-92* **(February 13, 1992)**

Rutting Level of Service

Figure 6.1 shows the statewide distribution for Rutting level of service for fiscal years 2004 through 2007.

Please note that the level of service definitions have been changed to treat 1 percent Rutting the same as 0 percent Rutting. This was done to account for sensor "noise" typically observed in the acoustic sensors used to measure Rutting.

52.57 percent of the flexible lane miles was "Desirable" in terms of Rutting in FY 2007.

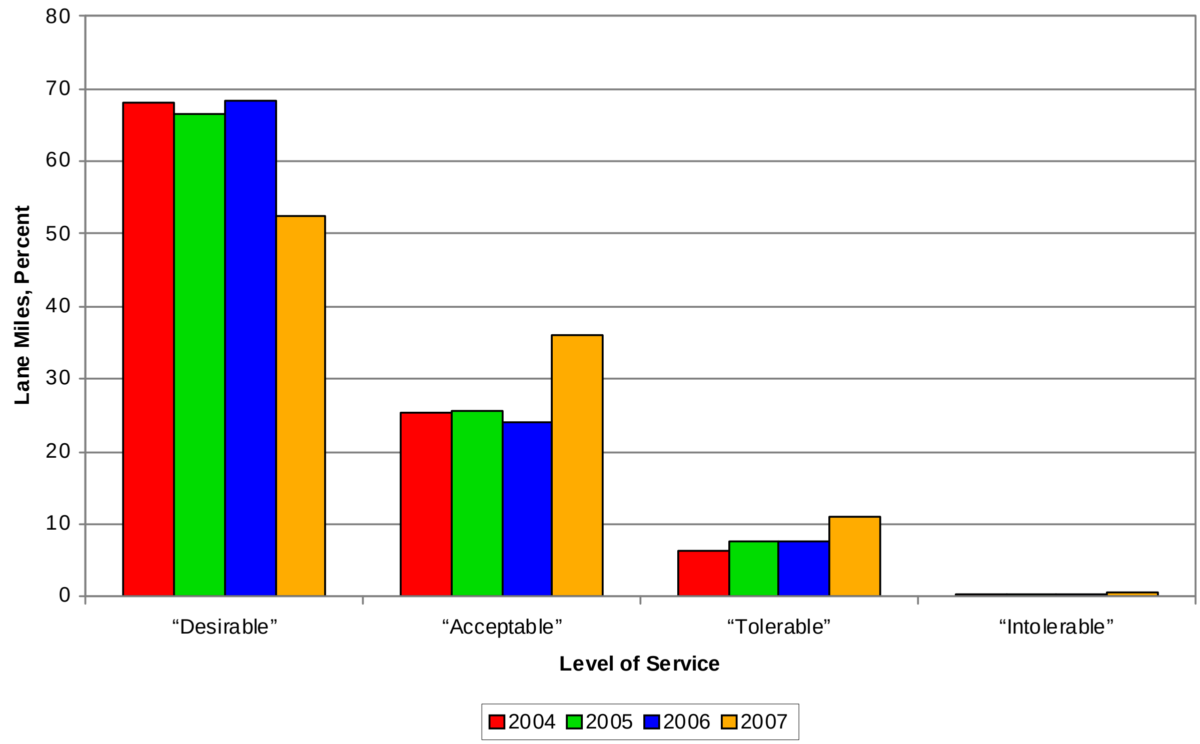


Figure 6.1 — Rutting Level of Service, FY 2004-2007.

The Rutting Level of Service shows that:

- "Desirable" mileage decreased (from 68.29% in 2006 to 52.57% in 2007)
- "Acceptable" mileage increased (from 23.93% in 2006 to 36.07% in 2007)
- "Tolerable" mileage increased (from 7.59% in 2006 to 10.89% in 2007)
- "Intolerable" mileage increased (from 0.19% in 2006 to 0.47% in 2007).

TxDOT experience with the automated rut-measuring equipment ("Rutbar") suggests that these PMIS results are a minimum estimate of the amount of rutting that actually exists on the road. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some pavement rutting that exists on the road might not be shown in these PMIS measurements.

Maps 6.1 and 6.2 on the following pages show Rutting level of service in each county for fiscal years 2006 and 2007. These maps show the percentage of lane miles in each county that were maintained at a “Desirable” or “Acceptable” level of service. Counties in red had the lowest Rutting level of service, while counties in blue had the highest Rutting level of service.

The percentage of lane miles with “Desirable” or “Acceptable” level of service for Rutting decreased in FY 2007. The amount of Shallow Rutting and Deep Rutting increased, as described in Chapter 3.

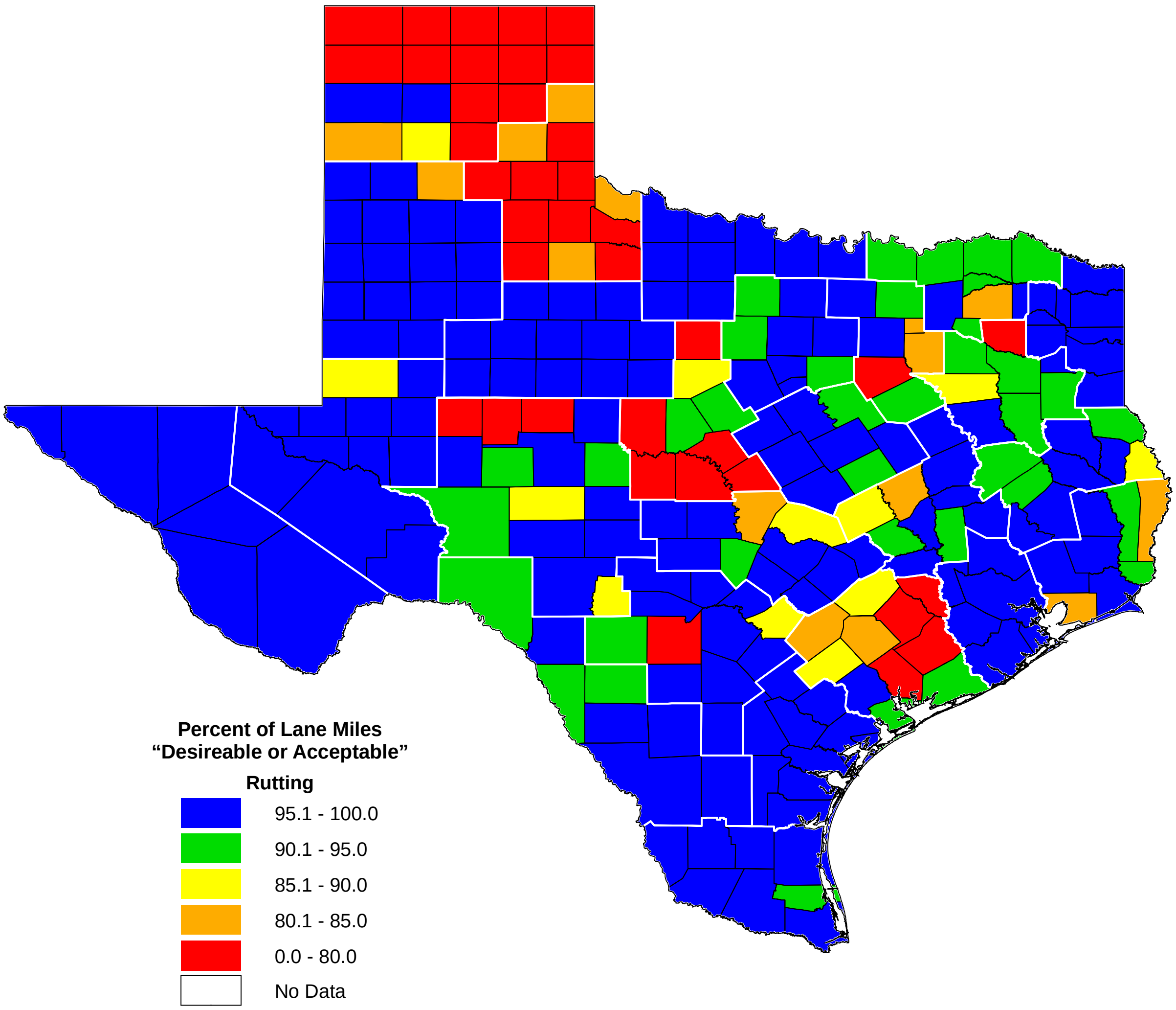
Rutting increased even after subtracting 0.1 inches from each rut depth measurement. This was done to compensate for a change in the Rutbar dynamic calibration procedure back in FY 2006 which had produced very large increases in the amount of Shallow Rutting and Deep Rutting.

Additional information about the FY 2007 Rutbar changes may be found in “Description of FY 2006-2007 Rutbar Changes” on page iii.

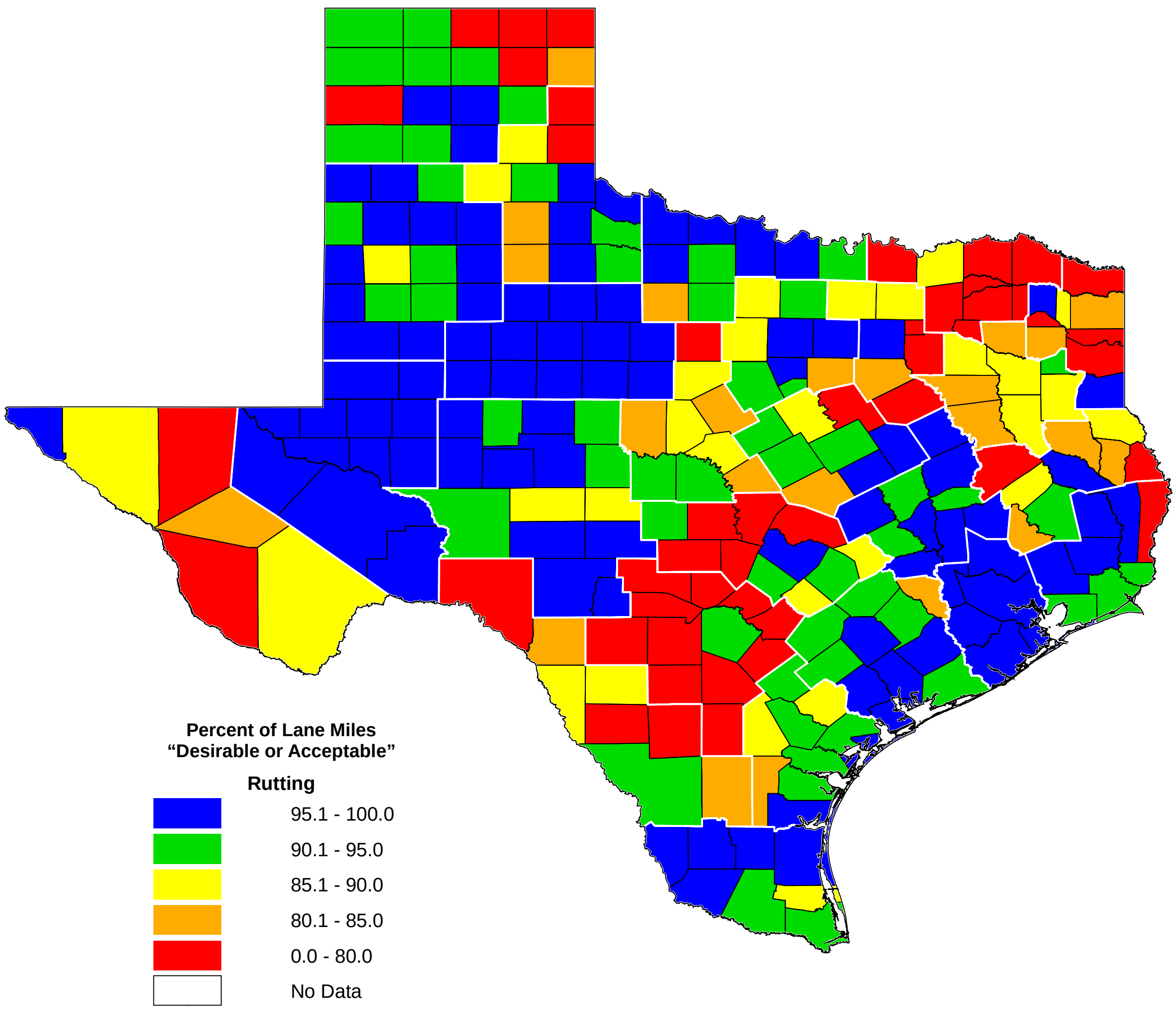
The adjusted Rutting data also affected the “Combined” maintenance level of service results, as will be discussed later in this Chapter.

Rutting Level of Service

Map 6.1 — Rutting Level of Service, FY 2006.



Map 6.2 — Rutting Level of Service, FY 2007.



Alligator Cracking Level of Service

Figure 6.2 shows the statewide distribution for Alligator Cracking level of service for fiscal years 2004 through 2007.

85.00 percent of flexible lane miles was “Desirable” in terms of Alligator Cracking in FY 2007.

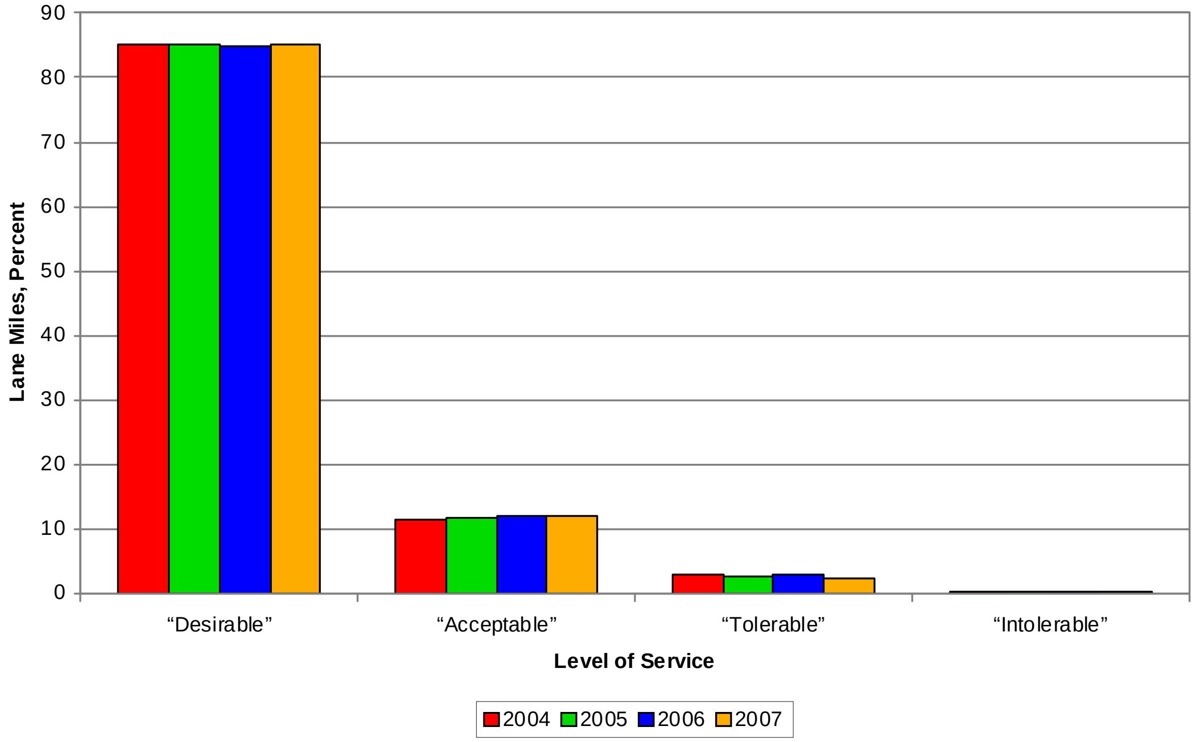


Figure 6.2 — Alligator Cracking Level of Service, FY 2004-2007.

The Alligator Cracking Level of Service shows that:

- “Desirable” mileage increased (from 84.73% in 2006 to 85.00% in 2007)
- “Acceptable” mileage increased (from 12.00% in 2006 to 12.24% in 2007)
- “Tolerable” mileage decreased (from 2.90% in 2006 to 2.53% in 2007)
- “Intolerable” mileage decreased (from 0.36% in 2006 to 0.24% in 2007).

Maps 6.3 and 6.4 on the following pages show Alligator Cracking level of service in each county for fiscal years 2006 and 2007. These maps show the percentage of lane miles in each county that were maintained at a “Desirable” or “Acceptable” level of service. Counties in red had the lowest Alligator Cracking level of service, while counties in blue had the highest Alligator Cracking level of service.

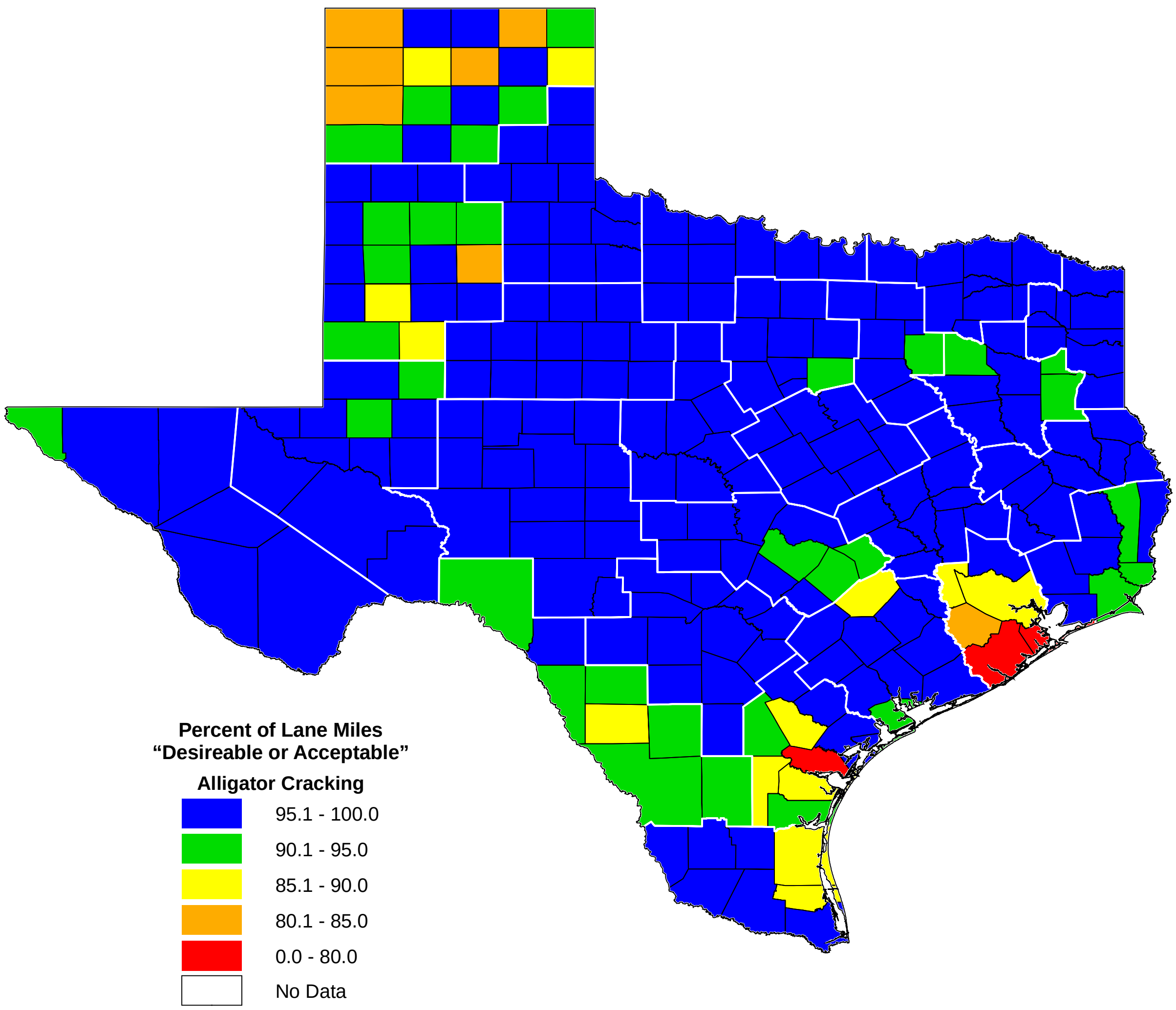
The percentage of lane miles with “Desirable” or “Acceptable” level of service for Alligator Cracking increased slightly in FY 2007. This trend is consistent with the improvement in Alligator Cracking described in Chapter 3.

Small changes in Alligator Cracking usually do not show up in the level of service percentages because they are so broadly defined. For example, if a PMIS section changes from 5 to 10 percent Alligator Cracking, it will remain in the “Acceptable” level of service category (which is 1-10 percent); and if it changes from 15 to 20 percent, it will remain in the “Tolerable” category (which is 11-50 percent). However, small amounts of “new” Alligator Cracking on sections that previously had none will change the level of service from “Desirable” to “Acceptable” or maybe even to “Tolerable.”

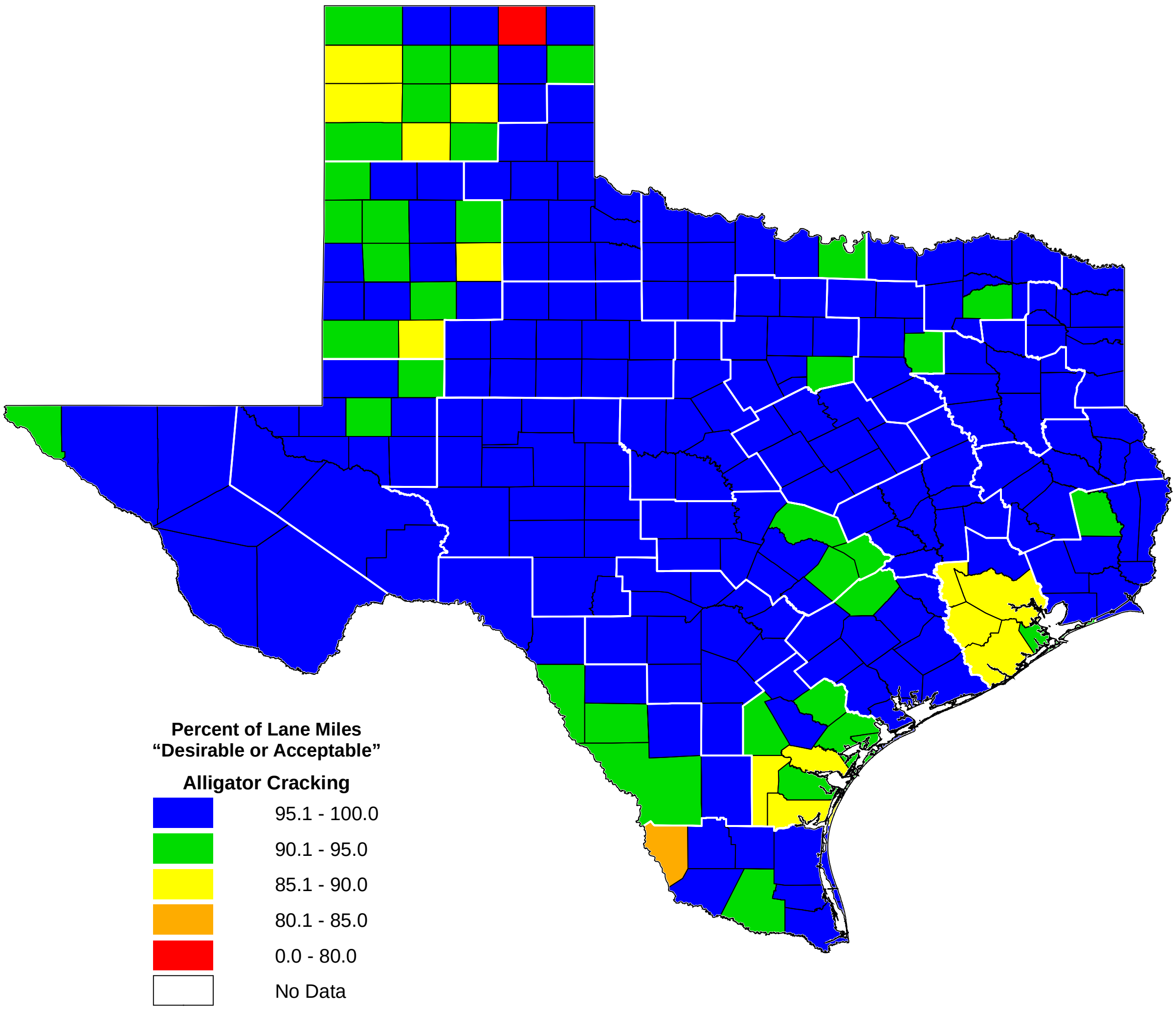
Almost all of the Alligator Cracking that does exist in Texas is in the 1-15 percent range, and these small amounts of Alligator Cracking can be quickly eliminated with in-place base repair or thin surface patches.

Alligator Cracking Level of Service

Map 6.3 — Alligator Cracking Level of Service, FY 2006.



Map 6.4 — Alligator Cracking Level of Service, FY 2007.



Ride Quality Level of Service

Figure 6.3 shows the statewide distribution for Ride Quality level of service for fiscal years 2004 through 2007.

76.62 percent of the flexible lane miles was "Desirable" in terms of Ride Quality in FY 2007.

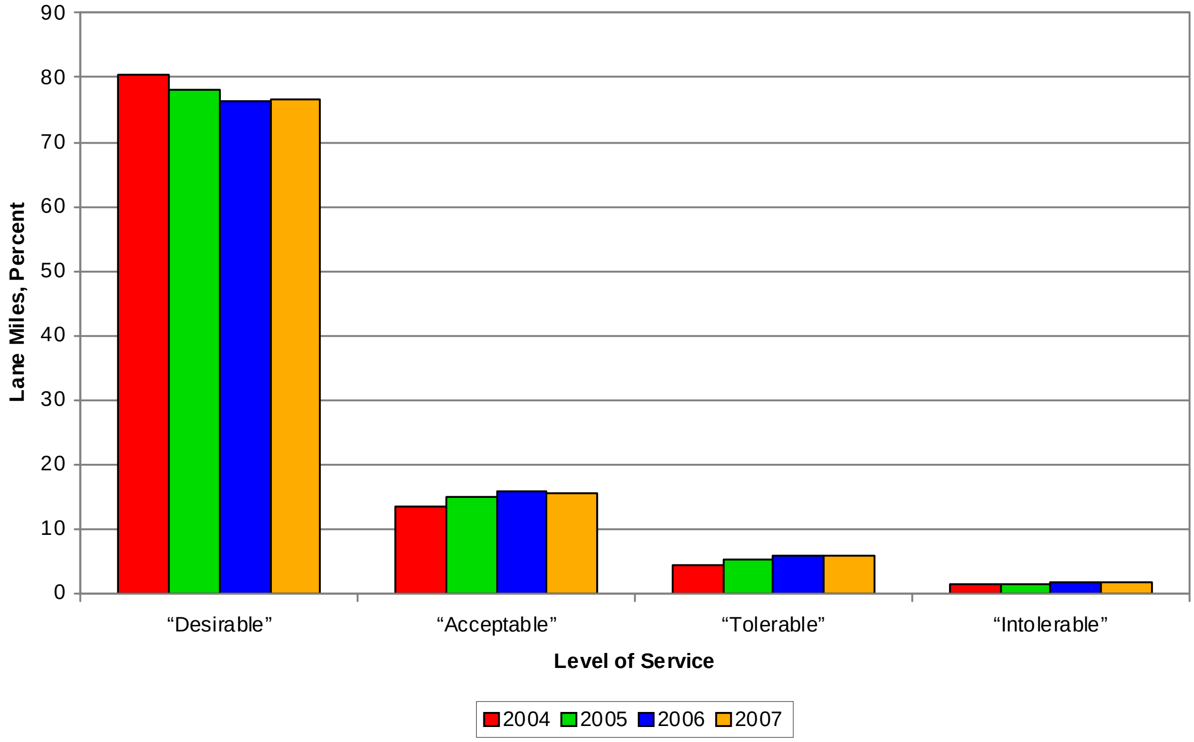


Figure 6.3 — Ride Quality Level of Service, FY 2004-2007.

The Ride Quality Level of Service shows that:

- "Desirable" mileage increased (from 76.31% in 2006 to 76.62% in 2007)
- "Acceptable" mileage decreased (from 15.89% in 2006 to 15.54% in 2007)
- "Tolerable" mileage decreased (from 5.93% in 2006 to 5.91% in 2007)
- "Intolerable" mileage increased (from 1.86% in 2006 to 1.93% in 2007).

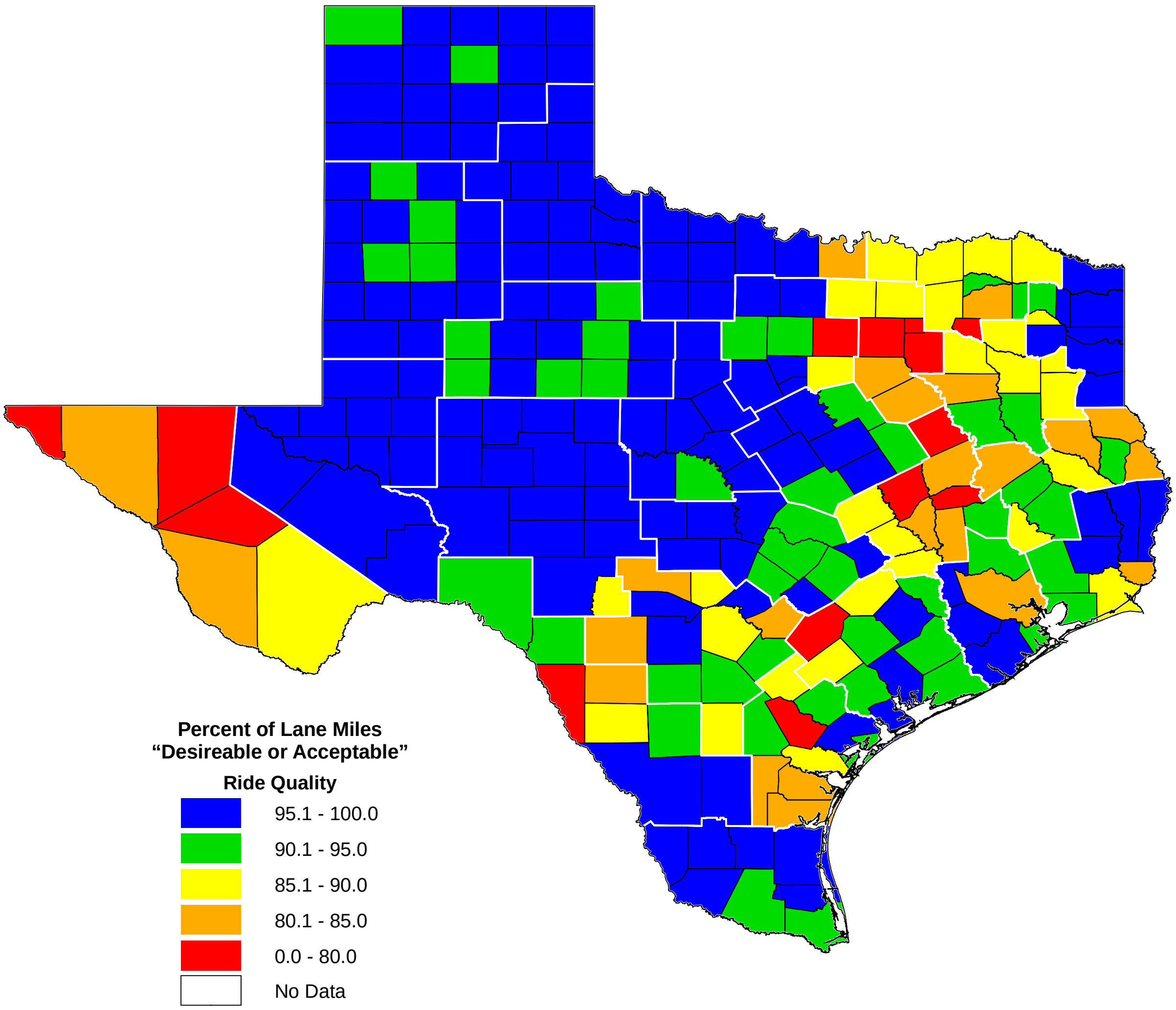
Maps 6.5 and 6.6 on the following pages show Ride Quality level of service in each county for fiscal years 2006 and 2007. These maps show the percentage of lane miles in each county that were maintained at a "Desirable" or "Acceptable" level of service. Counties in red had the lowest Ride Quality level of service, while counties in blue had the highest Ride Quality level of service.

The percentage of lane miles with "Desirable" or "Acceptable" level of service for Ride Quality decreased in FY 2007. This trend does not match the observed improvement in overall ACP Ride Quality described in Chapter 3, because of an increase in the number of lane miles rated in FY 2007. There were actually 679.2 more lane miles in "Desirable" or "Acceptable" level of service in FY 2007. These additional lane miles made the overall Ride Quality in Chapter 3 go up, but they were not enough to offset the 828.1 additional lane miles rated that drove down the level of service percentage.

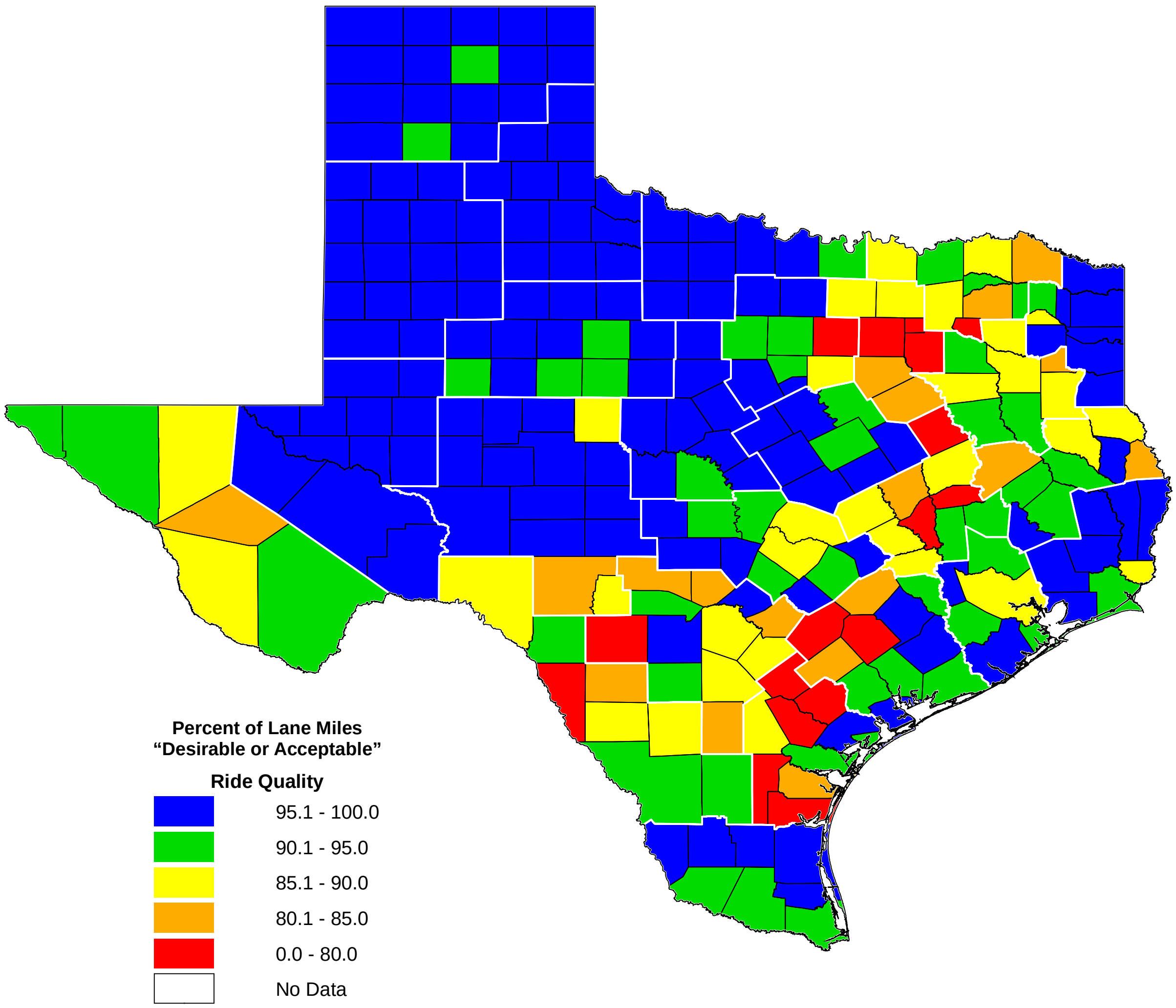
It should be noted that the Ride Quality level of service definitions are based in part on traffic. This means that high-traffic roads must have better ride quality to provide "Desirable" or "Acceptable" level of service. As a result, it is harder for urban and metropolitan counties to show up as having "Desirable" or "Acceptable" level of service for Ride Quality because of their higher traffic volumes. Of course, those higher traffic volumes also make it more difficult to maintain good ride quality.

Ride Quality Level of Service

Map 6.5 — Ride Quality Level of Service, FY 2006.



Map 6.6 — Ride Quality Level of Service, FY 2007.



Combined Maintenance Level of Service

Figure 6.4 shows the statewide distribution for Combined level of service for fiscal years 2004 through 2007.

37.48 percent of flexible lane miles provided an overall “Desirable” level of service in FY 2007.

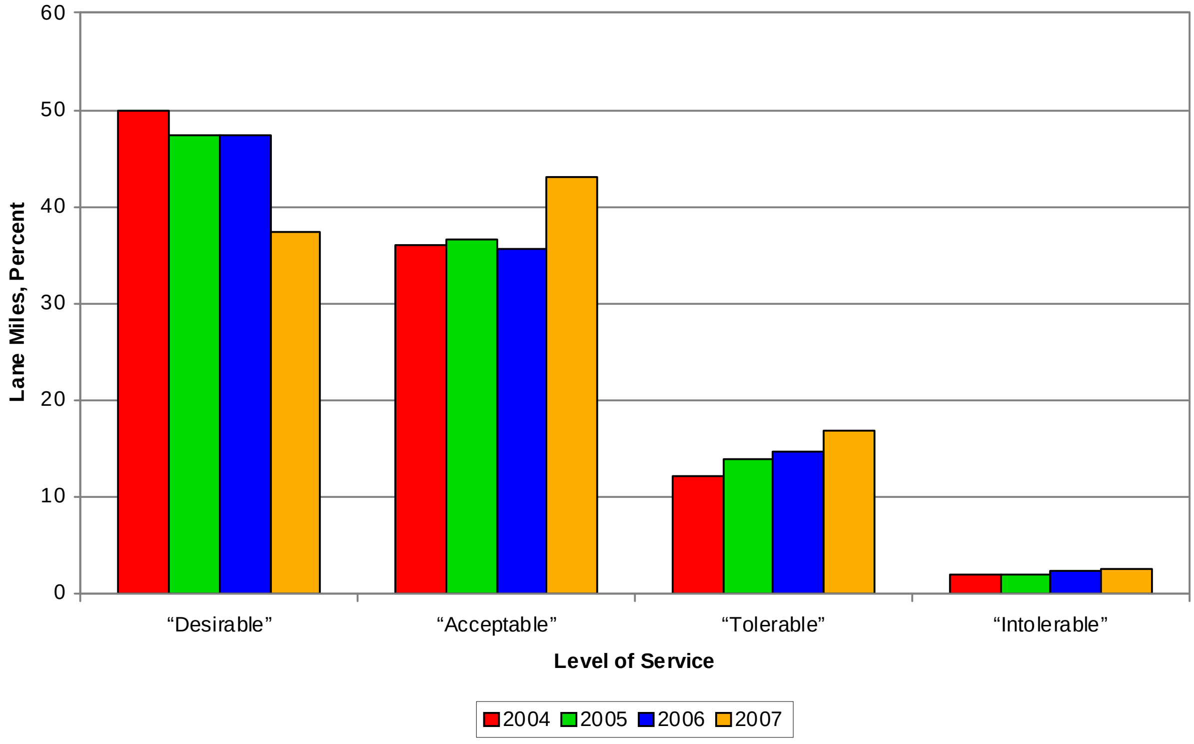


Figure 6.4 — Combined Maintenance Level of Service, FY 2004-2007.

The Combined Maintenance Level of Service shows that:

- “Desirable” mileage decreased (from 47.28% in 2006 to 37.48% in 2007)
- “Acceptable” mileage increased (from 35.62% in 2006 to 43.05% in 2007)
- “Tolerable” mileage increased (from 14.76% in 2006 to 16.92% in 2007)
- “Intolerable” mileage increased (from 2.35% in 2006 to 2.54% in 2007).

Maps 6.7 and 6.8 on the following pages show Combined level of service in each county for fiscal years 2006 and 2007. These maps show the percentage of lane miles in each county that were maintained at a “Desirable” or “Acceptable” level of service. Counties in red had the lowest Combined level of service, while counties in blue had the highest Combined level of service.

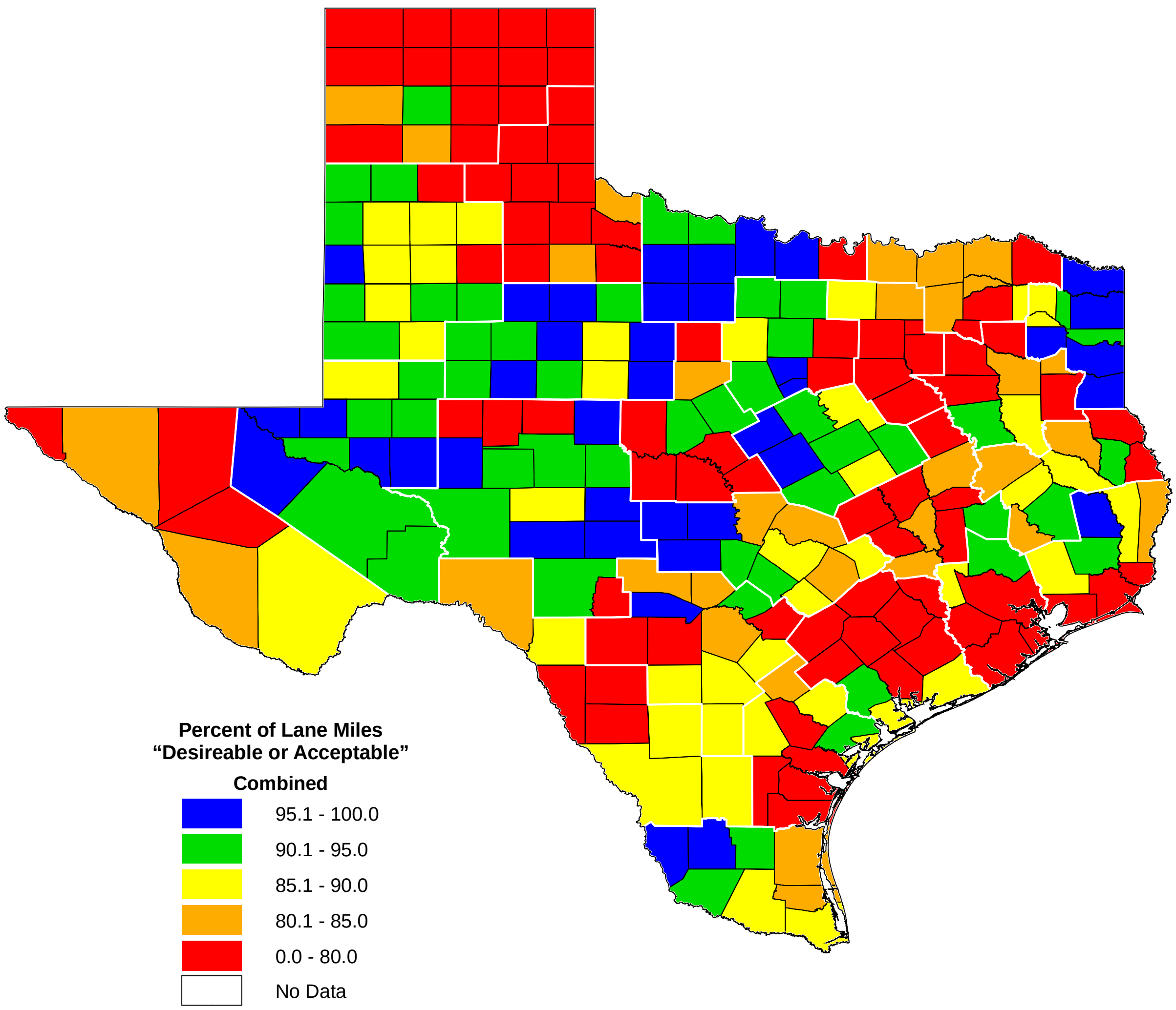
The percentage of lane miles with “Desirable” or “Acceptable” level of service for “Combined” decreased in FY 2007, because of worsening Rutting and Ride Quality.

As mentioned earlier in this Chapter, the FY 2007 Rutting data in PMIS was adjusted by subtracting 0.1 inches from each rut depth measurement to compensate for a change in the Rutbar dynamic calibration procedure. Despite these adjustments, Rutting got worse statewide in FY 2007 and helped reduce the overall “Combined” level of service.

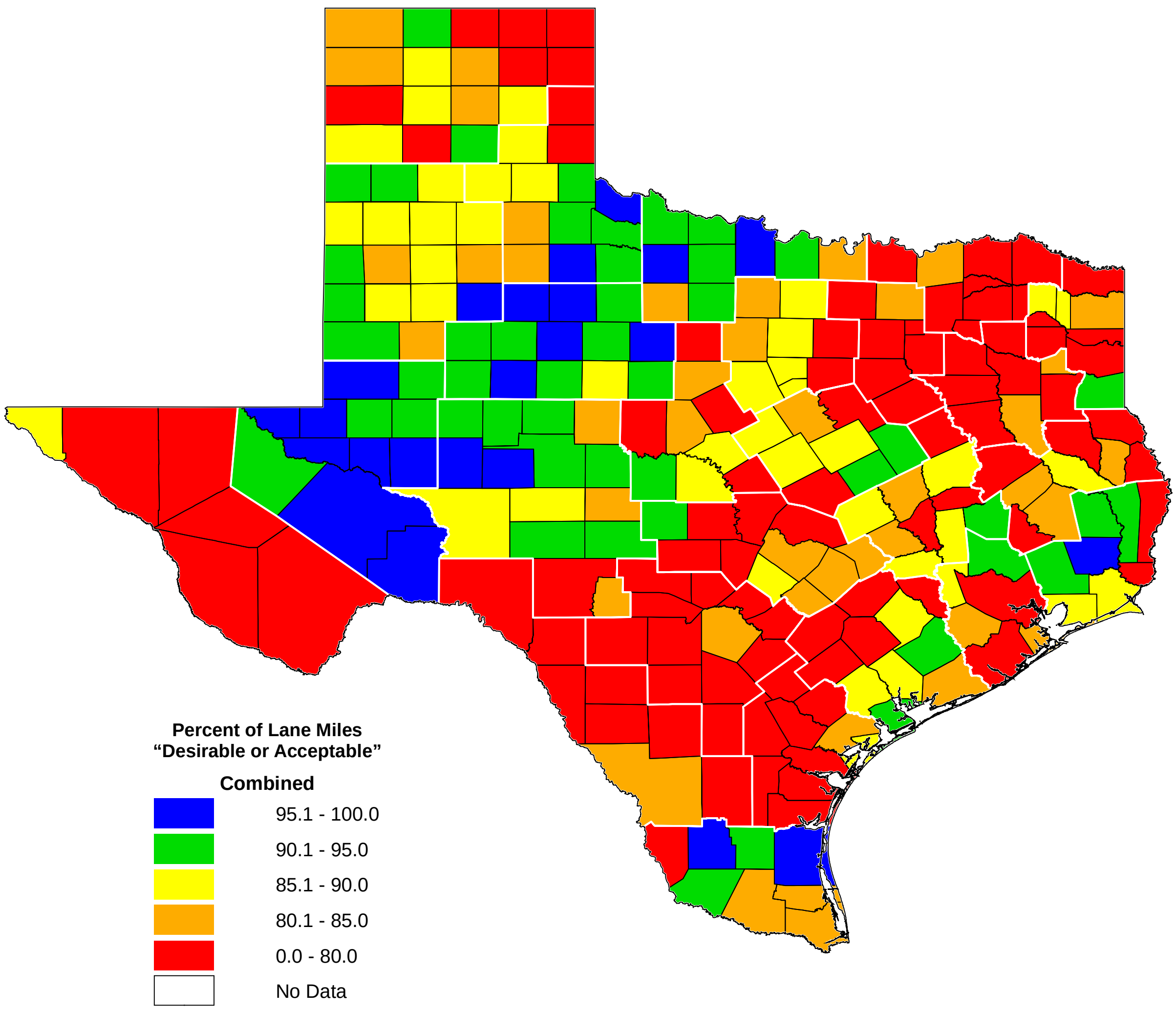
However, even with the drop in overall “Combined” level of service, more than 80 percent of Texas flexible pavements still provided “Desirable” or “Acceptable” level of service in FY 2007.

The “Combined” maintenance level of service is a “combination” of the worst of the other three levels of service. It is very difficult to improve “Combined” level of service because it requires the same mileage to improve in distress and ride quality. Such improvement usually requires rehabilitation-type treatments such as thin/thick overlays or in-place base repair to correct sub-surface structural problems. Thin surface treatments usually do not improve “Combined” level of service because they do not substantially improve ride quality. Even worse is the fact that small increases in Rutting, Alligator Cracking, or small declines in Ride Quality levels of service can produce very large reductions in “Combined” level of service.

Map 6.7 — Combined Maintenance Level of Service, FY 2006.



Map 6.8 — Combined Maintenance Level of Service, FY 2007.



PMIS is based on fiscal year (September to August). The old PES was based on calendar year, even though distress and ride ratings still started in September of each year.

Combined Maintenance Level of Service, by Traffic Category

As mentioned earlier in this chapter, the maintenance levels of service are defined by traffic. High-traffic roads must have lower amounts of distress and smoother ride quality to provide the same level of service as low-traffic roads. Figures 6.5 and 6.6 show the distribution of the Combined Maintenance level of service percentages, by traffic category, for fiscal years 2006 and 2007.

These distributions show that the overall level of service provided by Texas flexible pavements got worse in FY 2007, because of declines in “Low-traffic” and “Medium-traffic” mileage.

“Low-traffic” roads got worse in FY 2007. “Desirable” mileage (the blue slices) dropped by ten percent and “Acceptable” mileage (the green slices) rose by seven percent. “Tolerable” mileage (the yellow slices) rose by three percent. “Intolerable” mileage (the red slices) stayed the same at 1 percent.

“Low-traffic” roads accounted for 26.90 percent of the lane miles but only 1.62 percent of the vehicles miles traveled in FY 2007. Both of these percentages decreased in FY 2007.

“Medium-traffic” roads also got worse in FY 2007, and showed exactly the same trends as the “Low-traffic” roads. “Desirable” mileage dropped by ten percent, “Acceptable” mileage rose by seven percent, “Tolerable” mileage rose by three percent, and “Intolerable” mileage stayed the same at 1 percent.

“Medium-traffic” roads accounted for 59.21 percent of the lane miles and 42.13 percent of the vehicles miles traveled in FY 2007. The percentage of lane miles increased, but the percentage of vehicle miles traveled decreased in FY 2007.

“High-traffic” roads stayed the same overall in FY 2007. A seven percent drop in “Desirable” mileage was matched by a seven percent rise in “Acceptable” mileage, and a one percent drop in “Acceptable” mileage was matched by a one percent rise in “Intolerable” mileage.

“High-traffic” roads accounted for only 13.89 percent of the lane miles but 56.25 percent of the vehicles miles traveled in FY 2007. Both of these percentages increased in FY 2007.

From a public service standpoint, it is preferable to have high-traffic roads in the best condition, but from a pavement standpoint this is difficult to do because of the higher traffic volumes and loads. Safety, congestion, user delay, and scheduling add to the problem of not being able to get out on the road to do preventive maintenance to keep the road in good condition. The problem is that when preventive maintenance is not done when needed, pavement condition drops, the overall level of service provided to the public drops, and the cost to repair the pavement increases. Depending on the time delay and type of pavement, the increased cost can be five- to seven-times (or more) of the original preventive maintenance treatment cost. These increases only relate to the increased cost of materials and construction labor to repair the pavement and do not take into account additional cost increases due to motorist time delays within construction zones.

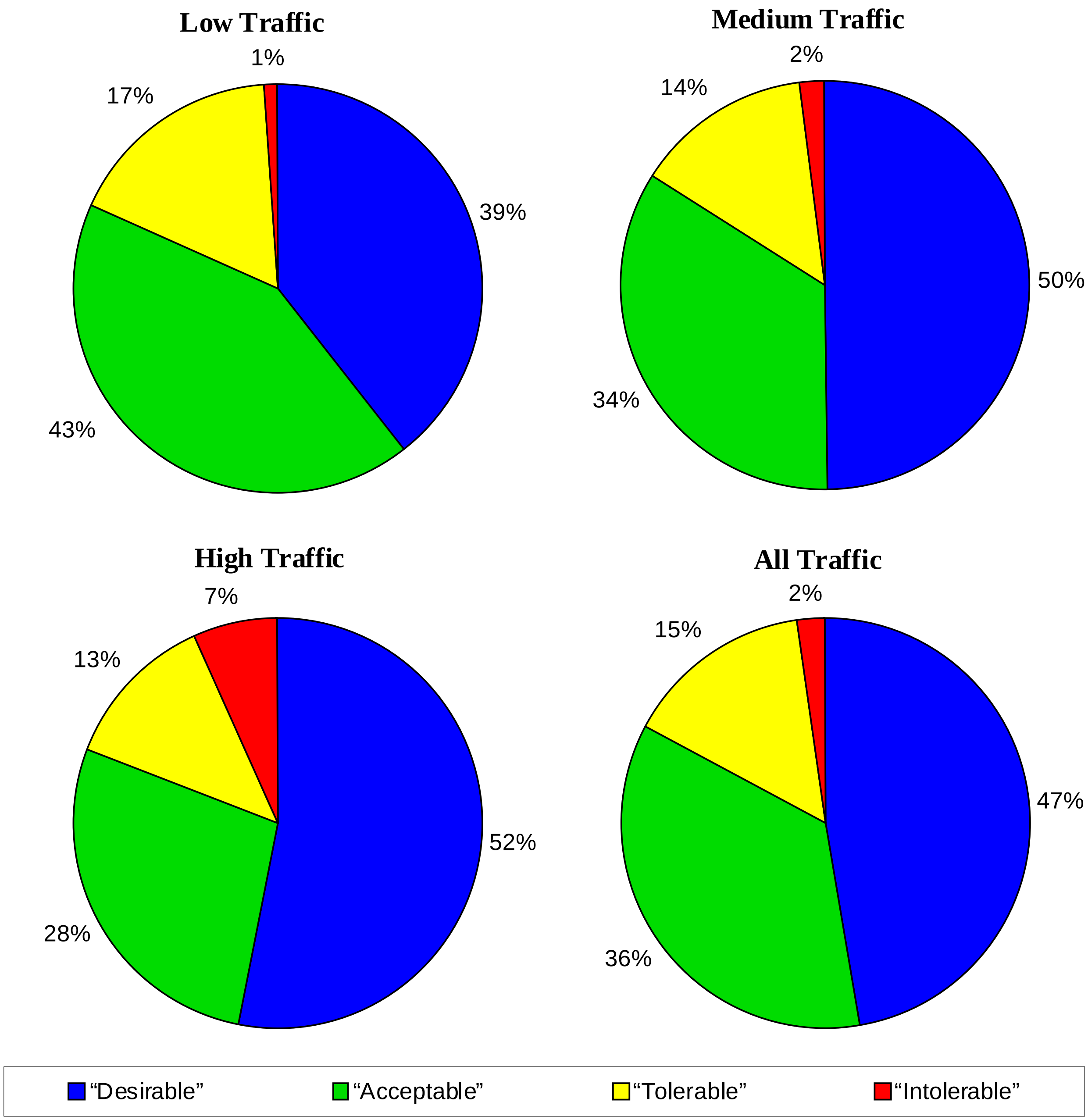


Figure 6.5 — Combined Maintenance Level of Service for FY 2006, by Traffic Category.

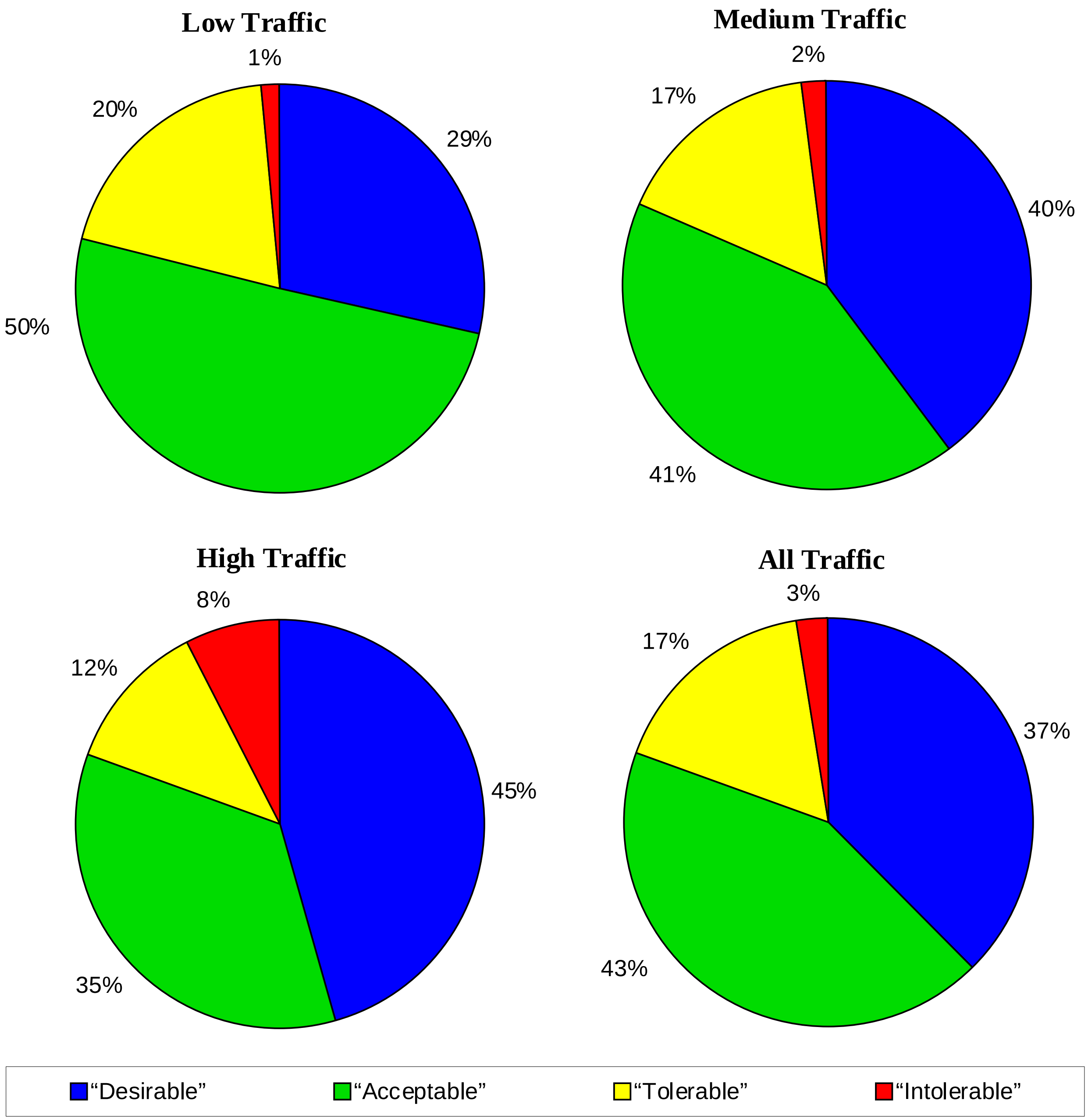


Figure 6.6 — Combined Maintenance Level of Service for FY 2007, by Traffic Category.

How times change: Back before World War I, the phrase "good roads" in Texas had a different meaning. "Come to Texas if you want to see good roads," a turn-of-the-century Bell County farmer growled; "good and rough, good and muddy." In 1925, the Federal Bureau of Public Roads shut off all federal highway aid to Texas because of the poor state of maintenance. In 1928, Texas was spending $495 per mile for maintenance, with most of the money spent for work trying to satisfy the Bureau of Public Roads to regain federal aid. Today, Texas highways consistently rate as the best in the country, according to Overdrive Magazine surveys of trucking owners and operators.

Discussion

The overall “Combined” level of service maintained on Texas flexible (ACP) pavements got worse in FY 2007, despite an improved level of service for Alligator Cracking.

The percentage of lane miles with “Desirable” or “Acceptable” level of service for Rutting decreased in FY 2007 because of increases in the amount of Shallow Rutting and Deep Rutting. Please note that the level of service definitions in this report were changed to treat 1 percent Rutting the same as 0 percent Rutting. This was done to account for sensor “noise” typically observed in the acoustic sensors used to measure Rutting. This change reduced – but did not reverse – the increase in the amount of Rutting.

The percentage of lane miles with “Desirable” or “Acceptable” level of service for Alligator Cracking increased slightly in FY 2007. This trend was consistent with the improvement in Alligator Cracking described in Chapter 3.

The percentage of lane miles with “Desirable” or “Acceptable” level of service for Ride Quality decreased in FY 2007. This trend does not match the observed improvement in overall ACP Ride Quality described in Chapter 3, because of an increase in the number of lane miles rated in FY 2007. There were actually 679.2 more lane miles in “Desirable” or “Acceptable” level of service in FY 2007. These additional lane miles made the overall Ride Quality in Chapter 3 go up, but they were not enough to offset the 828.1 additional lane miles rated that drove down the level of service percentage.

The overall level of service for “Low-traffic” and “Medium-traffic” mileage got worse, while “High-traffic” level of service did not change in FY 2007. “High-traffic” roads continued to carry the majority of vehicle miles traveled — 56.25 percent in FY 2007 — despite being only 13.89 percent of the lane miles. This means that more than half of the public’s perception of the overall quality of Texas pavements was based on the condition of these “high-traffic” roads.

The maintenance level of service results shown in this chapter only apply to flexible (ACP) pavement. Rigid pavements (CRCP and JCP) do not yet have level of service definitions for pavement maintenance, but these could be developed at any time based on the PMIS distress ratings, ride quality measurements, and other factors.

Summary

The overall “Combined” level of service maintained on Texas flexible (ACP) pavements got worse in FY 2007, despite an improved level of service for Alligator Cracking. “Low-traffic” and “Medium-traffic” mileage got worse, while “High-traffic” level of service did not change in FY 2007.

There is no requirement that one in five miles of the Interstate System be straight so that airplanes can land in emergencies. Airplanes do occasionally land on Interstate highways when no alternative is available in an emergency, but not because the Interstates are designed for that purpose. Source: FHWA.

Chapter 7 Performance Measures

This report has shown that there are many ways to describe the condition of Texas pavements. No matter which method is used, the intent is the same: to produce pavements that provide safe and efficient transport of people and goods. To meet this intent, TxDOT defines performance measures and adjusts funding, as necessary, to improve the overall condition of Texas pavements. These performance measures are then used for TxDOT pavement management, for funding of pavement projects in the annual Unified Transportation Program (UTP), and for National strategic planning.

Performance Measures Analyzed in This Chapter

This chapter reports the FY 2004-2007 PMIS data in terms of the following performance measures:

- Statewide Pavement Condition Goal – Percentage of Lane Miles in “Good” or Better Condition
- UTP Category 1 — Preventive Maintenance and Rehabilitation
- FHWA Strategic Goal for NHS Ride Quality.

Overview of the Statewide Pavement Condition Goal

In August 2001, the Texas Transportation Commission set a goal to have 90 percent of Texas pavement lane miles in “Good” or better condition within the next ten years (that is, by FY 2012). “Good or better” was defined as a PMIS Condition Score of 70 or above. In July 2002, TxDOT Administration established specific two- and ten-year goals for each district, using FY 2002 PMIS results as the baseline.

PMIS-related performance measures show mixed condition trends for FY 2007. The statewide pavement condition goal percentage of lane miles in “Good” or better condition increased from 86.69 percent in FY 2006 to 86.76 percent in FY 2007. For UTP Category 1, the Distress Score 1-59 measure improved, but the Distress Score 70-89 and Ride Score 0.1-1.9 measures got worse. The Federal ride quality performance measures all improved in FY 2007.

Additional information about the statewide pavement condition goal may be found in *Status of Statewide Pavement Condition Goal, FY 2004-2007* (Executive Summary or Full Version). These reports are available from the Construction Division, Materials and Pavements Section.

Texas has 17 Interstate highways: IH 10, IH 20, IH 27, IH 30, IH 35, IH 35E, IH 35W, IH 37, IH 40, IH 44, IH 45, IH 110, IH 345, IH 410, IH 610, 635, and IH 820.

Statewide Pavement Condition Goal

Table 7.1 shows the percentage of lane miles that meet the statewide pavement condition goal, based on PMIS Condition Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Condition Score of 70 or above ("Very Good" and "Good" mileage).

86.76 percent of statewide pavement lane miles were in "Good" or better condition in FY 2007. The goal is to have this value up to 90 percent by FY 2012.

Table 7.1 — Percentage of Lane Miles Above Condition Score Goal.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	90.83%	89.23%	92.09%	91.89%
Amarillo	85.67%	86.89%	83.02%	85.46%
Atlanta	93.48%	93.94%	94.57%	93.57%
Austin	88.50%	89.81%	88.62%	84.18%
Beaumont	84.24%	81.47%	83.10%	87.25%
Brownwood	95.74%	94.28%	94.56%	93.27%
Bryan	84.42%	84.50%	81.85%	86.80%
Childress	90.62%	92.17%	91.33%	92.59%
Corpus Christi	82.24%	78.15%	81.48%	80.68%
Dallas	76.14%	77.53%	71.93%	74.48%
El Paso	87.99%	83.36%	83.76%	90.17%
Fort Worth	85.41%	84.75%	85.50%	83.41%
Houston	73.51%	77.54%	77.93%	80.14%
Laredo	83.43%	83.30%	84.60%	86.89%
Lubbock	88.68%	89.82%	90.03%	91.39%
Lufkin	86.21%	87.25%	88.65%	88.26%
Odessa	95.04%	95.55%	94.83%	96.15%
Paris	86.07%	85.60%	85.11%	77.26%
Pharr	90.26%	88.43%	87.93%	83.77%
San Angelo	95.27%	95.93%	96.42%	94.89%
San Antonio	83.64%	82.98%	85.08%	81.76%
Tyler	88.75%	90.88%	86.17%	89.91%
Waco	90.14%	91.55%	92.04%	90.90%
Wichita Falls	91.05%	93.00%	90.38%	91.76%
Yoakum	87.88%	90.54%	83.81%	81.94%
STATEWIDE	87.02%	87.34%	86.69%	86.76%

PMIS Annual Reports usually summarize results for the last four years, but there have been some exceptions. When the PMIS sample increased to 100 percent in FY 2001, TxDOT published a two-year report for FY 2001-2002 and a three-year report for FY 2001-2003 before going back to the typical four-year report format for FY 2001-2004.

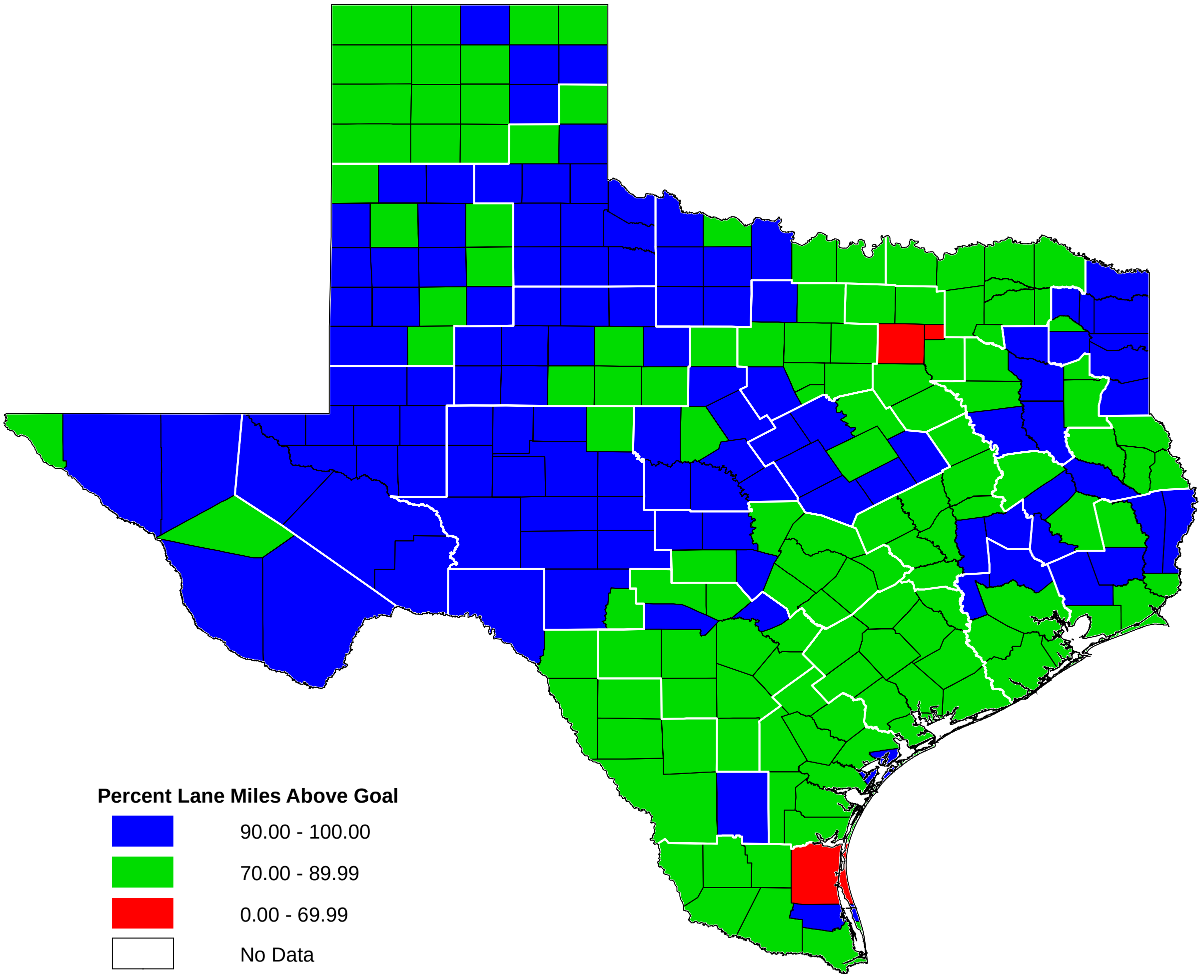
Statewide Pavement Condition Goal Maps, FY 2006-2007

Maps 7.1 and 7.2 show the percentage of lane miles that meet the statewide pavement condition goal by county, for FY 2006 and FY 2007 respectively. The percentages are weighted by lane miles, and include all mainlanes and frontage roads. Counties in blue already meet the statewide pavement condition goal (90 percent or more "Good" or better), while counties in red are well below the goal (less than 70 percent "Good" or better).

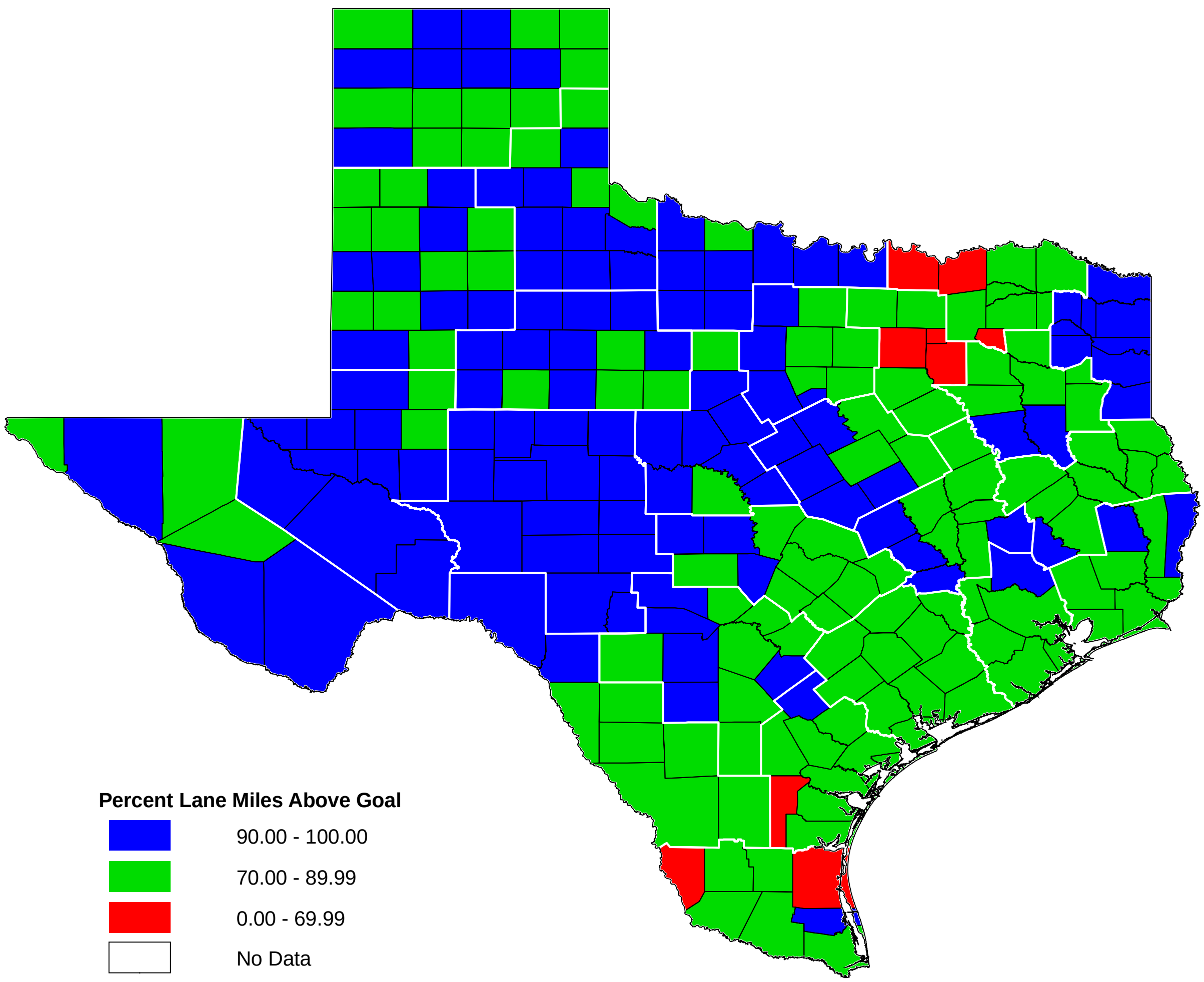
In all maps, the percentages are weighted by lane miles, and include all mainlanes and frontage roads. Counties in blue already meet the statewide pavement condition goal (90 percent or more "Good" or better), while counties in red are well below the goal (less than 70 percent "Good" or better).

The maps show the slight improvement of statewide pavement condition from FY 2006 to FY 2007.

Map 7.1 — Percentage of Lane Miles Above Pavement Condition Goal, FY 2006.



Map 7.2 — Percentage of Lane Miles Above Pavement Condition Goal, FY 2007.



Statewide Substandard Utility Values, FY 2004-2005.

Table 7.2 shows statewide "substandard utility values" causing mileage to fall below the statewide pavement condition goal of Condition Score 70 or above. This is the list of pavement problems, in priority order, which must be fixed to meet the pavement condition goal (that is, to make the most improvement on the most mileage).

Table 7.2 — Statewide Substandard Utility Values, FY 2004-2005.

	Fiscal Year					
	2004			2005		
Priority	Utility Id	Overall Utility Average	Substandard Utility (<0.7) Lane Miles	Utility Id	Overall Utility Average	Substandard Utility (<0.7) Lane Miles
1	ACP Patching	86.23	5,442.5	ACP Ride	83.18	5,243.0
2	ACP Ride	85.64	4,534.1	ACP Patching	87.65	4,665.5
3	ACP Alligator Cracking	88.56	4,007.8	JCP Ride	60.27	1,214.0
4	JCP Ride	61.73	1,048.2	ACP Alligator Cracking	89.01	3,750.0
5	ACP Failures	91.73	3,341.9	ACP Failures	91.66	3,332.2
6	CRCP Portland Concrete Patching	73.75	814.5	CRCP Ride	75.18	661.0
7	CRCP Ride	77.56	657.7	CRCP Portland Concrete Patching	76.35	684.2
8	JCP Portland Concrete Patching	80.39	482.8	JCP Portland Concrete Patching	76.40	639.1
9	JCP Failures	82.01	374.1	JCP Failures	87.54	273.0
10	CRCP Punchouts	87.07	314.6	CRCP Punchouts	90.48	181.7
11	ACP Longitudinal Cracking	96.35	664.4	ACP Longitudinal Cracking	96.72	472.2
12	CRCP Spalled Cracks	93.61	134.4	ACP Block Cracking	98.97	308.4
13	ACP Block Cracking	98.41	519.6	CRCP Spalled Cracks	95.52	69.2
14	JCP Failed Joints & Cracks	95.66	54.8	ACP Transverse Cracking	98.57	117.6
15	ACP Transverse Cracking	98.72	100.2	CRCP Asphalt Concrete Patching	98.21	43.1
16	CRCP Asphalt Concrete Patching	98.14	49.5	JCP Failed Joints & Cracks	96.79	17.5
17	ACP Deep Rutting	99.57	24.2	ACP Deep Rutting	99.61	16.4
18	JCP Longitudinal Cracks	99.69	0.2	JCP Longitudinal Cracks	99.71	0.6
19	ACP Shallow Rutting	99.41	0.0	JCP Shattered Slabs	99.98	0.8
20	JCP Shattered Slabs	99.99	0.0	ACP Shallow Rutting	99.38	0.0

Table 7.3 shows lane miles above the pavement condition goal, by pavement type, in FY 2004 and FY 2005.

Table 7.3 — Lane Miles Above Condition Goal, by Pavement Type, FY 2004-2005.

	Fiscal Year					
	2004			2005		
	Lane Miles			Lane Miles		
Pavement Type	Above Goal	Rated	Percent Above Goal	Above Goal	Rated	Percent Above Goal
Flexible or Asphalt Concrete Pavements (ACP)	149,685.0	169,973.5	88.06%	150,218.2	170,064.5	88.33%
Continuously Reinforced Concrete Pavement (CRCP)	7,170.0	8,988.8	79.77%	7,780.5	9,401.5	82.76%
Jointed Concrete Pavement (JCP)	2,295.3	3,927.6	58.44%	2,343.9	4,125.8	56.81%
STATEWIDE	159,150.3	182,889.9	87.02%	160,342.6	183,591.8	87.34%

Statewide Substandard Utility Values, FY 2006-2007.

Table 7.4 shows the statewide "substandard utility values" for FY 2006-2007.

Table 7.4 — Statewide Substandard Utility Values, FY 2006-2007.

Priority	Fiscal Year 2006 Utility Id	2006 Overall Utility Average	2006 Substandard Utility (<0.7) Lane Miles	Fiscal Year 2007 Utility Id	2007 Overall Utility Average	2007 Substandard Utility (<0.7) Lane Miles
1	ACP Ride	79.78	7,821.3	ACP Ride	79.12	8,115.3
2	ACP Patching	76.39	4,753.8	ACP Patching	76.35	4,615.8
3	ACP Alligator Cracking	77.30	3,965.6	ACP Alligator Cracking	78.68	3,223.3
4	ACP Failures	80.37	3,104.3	ACP Failures	80.44	3,074.3
5	JCP Ride	56.75	1,392.8	JCP Ride	58.24	1,218.3
6	CRCP Ride	73.16	761.9	CRCP Ride	72.53	823.8
7	CRCP Portland Concrete Patching	77.36	685.1	CRCP Portland Concrete Patching	77.60	712.6
8	JCP Portland Concrete Patching	78.30	583.9	JCP Portland Concrete Patching	76.29	598.2
9	ACP Longitudinal Cracking	83.82	644.3	ACP Longitudinal Cracking	83.45	832.2
10	ACP Block Cracking	86.00	341.2	ACP Block Cracking	86.09	290.5
11	JCP Failures	86.34	319.7	JCP Failures	86.29	285.3
12	CRCP Punchouts	88.21	278.4	CRCP Punchouts	90.37	209.2
13	ACP Transverse Cracking	85.82	88.7	ACP Transverse Cracking	85.94	56.0
14	CRCP Spalled Cracks	95.59	96.8	ACP Deep Rutting	86.17	30.4
15	ACP Deep Rutting	86.47	13.8	CRCP Spalled Cracks	97.02	51.7
16	CRCP Asphalt Concrete Patching	98.33	35.1	CRCP Asphalt Concrete Patching	98.33	42.6
17	JCP Failed Joints & Cracks	97.61	16.5	JCP Failed Joints & Cracks	97.47	25.9
18	JCP Longitudinal Cracks	99.68	2.4	ACP Shallow Rutting	85.78	0.0
19	ACP Shallow Rutting	86.32	0.0	JCP Shattered Slabs	100.00	0.0
20	JCP Shattered Slabs	100.00	0.0	JCP Longitudinal Cracks	99.66	0.0

Table 7.5 shows lane miles above the pavement condition goal, by pavement type, in FY 2006 and FY 2007.

Table 7.5 — Lane Miles Above Condition Goal, by Pavement Type, FY 2006-2007.

Pavement Type	2006 Lane Miles Above Goal	2006 Lane Miles Rated	2006 Percent Above Goal	2007 Lane Miles Above Goal	2007 Lane Miles Rated	2007 Percent Above Goal
Flexible or Asphalt Concrete Pavements (ACP)	148,982.7	169,830.7	87.72%	149,767.1	170,709.0	87.73%
Continuously Reinforced Concrete Pavement (CRCP)	7,820.2	9,543.3	81.94%	8,145.1	9,908.0	82.21%
Jointed Concrete Pavement (JCP)	2,268.3	4,128.7	54.94%	2,255.7	3,984.9	56.61%
STATEWIDE	159,071.2	183,502.7	86.69%	160,167.9	184,601.9	86.76%

UTP Category 1 — Distress Score 1-59 (Rehabilitation)

Table 7.6 shows the number of lane miles considered to be in need of rehabilitation, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score of 59 or below.

Table 7.6 — Lane Miles With Distress Score 1-59, FY 2004-2007.

District	Fiscal Year				2005-2007
	2004	2005	2006	2007	Average
Abilene	246.3	261.2	160.4	187.5	203.0
Amarillo	558.2	456.1	841.8	694.6	664.2
Atlanta	115.3	59.1	72.7	63.1	65.0
Austin	258.5	241.1	320.5	537.0	366.2
Beaumont	267.7	383.9	317.8	268.9	323.5
Brownwood	40.2	86.2	68.2	120.8	91.7
Bryan	394.4	300.1	343.5	192.2	278.6
Childress	178.4	158.4	149.4	131.4	146.4
Corpus Christi	574.6	690.8	516.4	421.3	542.8
Dallas	1,012.2	883.1	1,041.8	947.7	957.5
El Paso	194.6	191.9	120.8	115.7	142.8
Fort Worth	365.6	500.9	370.0	520.0	463.6
Houston	1,417.2	1,007.6	944.1	715.8	889.2
Laredo	412.0	367.4	339.0	205.0	303.8
Lubbock	763.8	667.5	559.5	490.5	572.5
Lufkin	196.0	114.0	82.1	104.8	100.3
Odessa	133.1	143.4	169.0	118.4	143.6
Paris	300.4	231.4	187.0	469.4	295.9
Pharr	107.8	198.9	236.4	324.6	253.3
San Angelo	118.1	76.6	71.8	89.8	79.4
San Antonio	744.4	762.1	500.1	631.4	631.2
Tyler	386.8	232.8	328.0	139.5	233.4
Waco	251.9	226.6	173.6	224.2	208.1
Wichita Falls	214.9	152.2	199.8	205.2	185.7
Yoakum	219.0	201.8	458.6	383.0	347.8
STATEWIDE	**9,471.4**	**8,595.1**	**8,572.3**	**8,301.8**	**8,489.7**

This measure is part of the formula used to allocate funds for UTP Category 1 — Preventive Maintenance and Rehabilitation.

Table 7.7 shows the percentage of lane miles considered to be in need of rehabilitation, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score of 59 or below.

Table 7.7 — Percentage of Lane Miles With Distress Score 1-59, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	2.96%	3.11%	1.93%	2.29%
Amarillo	6.10%	5.08%	9.25%	7.64%
Atlanta	1.89%	0.95%	1.17%	1.02%
Austin	3.09%	2.91%	3.84%	6.43%
Beaumont	4.93%	6.89%	5.78%	5.02%
Brownwood	0.70%	1.49%	1.18%	2.11%
Bryan	5.84%	4.45%	5.14%	2.86%
Childress	3.34%	2.94%	2.77%	2.47%
Corpus Christi	8.38%	10.43%	7.59%	6.26%
Dallas	10.96%	9.01%	10.55%	9.40%
El Paso	4.27%	4.23%	2.79%	2.49%
Fort Worth	4.35%	5.94%	4.42%	6.11%
Houston	14.58%	10.66%	10.09%	7.72%
Laredo	8.36%	7.48%	6.84%	4.22%
Lubbock	6.54%	5.66%	4.83%	4.16%
Lufkin	3.17%	1.82%	1.30%	1.66%
Odessa	1.66%	1.78%	2.08%	1.47%
Paris	4.57%	3.38%	2.83%	6.83%
Pharr	2.02%	3.72%	4.34%	5.80%
San Angelo	1.75%	1.17%	1.05%	1.25%
San Antonio	7.12%	7.30%	4.81%	6.01%
Tyler	4.57%	2.76%	3.78%	1.62%
Waco	3.40%	3.08%	2.33%	3.04%
Wichita Falls	3.46%	2.47%	3.27%	3.32%
Yoakum	2.85%	2.68%	5.95%	4.93%
STATEWIDE	**5.16%**	**4.67%**	**4.65%**	**4.48%**

UTP Category 1 — Ride Score 0.1-1.9 (Rehabilitation)

Table 7.8 shows the number of lane miles considered to be in need of rehabilitation, based on the PMIS Ride Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Ride Score of 1.9 or below.

Table 7.8 — Lane Miles With Ride Score 0.1-1.9, FY 2004-2007.

District	Fiscal Year				2005-2007
	2004	2005	2006	2007	Average
Abilene	168.9	242.1	239.7	203.7	228.5
Amarillo	119.8	149.2	127.8	73.6	116.9
Atlanta	25.8	24.2	21.8	42.6	29.5
Austin	22.0	13.7	26.2	53.0	31.0
Beaumont	72.8	117.0	126.3	79.3	107.5
Brownwood	19.0	26.2	47.4	39.4	37.7
Bryan	171.8	243.2	279.9	254.6	259.2
Childress	25.8	25.6	28.2	19.4	24.4
Corpus Christi	213.0	323.6	309.7	487.2	373.5
Dallas	263.0	301.5	450.0	421.1	390.9
El Paso	231.2	347.9	374.8	257.4	326.7
Fort Worth	165.3	116.8	126.0	126.8	123.2
Houston	113.6	136.2	178.8	151.9	155.6
Laredo	248.9	259.5	296.2	333.8	296.5
Lubbock	45.2	89.6	102.8	79.2	90.5
Lufkin	201.0	216.6	185.4	174.0	192.0
Odessa	88.6	63.4	71.8	74.8	70.0
Paris	122.2	154.2	279.2	284.3	239.2
Pharr	28.0	35.8	38.8	49.6	41.4
San Angelo	50.4	59.0	57.6	187.8	101.5
San Antonio	245.1	294.5	263.6	349.5	302.5
Tyler	29.2	53.6	101.8	115.2	90.2
Waco	117.3	66.4	83.7	89.5	79.9
Wichita Falls	53.8	60.2	86.4	54.8	67.1
Yoakum	118.0	168.4	197.4	429.0	264.9
STATEWIDE	**2,959.7**	**3,588.4**	**4,101.3**	**4,431.5**	**4,040.4**

This measure is part of the formula used to allocate funds for UTP Category 1 — Preventive Maintenance and Rehabilitation.

Table 7.9 shows the percentage of lane miles considered to be in need of rehabilitation, based on the PMIS Ride Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Ride Score of 1.9 or below.

Table 7.9 — Percentage of Lane Miles With Ride Score 0.1-1.9, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	2.03%	2.88%	2.88%	2.45%
Amarillo	1.30%	1.66%	1.40%	0.80%
Atlanta	0.41%	0.38%	0.34%	0.69%
Austin	0.26%	0.16%	0.31%	0.64%
Beaumont	1.33%	2.07%	2.27%	1.48%
Brownwood	0.33%	0.45%	0.82%	0.68%
Bryan	2.47%	3.49%	4.11%	3.64%
Childress	0.48%	0.47%	0.52%	0.36%
Corpus Christi	3.04%	4.76%	4.43%	6.95%
Dallas	2.78%	2.97%	4.43%	4.12%
El Paso	5.02%	7.50%	8.65%	5.47%
Fort Worth	1.97%	1.38%	1.50%	1.48%
Houston	1.15%	1.36%	1.79%	1.54%
Laredo	5.04%	5.23%	5.89%	6.65%
Lubbock	0.38%	0.74%	0.85%	0.66%
Lufkin	3.19%	3.40%	2.89%	2.73%
Odessa	1.10%	0.78%	0.88%	0.92%
Paris	1.81%	2.21%	3.97%	4.05%
Pharr	0.52%	0.65%	0.70%	0.89%
San Angelo	0.73%	0.87%	0.81%	2.62%
San Antonio	2.34%	2.80%	2.49%	3.27%
Tyler	0.34%	0.63%	1.17%	1.33%
Waco	1.56%	0.89%	1.12%	1.19%
Wichita Falls	0.85%	0.95%	1.38%	0.87%
Yoakum	1.54%	2.20%	2.51%	5.50%
STATEWIDE	**1.59%**	**1.91%**	**2.18%**	**2.35%**

UTP Category 1 — Distress Score 70-89 (Preventive Maintenance)

Table 7.10 shows the number of lane miles considered to be in need of preventive maintenance, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score between 70 and 89, inclusive.

Table 7.10— Lane Miles With Distress Score 70-89, FY 2004-2007.

District	Fiscal Year				2005-2007
	2004	2005	2006	2007	Average
Abilene	532.7	546.2	470.4	633.0	549.9
Amarillo	1,373.0	1,228.8	1,410.1	1,152.3	1,263.7
Atlanta	716.2	514.6	367.4	864.6	582.2
Austin	1,157.5	1,184.4	1,249.9	1,361.9	1,265.4
Beaumont	594.6	559.2	488.6	414.7	487.5
Brownwood	634.2	723.2	794.2	698.5	738.6
Bryan	651.3	599.4	1,004.6	755.9	786.6
Childress	598.0	563.5	602.8	475.9	547.4
Corpus Christi	1,063.1	835.9	786.7	862.6	828.4
Dallas	1,000.0	883.5	1,144.6	1,252.6	1,093.6
El Paso	479.7	508.2	504.4	382.4	465.0
Fort Worth	837.6	883.7	955.2	1,229.6	1,022.8
Houston	1,215.6	1,199.3	961.3	1,049.3	1,070.0
Laredo	541.3	594.6	505.4	564.5	554.8
Lubbock	879.9	761.3	876.1	925.6	854.3
Lufkin	820.0	731.6	668.8	931.7	777.4
Odessa	462.6	357.6	383.2	330.4	357.1
Paris	809.6	894.6	946.6	1,322.3	1,054.5
Pharr	514.6	677.9	603.0	681.5	654.1
San Angelo	533.2	496.2	412.4	492.4	467.0
San Antonio	1,086.6	1,448.0	1,254.1	1,732.4	1,478.2
Tyler	2,041.3	1,656.6	1,795.0	1,639.2	1,696.9
Waco	786.1	838.6	793.1	966.6	866.1
Wichita Falls	689.2	618.9	633.6	613.5	622.0
Yoakum	1,148.0	1,033.6	1,236.8	1,200.7	1,157.0
STATEWIDE	**21,165.9**	**20,339.4**	**20,848.3**	**22,534.1**	**21,240.6**

This measure is part of the formula used to allocate funds for UTP Category 1 — Preventive Maintenance and Rehabilitation.

Table 7.11 shows the percentage of lane miles considered to be in need of preventive maintenance, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score between 70 and 89, inclusive.

Table 7.11— Percentage of Lane Miles With Distress Score 70-89, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	6.88%	7.06%	5.95%	8.17%
Amarillo	17.23%	15.35%	18.31%	14.58%
Atlanta	12.35%	8.59%	6.14%	14.54%
Austin	15.28%	15.61%	16.45%	18.63%
Beaumont	12.05%	11.32%	9.86%	8.37%
Brownwood	11.38%	13.16%	14.42%	12.94%
Bryan	10.85%	9.77%	16.86%	11.98%
Childress	12.29%	11.28%	12.18%	9.59%
Corpus Christi	18.00%	15.10%	13.35%	14.36%
Dallas	12.70%	10.33%	13.56%	14.32%
El Paso	11.37%	12.11%	12.34%	8.61%
Fort Worth	10.77%	11.59%	12.43%	16.17%
Houston	15.69%	14.98%	12.16%	12.83%
Laredo	12.59%	13.79%	11.46%	12.61%
Lubbock	8.42%	7.10%	8.28%	8.51%
Lufkin	14.52%	12.54%	11.25%	15.79%
Odessa	6.00%	4.59%	4.92%	4.21%
Paris	13.81%	14.51%	15.65%	22.99%
Pharr	10.43%	13.84%	12.21%	13.89%
San Angelo	8.19%	7.84%	6.21%	7.10%
San Antonio	11.89%	15.81%	13.43%	18.75%
Tyler	26.50%	20.79%	22.51%	19.83%
Waco	11.37%	12.21%	11.25%	14.04%
Wichita Falls	11.92%	10.57%	11.16%	10.59%
Yoakum	16.53%	14.70%	18.41%	17.58%
STATEWIDE	**11.52%**	**11.06%**	**11.32%**	**12.16%**

UTP Category 1 — Distress Score 60-69 (PM-Rehabilitation "Gap")

Table 7.12 shows the number of lane miles **not** considered to be in need of preventive maintenance or rehabilitation, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score between 60 and 69, inclusive.

Table 7.12— Lane Miles With Distress Score 60-69, FY 2004-2007.

District	Fiscal Year				2005-2007
	2004	2005	2006	2007	Average
Abilene	332.7	405.0	254.3	263.1	307.5
Amarillo	619.2	513.6	552.9	497.2	521.2
Atlanta	184.4	199.2	175.7	208.6	194.5
Austin	525.3	449.6	423.9	507.1	460.2
Beaumont	227.7	244.8	225.6	131.8	200.7
Brownwood	164.2	189.0	198.2	198.4	195.2
Bryan	360.4	313.2	383.8	224.4	307.1
Childress	289.6	231.2	284.4	235.0	250.2
Corpus Christi	377.7	396.8	397.4	306.2	366.8
Dallas	346.6	357.1	391.5	383.0	377.2
El Paso	142.2	147.9	116.3	95.0	119.7
Fort Worth	267.2	312.1	316.1	385.0	337.7
Houston	552.2	435.1	509.5	381.0	441.9
Laredo	218.4	236.5	211.6	171.3	206.5
Lubbock	472.7	398.5	430.5	420.1	416.4
Lufkin	342.3	327.6	292.2	307.2	309.0
Odessa	164.1	135.2	164.5	105.1	134.9
Paris	406.6	449.4	372.2	646.4	489.3
Pharr	289.2	252.6	265.3	361.2	293.0
San Angelo	127.6	128.4	109.2	141.7	126.4
San Antonio	570.8	523.3	559.4	634.2	572.3
Tyler	375.0	243.0	373.2	229.4	281.9
Waco	235.9	255.8	217.2	261.2	244.7
Wichita Falls	221.5	162.8	231.1	182.8	192.2
Yoakum	506.8	288.8	528.0	561.3	459.4
STATEWIDE	**8,320.3**	**7,596.5**	**7,984.0**	**7,837.7**	**7,806.1**

This measure is **not** part of the formula used to allocate funds for UTP Category 1 — Preventive Maintenance and Rehabilitation — but is included here for reference to identify mileage which falls in the gap between "preventive maintenance" and "rehabilitation."

Table 7.13 shows the percentage of lane miles **not** considered to be in need of preventive maintenance or rehabilitation, based on the PMIS Distress Score, for fiscal years 2004 through 2007. It includes all mainlanes and frontage roads with a Distress Score between 60 and 69, inclusive.

Table 7.13— Percentage of Lane Miles With Distress Score 60-69, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	4.12%	4.97%	3.12%	3.28%
Amarillo	7.21%	6.03%	6.70%	5.92%
Atlanta	3.08%	3.22%	2.85%	3.39%
Austin	6.49%	5.60%	5.28%	6.49%
Beaumont	4.41%	4.72%	4.35%	2.59%
Brownwood	2.86%	3.32%	3.47%	3.54%
Bryan	5.67%	4.86%	6.05%	3.43%
Childress	5.62%	4.42%	5.43%	4.52%
Corpus Christi	6.01%	6.69%	6.32%	4.85%
Dallas	4.22%	4.01%	4.43%	4.19%
El Paso	3.26%	3.41%	2.77%	2.09%
Fort Worth	3.32%	3.93%	3.95%	4.82%
Houston	6.65%	5.15%	6.05%	4.45%
Laredo	4.84%	5.20%	4.58%	3.69%
Lubbock	4.33%	3.58%	3.91%	3.72%
Lufkin	5.71%	5.32%	4.68%	4.95%
Odessa	2.08%	1.70%	2.07%	1.32%
Paris	6.49%	6.79%	5.80%	10.10%
Pharr	5.54%	4.90%	5.10%	6.86%
San Angelo	1.92%	1.99%	1.62%	2.00%
San Antonio	5.88%	5.40%	5.65%	6.42%
Tyler	4.64%	2.96%	4.47%	2.70%
Waco	3.30%	3.59%	2.99%	3.66%
Wichita Falls	3.69%	2.70%	3.91%	3.06%
Yoakum	6.80%	3.95%	7.29%	7.59%
STATEWIDE	**4.53%**	**4.13%**	**4.33%**	**4.23%**

FHWA Headquarters Strategic Plan for NHS Ride Quality

The Federal Highway Administration (FHWA) headquarters office recently established a strategic plan for ride quality on the National Highway System (NHS). The plan included two new performance measures and then proposed to adjust annual goals as necessary to improve NHS ride quality.

Table 7.14 shows results for the first measure: percentage of NHS mainlane vehicle miles traveled (VMT) with "Good" smoothness, for fiscal years 2004 through 2007. "Good" smoothness is defined as IRI of 1-95 inches per mile (same as PMIS Ride Score of 3.8 or above).

48.54 percent of the mainlane NHS VMT had IRI between 1 and 95 in FY 2007.

Table 7.14— Percentage of NHS VMT With IRI Between 1 and 95, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	67.27%	59.19%	66.28%	69.22%
Amarillo	60.07%	53.77%	50.47%	59.42%
Atlanta	93.61%	91.96%	92.08%	88.38%
Austin	77.18%	76.59%	76.62%	59.22%
Beaumont	45.53%	38.84%	44.04%	54.52%
Brownwood	80.19%	75.58%	72.53%	68.41%
Bryan	86.33%	82.13%	82.48%	81.93%
Childress	90.64%	89.12%	88.50%	89.30%
Corpus Christi	70.83%	70.33%	73.46%	68.23%
Dallas	29.01%	35.22%	29.81%	34.71%
El Paso	37.24%	28.80%	23.14%	34.68%
Fort Worth	25.37%	28.91%	26.44%	31.02%
Houston	29.92%	25.86%	28.33%	26.23%
Laredo	56.84%	55.96%	56.59%	50.71%
Lubbock	72.45%	66.55%	67.85%	69.04%
Lufkin	69.88%	62.25%	55.71%	57.89%
Odessa	73.88%	76.59%	74.42%	79.08%
Paris	63.42%	62.95%	59.50%	58.27%
Pharr	74.18%	70.57%	67.34%	69.79%
San Angelo	68.16%	74.49%	70.83%	71.10%
San Antonio	68.40%	65.98%	68.44%	68.73%
Tyler	77.74%	73.35%	69.86%	73.07%
Waco	65.52%	64.97%	64.11%	64.21%
Wichita Falls	61.20%	56.47%	56.87%	60.58%
Yoakum	85.16%	87.90%	87.72%	85.31%
STATEWIDE	**49.91%**	**48.66%**	**48.18%**	**48.54%**

Table 7.15 shows results for the second measure: percentage of NHS mainlane vehicle miles traveled (VMT) with "Acceptable" smoothness, for fiscal years 2004 through 2007. "Acceptable" smoothness is defined as IRI of 1-170 inches per mile (same as PMIS Ride Score of 2.6 or above).

94.66 percent of the mainlane NHS VMT had IRI between 1 and 170 in FY 2007.

Table 7.15— Percentage of NHS VMT With IRI Between 1 and 170, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	99.44%	98.35%	98.47%	97.23%
Amarillo	98.59%	96.61%	97.26%	98.05%
Atlanta	98.88%	98.43%	98.31%	98.46%
Austin	98.85%	98.80%	98.70%	98.17%
Beaumont	84.88%	84.37%	85.98%	90.02%
Brownwood	97.82%	97.07%	96.87%	98.85%
Bryan	98.88%	98.49%	98.93%	98.58%
Childress	97.24%	98.28%	98.38%	98.41%
Corpus Christi	98.14%	97.46%	98.23%	97.72%
Dallas	95.25%	94.73%	90.82%	92.87%
El Paso	94.68%	88.36%	89.81%	94.66%
Fort Worth	93.86%	95.11%	93.77%	96.10%
Houston	91.96%	90.55%	92.15%	90.00%
Laredo	94.20%	93.73%	93.30%	92.74%
Lubbock	98.29%	97.04%	96.66%	97.42%
Lufkin	98.60%	99.09%	98.32%	99.05%
Odessa	98.41%	98.79%	99.40%	99.42%
Paris	97.24%	96.24%	94.16%	96.37%
Pharr	97.25%	97.06%	98.26%	96.70%
San Angelo	98.66%	99.24%	99.38%	99.21%
San Antonio	97.26%	96.29%	96.25%	95.81%
Tyler	99.36%	99.14%	98.34%	97.63%
Waco	96.35%	98.05%	97.01%	98.09%
Wichita Falls	95.65%	95.68%	95.86%	95.19%
Yoakum	99.70%	99.84%	99.52%	99.88%
STATEWIDE	**95.36%**	**94.68%**	**94.37%**	**94.66%**

Texas is the only state in the union to have Farm to Market Roads.

FHWA Regional Center Measure for NHS Ride Quality

The FHWA Regional Center also recently established an annual performance measure for NHS ride quality. This measure was based on IRI less than 95 inches per mile.

Table 7.16 shows results for this measure: percentage of NHS mainlane lane miles with IRI between 1 and 94 inches per mile.

56.80 percent of the mainlane NHS lane miles had IRI between 1 and 94 in FY 2007.

Table 7.16— Percentage of NHS Lane Miles With IRI Less Than 95, FY 2004-2007.

District	Fiscal Year			
	2004	2005	2006	2007
Abilene	63.79%	55.79%	62.40%	65.22%
Amarillo	62.67%	57.77%	53.15%	61.21%
Atlanta	89.62%	87.74%	88.66%	84.19%
Austin	74.08%	73.35%	71.38%	57.70%
Beaumont	44.67%	37.10%	42.19%	53.29%
Brownwood	77.18%	73.15%	70.88%	71.19%
Bryan	85.28%	80.88%	79.06%	79.83%
Childress	88.83%	86.96%	85.37%	86.80%
Corpus Christi	69.69%	68.05%	70.54%	64.94%
Dallas	30.04%	32.93%	28.47%	32.09%
El Paso	47.03%	34.96%	30.35%	39.56%
Fort Worth	28.90%	31.58%	29.62%	30.82%
Houston	32.85%	31.68%	32.55%	30.83%
Laredo	55.07%	52.45%	50.96%	43.68%
Lubbock	78.33%	69.61%	71.95%	72.98%
Lufkin	65.87%	57.29%	50.82%	51.05%
Odessa	73.79%	73.99%	71.35%	78.72%
Paris	61.92%	60.91%	57.67%	58.87%
Pharr	72.11%	66.72%	64.51%	67.15%
San Angelo	71.75%	76.69%	74.15%	74.84%
San Antonio	67.67%	65.04%	68.23%	68.95%
Tyler	71.21%	67.44%	63.73%	67.93%
Waco	60.39%	61.43%	63.16%	61.72%
Wichita Falls	61.83%	56.52%	56.90%	63.61%
Yoakum	77.37%	81.81%	82.48%	83.51%
STATEWIDE	**59.23%**	**56.58%**	**55.87%**	**56.80%**

This is not the same as the "Good" smoothness measure shown in Table 7.19, which is based on IRI 1-95 and vehicle miles traveled.

Statewide Pavement Condition Goal — Total Lane Miles Rated

The statewide pavement condition goal includes all mainlanes and frontage roads rated during the annual PMIS pavement evaluation cycle, which begins in September of each fiscal year and usually lasts until February. The percentage of lane miles rated influences the expected reliability of the reported "Good or better" value — higher percentages of lane miles rated are expected to be more reliable than lower percentages.

Table 7.17 shows the percentage of lane miles (mainlanes and frontage roads) rated for fiscal years 2004 through 2005.

Table 7.17— Total Lane Miles Rated, FY 2004-2005.

District	Fiscal Year					
	2004			2005		
	Lane Miles		Percent Rated	Lane Miles		Percent Rated
	Rated	Total		Rated	Total	
Abilene	8,309.6	8,428.8	98.59%	8,405.2	8,435.0	99.65%
Amarillo	9,131.1	9,370.7	97.44%	8,886.8	9,369.7	94.85%
Atlanta	6,088.8	6,451.7	94.38%	6,244.0	6,453.1	96.76%
Austin	8,344.3	8,746.3	95.40%	8,276.1	8,771.4	94.35%
Beaumont	5,374.9	5,690.1	94.46%	5,563.3	5,728.9	97.11%
Brownwood	5,776.4	5,827.6	99.12%	5,771.8	5,834.6	98.92%
Bryan	6,751.5	6,992.5	96.55%	6,743.9	7,001.3	96.32%
Childress	5,331.0	5,402.6	98.67%	5,384.0	5,410.2	99.52%
Corpus Christi	6,847.6	7,023.6	97.49%	6,623.1	7,041.7	94.06%
Dallas	8,988.5	10,305.7	87.22%	9,676.1	10,454.3	92.56%
El Paso	4,547.9	4,748.2	95.78%	4,525.9	4,751.8	95.25%
Fort Worth	8,309.5	8,635.0	96.23%	8,400.1	8,703.4	96.52%
Houston	9,623.9	9,996.4	96.27%	9,422.6	10,100.8	93.29%
Laredo	4,918.6	5,014.8	98.08%	4,913.5	5,028.8	97.71%
Lubbock	11,668.7	12,122.1	96.26%	11,784.4	12,160.8	96.90%
Lufkin	6,178.7	6,394.9	96.62%	6,263.2	6,452.0	97.07%
Odessa	7,977.8	8,114.0	98.32%	8,074.8	8,192.6	98.56%
Paris	6,547.1	7,114.1	92.03%	6,840.4	7,147.5	95.70%
Pharr	5,305.6	5,725.5	92.67%	5,348.8	5,768.6	92.72%
San Angelo	6,753.5	7,207.8	93.70%	6,532.5	7,220.8	90.47%
San Antonio	10,423.3	10,547.4	98.82%	10,444.2	10,560.8	98.90%
Tyler	8,446.8	8,722.3	96.84%	8,443.4	8,733.6	96.68%
Waco	7,367.8	7,681.9	95.91%	7,332.1	7,715.8	95.03%
Wichita Falls	6,210.3	6,370.9	97.48%	6,171.9	6,387.5	96.62%
Yoakum	7,666.7	7,943.1	96.52%	7,519.7	7,990.3	94.11%
STATEWIDE	**182,889.9**	**190,578.0**	**95.97%**	**183,591.8**	**191,415.3**	**95.91%**

Table 7.18 shows the percentage of lane miles (mainlanes and frontage roads) rated for fiscal years 2006 through 2007.

The percentage of lane miles rated in PMIS has remained near 95 percent statewide in FY 2004-2007, and rose slightly in FY 2007 after having dropped slightly in the two previous years.

Table 7.18— Total Lane Miles Rated, FY 2006-2007.

District	Fiscal Year 2006 Lane Miles Rated	2006 Lane Miles Total	2006 Percent Rated	2007 Lane Miles Rated	2007 Lane Miles Total	2007 Percent Rated
Abilene	8,300.7	8,448.4	98.25%	8,187.9	8,440.0	97.01%
Amarillo	9,069.0	9,364.9	96.84%	9,085.7	9,367.3	96.99%
Atlanta	6,228.7	6,473.3	96.22%	6,204.3	6,474.7	95.82%
Austin	8,333.3	8,794.9	94.75%	8,309.8	8,803.0	94.40%
Beaumont	5,447.8	5,748.2	94.77%	5,297.1	5,746.2	92.18%
Brownwood	5,771.2	5,848.6	98.68%	5,713.8	5,857.8	97.54%
Bryan	6,629.5	7,030.7	94.29%	6,713.9	7,035.3	95.43%
Childress	5,383.8	5,410.2	99.51%	5,326.8	5,401.0	98.63%
Corpus Christi	6,799.5	7,095.6	95.83%	6,710.0	7,114.7	94.31%
Dallas	9,803.3	10,497.2	93.39%	9,946.0	10,533.1	94.43%
El Paso	4,278.4	4,753.2	90.01%	4,647.3	4,755.6	97.72%
Fort Worth	8,278.9	8,718.5	94.96%	8,450.6	8,767.7	96.38%
Houston	9,269.6	10,187.0	90.99%	9,157.9	10,189.6	89.87%
Laredo	4,951.4	5,090.7	97.26%	4,847.3	5,096.7	95.11%
Lubbock	11,524.7	12,192.7	94.52%	11,765.9	12,190.3	96.52%
Lufkin	6,316.8	6,447.4	97.97%	6,296.7	6,431.8	97.90%
Odessa	8,106.4	8,192.6	98.95%	8,044.8	8,189.8	98.23%
Paris	6,589.5	7,151.9	92.14%	6,855.8	7,116.9	96.33%
Pharr	5,429.1	5,866.5	92.54%	5,575.4	5,901.4	94.48%
San Angelo	6,812.4	7,220.8	94.34%	7,133.6	7,248.6	98.41%
San Antonio	10,394.6	10,629.1	97.79%	10,486.6	10,810.0	97.01%
Tyler	8,638.1	8,781.9	98.36%	8,619.0	8,825.5	97.66%
Waco	7,389.1	7,732.1	95.56%	7,311.0	7,739.3	94.47%
Wichita Falls	6,058.2	6,394.5	94.74%	6,160.0	6,374.9	96.63%
Yoakum	7,698.7	8,042.1	95.73%	7,754.7	8,119.6	95.51%
STATEWIDE	**183,502.7**	**192,113.0**	**95.52%**	**184,601.9**	**192,530.8**	**95.88%**

US 81 and US 287 in Montague County are paved with gold. When 39 miles of these roadways were paved in 1936, sand taken from a local pit was mixed with paving material. The sand contained gold but in small amounts. According to a roadside historical marker, the gold in the sand was valued at 54 cents per ton, or $31,000 in these sections of highway.

Discussion

PMIS-related performance measures show mixed condition trends for FY 2007. The statewide pavement condition goal percentage of lane miles in "Good" or better condition increased from 86.69 percent in FY 2006 to 86.76 percent in FY 2007. For UTP Category 1, the Distress Score 1-59 measure improved, but the Distress Score 70-89 and Ride Score 0.1-1.9 measures got worse. The Federal ride quality performance measures all improved in FY 2007.

As mentioned in Chapter 1, overall statewide condition got slightly worse in FY 2007 mainly because of increased distress on asphalt pavements. Overall pavement distress got worse, but overall ride quality improved. The performance measures do not necessarily describe overall conditions – they only describe the amount of mileage above or below an arbitrary value. It is possible for them to contradict the overall trends, which is what happened in FY 2007.

Three factors affect the results of the performance measures: 1) what is happening to the mileage above the standard; 2) the amount of mileage below the standard; and 3) the total amount of mileage actually on the highway system.

For example, if every mile of pavement in Texas had a PMIS Condition Score of 100 in FY 2006, the percentage of lane miles in "Good" or better condition would be 100 percent. If in FY 2007 every one of those miles dropped to 70, the percentage of lane miles in "Good" or better condition would not have changed (still 100 percent), but the overall condition would have dropped substantially.

For the UTP and Federal performance measures, the amount of mileage below the standard can change because "good" mileage gets worse and drops in, or because "bad" mileage improves and rises out.

Changes in the total amount of mileage on the highway system can also affect the performance measures. Small increases in "below standard" mileage can be offset by large increases in total mileage, especially when new mileage (which is usually "above standard") is added.

Summary

PMIS-related performance measures show mixed condition trends for FY 2007. The statewide pavement condition goal percentage of lane miles in "Good" or better condition increased from 86.69 percent in FY 2006 to 86.76 percent in FY 2007. For UTP Category 1, the Distress Score 1-59 measure improved, but the Distress Score 70-89 and Ride Score 0.1-1.9 measures got worse. The Federal ride quality performance measures all improved in FY 2007.

IH 35 has the only two split-route pairs on the IH system: IH 35 E and IH 35 W for Dallas-Fort Worth (in Texas) and Minneapolis-Saint Paul (in Minnesota). Source: TTI.

Chapter 8 Estimate of Pavement Needs

Previous chapters have described the condition of Texas pavements in terms of PMIS distress ratings and ride quality measurements. PMIS also uses this data to estimate pavement needs (lane miles and funding) for any given year.

The PMIS Needs Estimate program uses pre-defined criteria to propose broad categories of treatments. These treatments are:

- Needs Nothing (no treatment needed at this time)
- Preventive Maintenance (such as a seal coat or crack seal)
- Light Rehabilitation (such as a thin hot-mix overlay)
- Medium Rehabilitation (such as slab repair or thick hot-mix overlay)
- Heavy Rehabilitation (such as a new flexible or rigid pavement).

This estimate is provided to show trends only – it is not a total estimate of all pavement-related needs.

Needs Estimate treatments are based on pavement distress and ride quality, along with other factors such as traffic, number of lanes, and functional classification. They are not directly based on Distress Score or Condition Score because these scores do not contain enough detailed information to identify the type of treatment needed. As a result, Needs Estimate trends can occasionally disagree with Distress Score and Condition Score trends.

The lane mile estimates shown in this chapter can be used to monitor relationships between preventive maintenance (PM) and rehabilitation needs. The funding estimates can be used to evaluate the adequacy and distribution of pavement funds.

Unlike previous *Condition of Texas Pavements* reports, the Statewide pavement needs shown in this report have not been extrapolated. They are the total lane miles and funding needed to repair all “substandard” Texas pavements, based on FY2003 through FY 2007 PMIS data.

It should be noted that these PMIS Needs Estimate results only cover pavement-related expenses. They do not cover right-of-way, bridge repair, capacity, safety, traffic control, or other roadside improvement costs. They also do not include adjustments for changes in treatment costs over time because such adjustments would make it harder to track trends over time.

Please note that the PM Needs Estimate results for FY 2003-2005 in this report do not exactly match those that have been published in previous *Condition of Texas Pavements* reports. This is because the Needs Estimate contains a PM treatment for those PMIS sections that were last surfaced more than 7 years ago, and that this information is continuously being added to PMIS. For example, if a PMIS section was last surfaced in July 1995, but the surface date information was not added until January 2006, it would have showed up as “Needs Nothing” for FY 2003-2005 in last year’s report, but will show up as “PM” for FY 2004-2006 in this year’s report.

Pavement Needs

Figure 8.1 shows the PMIS estimate for the total funding needed to repair Texas pavements for fiscal years 2004 through 2007.

$1,664 million is needed to repair Texas pavements in FY 2007.

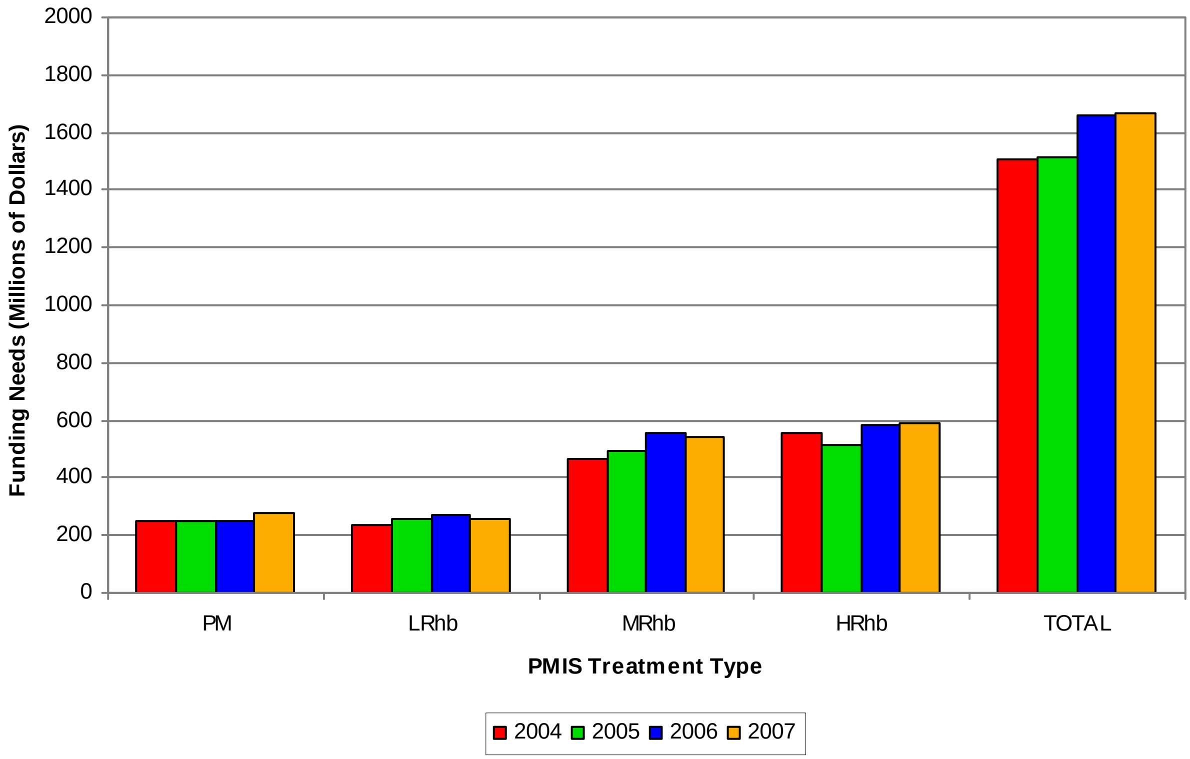


Figure 8.1 — Pavement Needs, FY 2004-2007.

The PMIS Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $248 million in 2006 to $275 million in 2007)
- Light Rehab (LRhb) decreased (from $271 million in 2006 to $260 million in 2007)
- Medium Rehab (MRhb) decreased (from $555 million in 2006 to $541 million in 2007)
- Heavy Rehab (HRhb) increased (from $585 million in 2006 to $588 million in 2007)
- Pavement needs increased (from $1,658 million in 2006 to $1,664 million in 2007).

IH Pavement Needs

Figure 8.2 shows the estimated pavement needs for the IH system for fiscal years 2004 through 2007.

Interstate highways make up 12.69 percent of the TxDOT-maintained lane mileage, but require 18.73 percent of the pavement needs.

$312 million is needed to repair IH lane miles in FY 2007.

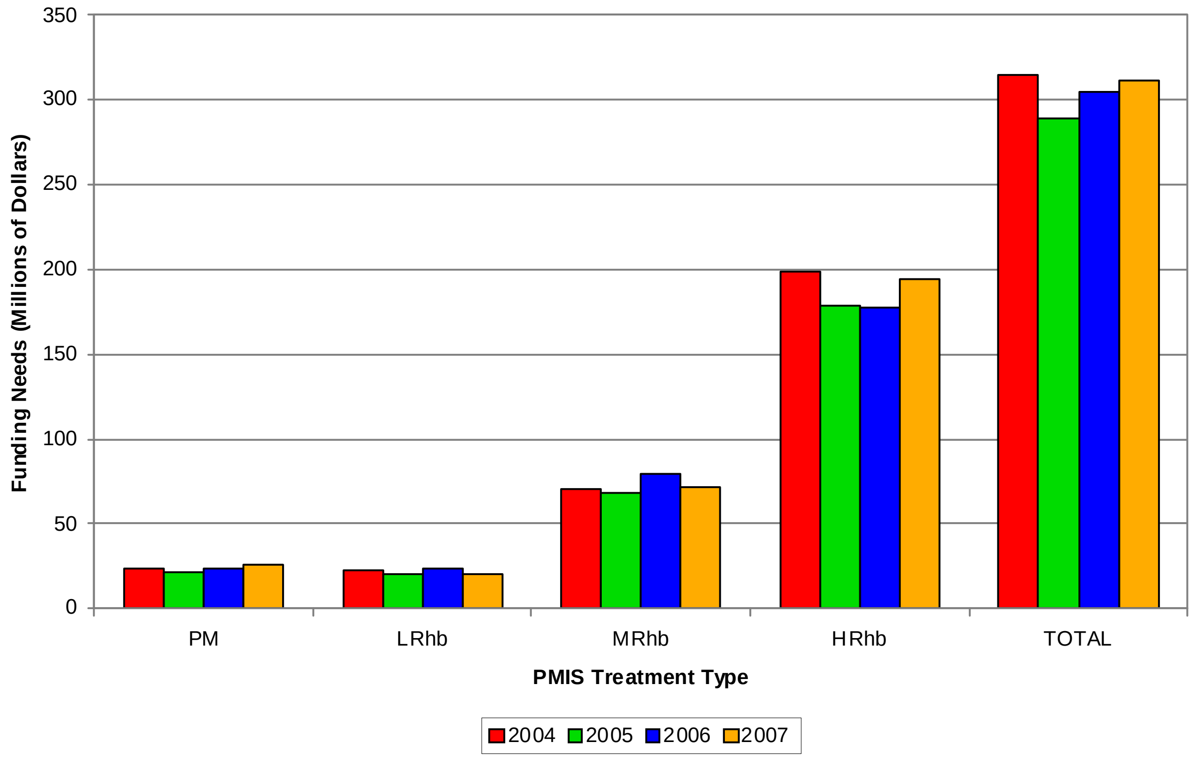


Figure 8.2 — IH Pavement Needs, FY 2004-2007.

The IH System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $24 million in 2006 to $26 million in 2007)
- Light Rehab (LRhb) decreased (from $23 million in 2006 to $20 million in 2007)
- Medium Rehab (MRhb) decreased (from $80 million in 2006 to $72 million in 2007)
- Heavy Rehab (HRhb) increased (from $178 million in 2006 to $195 million in 2007)
- IH pavement needs increased (from $305 million in 2006 to $312 million in 2007).

US Pavement Needs

Figure 8.3 shows the estimated pavement needs for the US system for fiscal years 2004 through 2007.

US highways make up 20.10 percent of the TxDOT-maintained lane mileage, and require 16.72 percent of the pavement needs.

$278 million is needed to repair US lane miles in FY 2007.

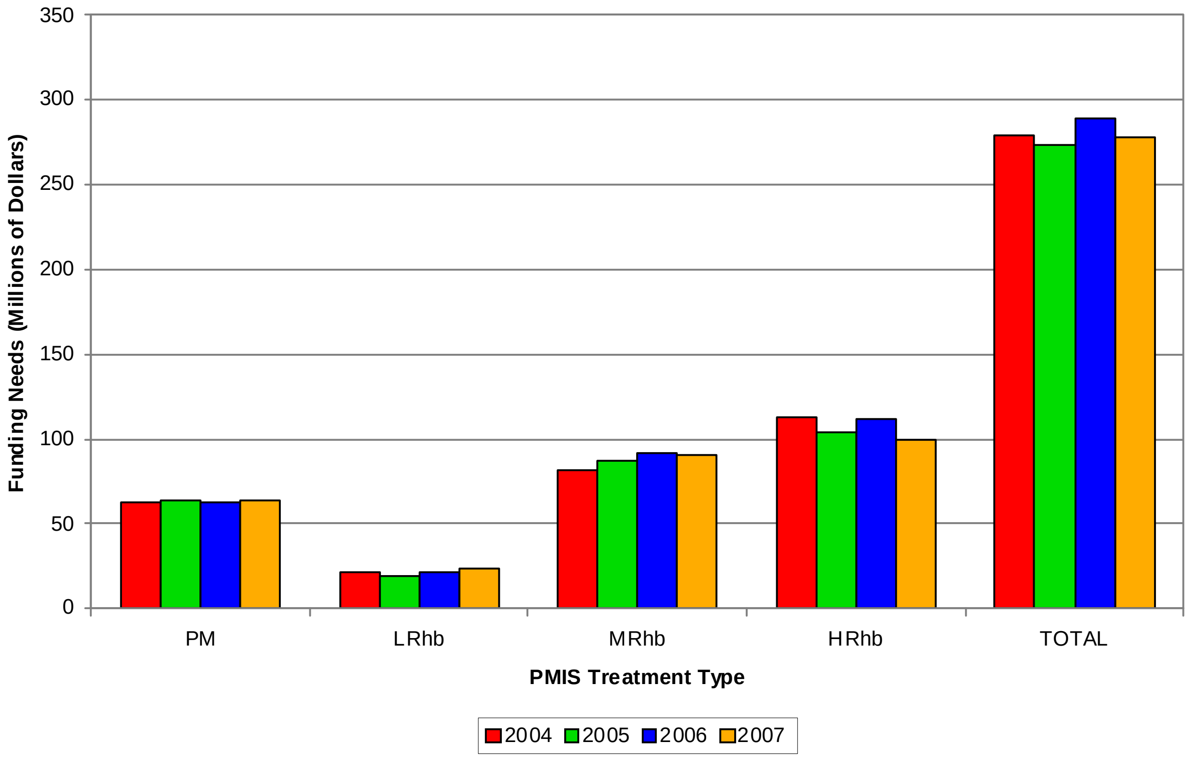


Figure 8.3 — US Pavement Needs, FY 2004-2007.

The US System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $63 million in 2006 to $64 million in 2007)
- Light Rehab (LRhb) increased (from $22 million in 2006 to $23 million in 2007)
- Medium Rehab (MRhb) decreased (from $92 million in 2006 to $91 million in 2007)
- Heavy Rehab (HRhb) decreased (from $112 million in 2006 to $100 million in 2007)
- US pavement needs decreased (from $289 million in 2006 to $278 million in 2007).

SH Pavement Needs

Figure 8.4 shows the estimated pavement needs for the SH system for fiscal years 2004 through 2007.

State highways make up 21.21 percent of the TxDOT-maintained lane mileage, and require 25.01 percent of the pavement needs.

$416 million is needed to repair SH lane miles in FY 2007.

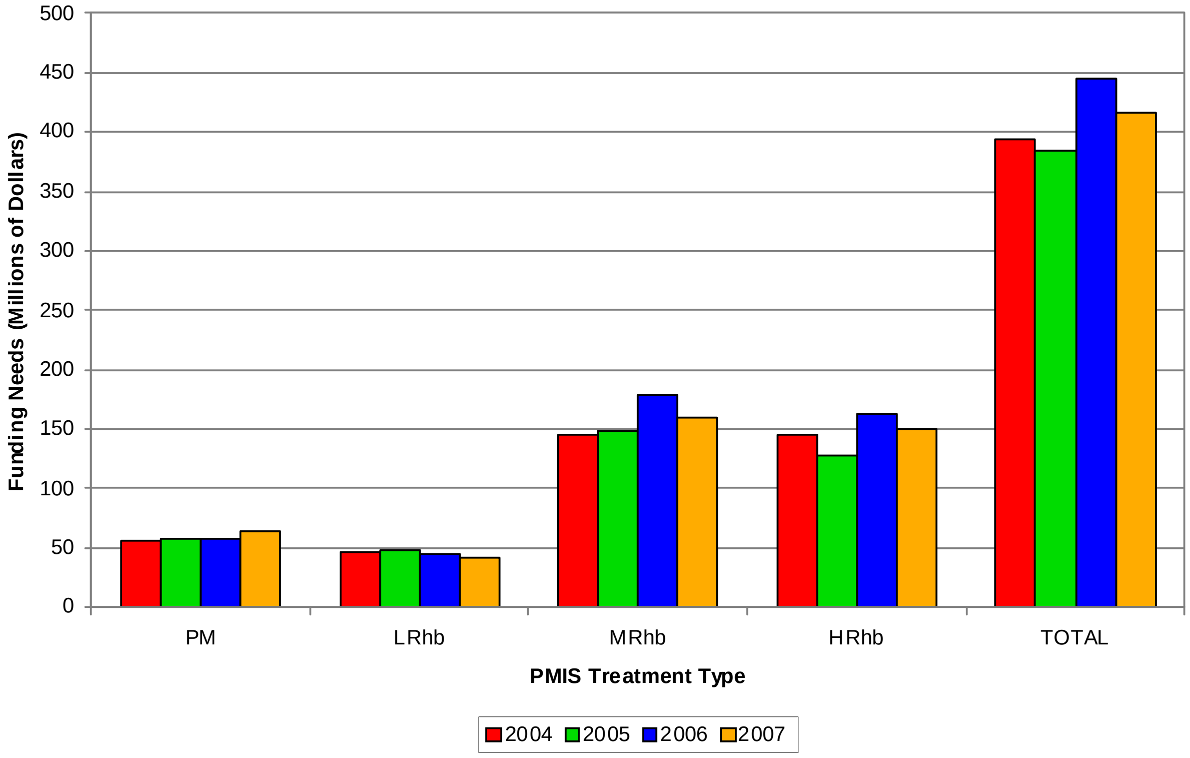


Figure 8.4 — SH Pavement Needs, FY 2004-2007.

The SH System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $57 million in 2006 to $63 million in 2007)
- Light Rehab (LRhb) decreased (from $45 million in 2006 to $42 million in 2007)
- Medium Rehab (MRhb) decreased (from $179 million in 2006 to $159 million in 2007)
- Heavy Rehab (HRhb) decreased (from $163 million in 2006 to $151 million in 2007)
- SH pavement needs decreased (from $445 million in 2006 to $416 million in 2007).

FM Pavement Needs

Figure 8.5 shows the estimated pavement needs for the FM system for fiscal years 2004 through 2007.

Farm-to-Market roads make up 44.03 percent of the TxDOT-maintained lane mileage, but only require 35.53 percent of the pavement needs. Other systems (BR, PR, and PA) make up the remaining 1.97 percent of TxDOT-maintained lane mileage and 4.01 percent of the pavement needs.

$591 million is needed to repair FM lane miles in FY 2007.

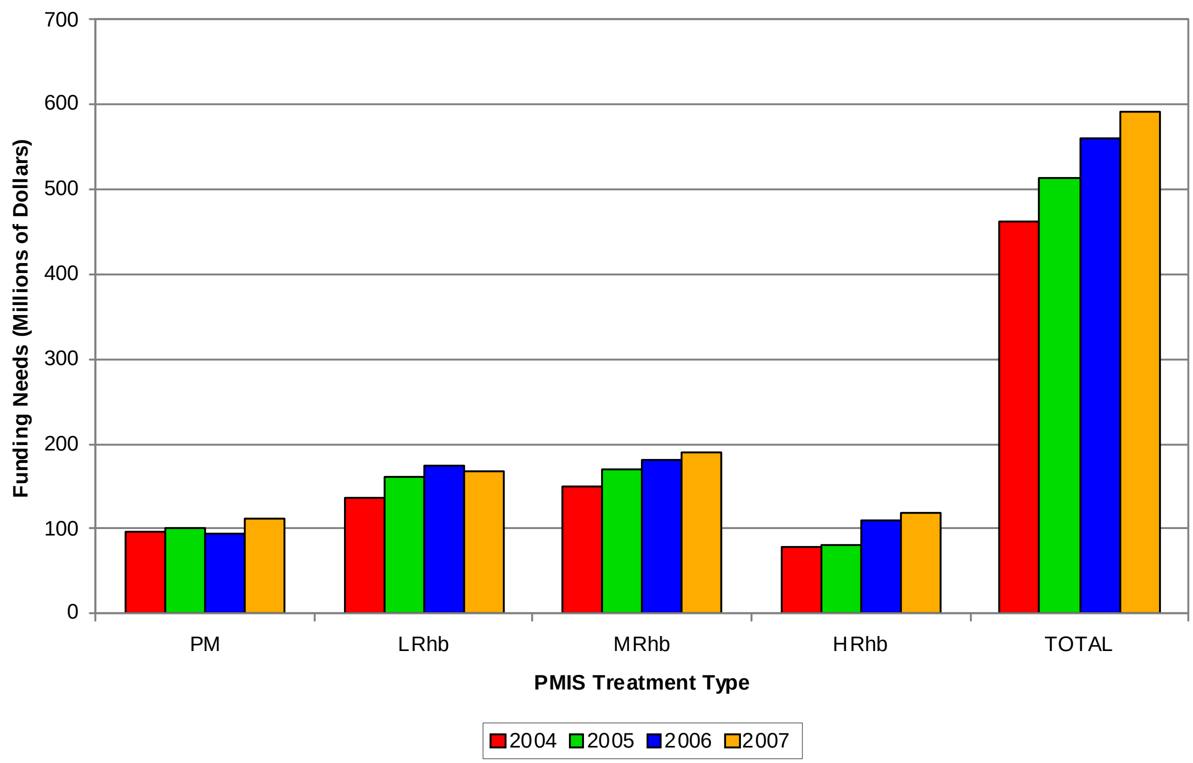


Figure 8.5 — FM Pavement Needs, FY 2004-2007.

The FY System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $95 million in 2006 to $113 million in 2007)
- Light Rehab (LRhb) decreased (from $175 million in 2006 to $168 million in 2007)
- Medium Rehab (MRhb) increased (from $181 million in 2006 to $191 million in 2007)
- Heavy Rehab (HRhb) increased (from $110 million in 2006 to $119 million in 2007)
- FM pavement needs increased (from $561 million in 2006 to $591 million in 2007).

Flexible Pavement Needs

Figure 8.6 shows the estimated pavement needs for flexible pavements for fiscal years 2004 through 2007.

Flexible pavements make up 92.31 percent of the TxDOT-maintained lane mileage, but only require 60.67 percent of the pavement needs.

$1,009 million is needed to repair flexible pavements in FY 2007.

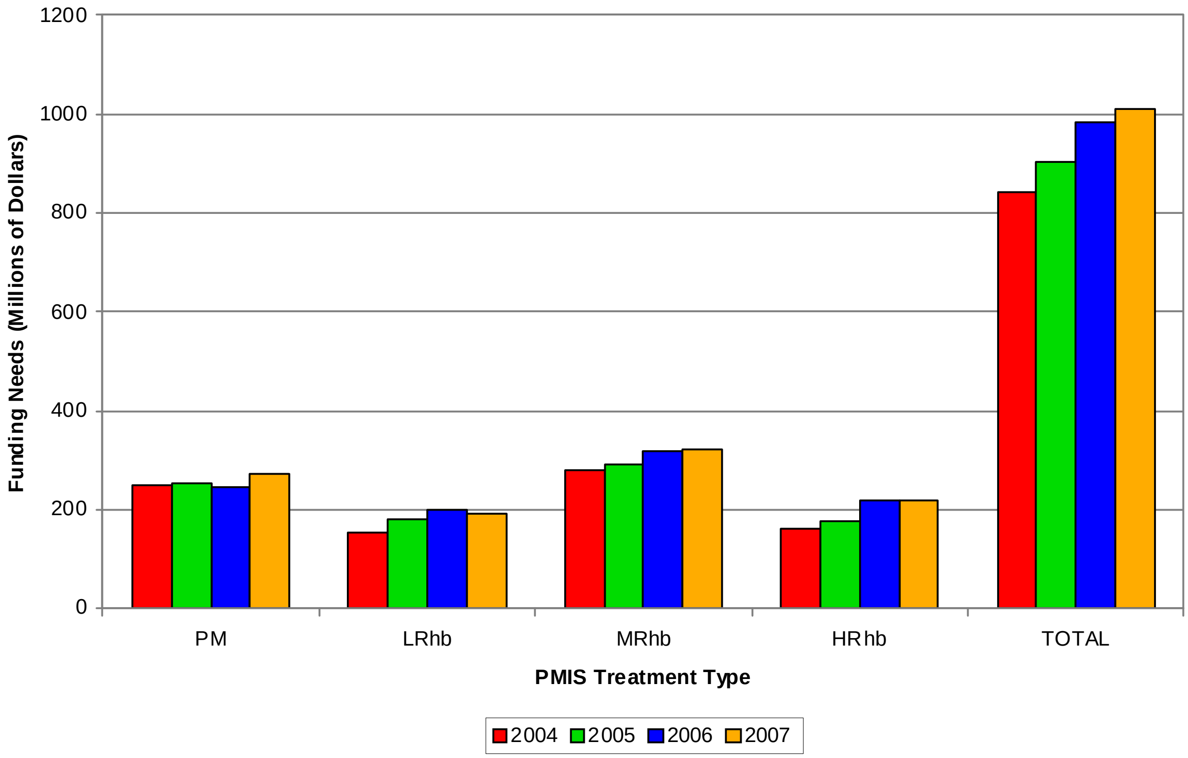


Figure 8.6 — Flexible Pavement Needs, FY 2004-2007.

The Flexible Pavement Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $247 million in 2006 to $274 million in 2007)
- Light Rehab (LRhb) decreased (from $198 million in 2006 to $193 million in 2007)
- Medium Rehab (MRhb) increased (from $319 million in 2006 to $322 million in 2007)
- Heavy Rehab (HRhb) decreased (from $220 million in 2006 to $219 million in 2007)
- Flexible pavement needs increased (from $985 million in 2006 to $1,009 million in 2007).

CRCP Pavement Needs

Figure 8.7 shows the estimated pavement needs for CRCP for fiscal years 2004 through 2007.

It should be noted that preventive maintenance (PM) treatments for CRCP are not defined in PMIS.

CRCP pavements make up only 5.44 percent of the TxDOT-maintained lane mileage, but require 25.86 percent of the pavement needs.

$430 million is needed to repair CRCP lane miles in FY 2007.

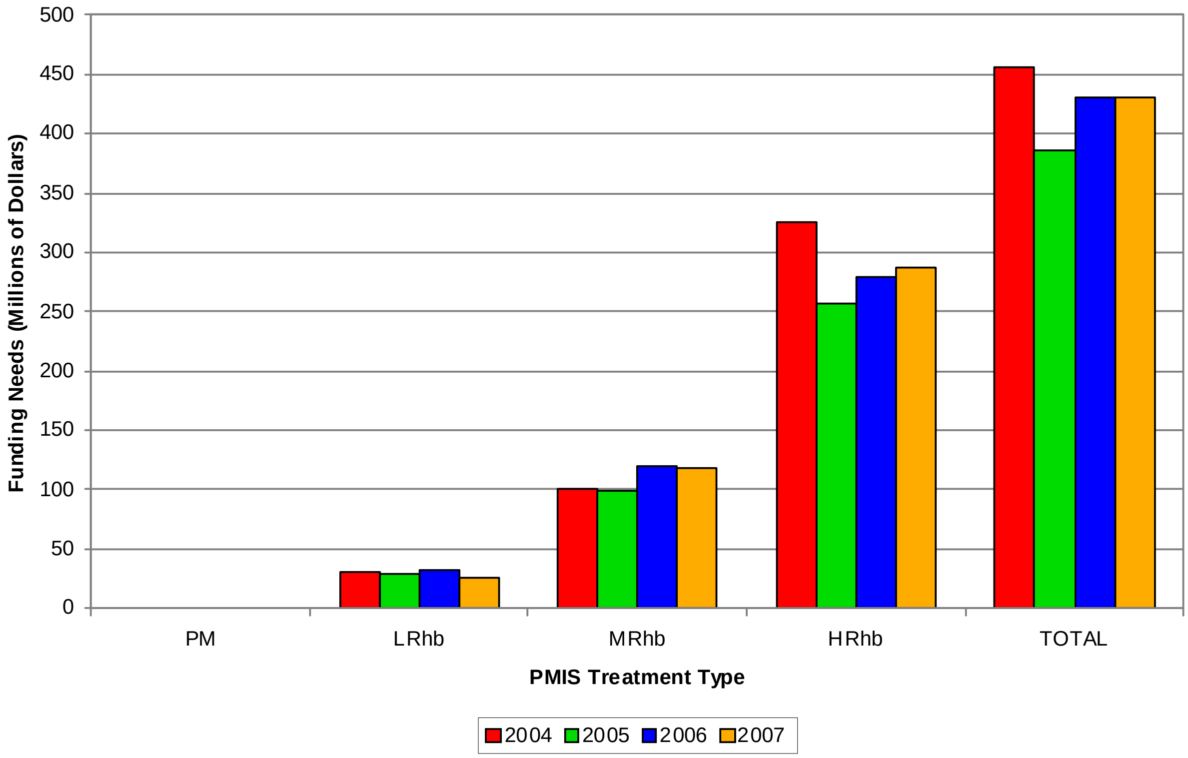


Figure 8.7 — CRCP Pavement Needs, FY 2004-2007.

The CRCP Needs Estimate shows that:

- Preventive Maintenance (PM) remained the same ($0 million in 2006 to $0 million in 2007)
- Light Rehab (LRhb) decreased (from $32 million in 2006 to $26 million in 2007)
- Medium Rehab (MRhb) decreased (from $119 million in 2006 to $118 million in 2007)
- Heavy Rehab (HRhb) increased (from $279 million in 2006 to $286 million in 2007)
- CRCP needs increased (from $430 million in 2006 to $430 million in 2007).

JCP Pavement Needs

Figure 8.8 shows the estimated pavement needs for JCP for fiscal years 2004 through 2007.

JCP pavements make up only 2.26 percent of the TxDOT-maintained lane mileage, but require 13.48 percent of the pavement needs.

$224 million is needed to repair JCP lane miles in FY 2007.

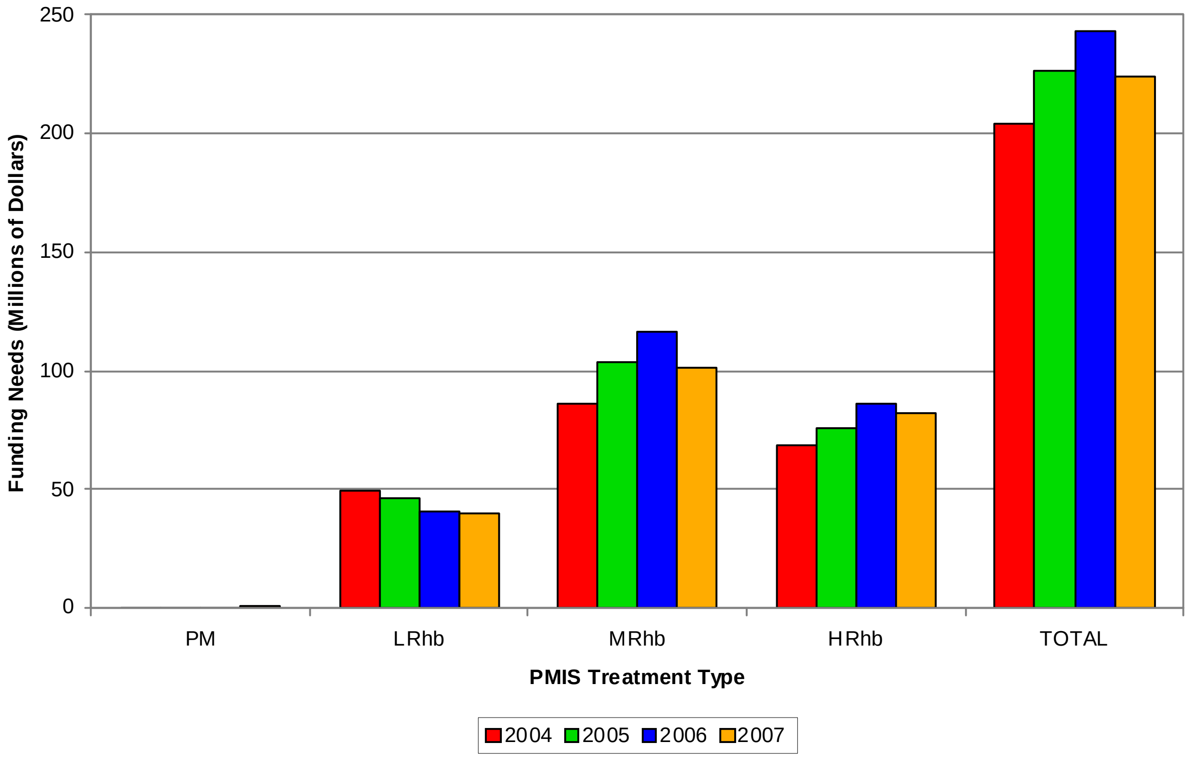


Figure 8.8 — JCP Pavement Needs, FY 2004-2007.

The JCP Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $1 million in 2006 to $1 million in 2007)
- Light Rehab (LRhb) decreased (from $41 million in 2006 to $40 million in 2007)
- Medium Rehab (MRhb) decreased (from $116 million in 2006 to $101 million in 2007)
- Heavy Rehab (HRhb) decreased (from $86 million in 2006 to $82 million in 2007)
- JCP needs decreased (from $244 million in 2006 to $224 million in 2007).

The Baytown Tunnel in Houston cost $10.8 million to build in 1953, and $30 million to remove in 1995.

Location of Preventive Maintenance Needs, FY 2006-2007

Maps 8.1 and 8.2 show preventive maintenance needs in each county for fiscal years 2006 and 2007. Counties in blue have the lowest need (less than $250,000) while counties in red have the highest need (more than $2,000,000).

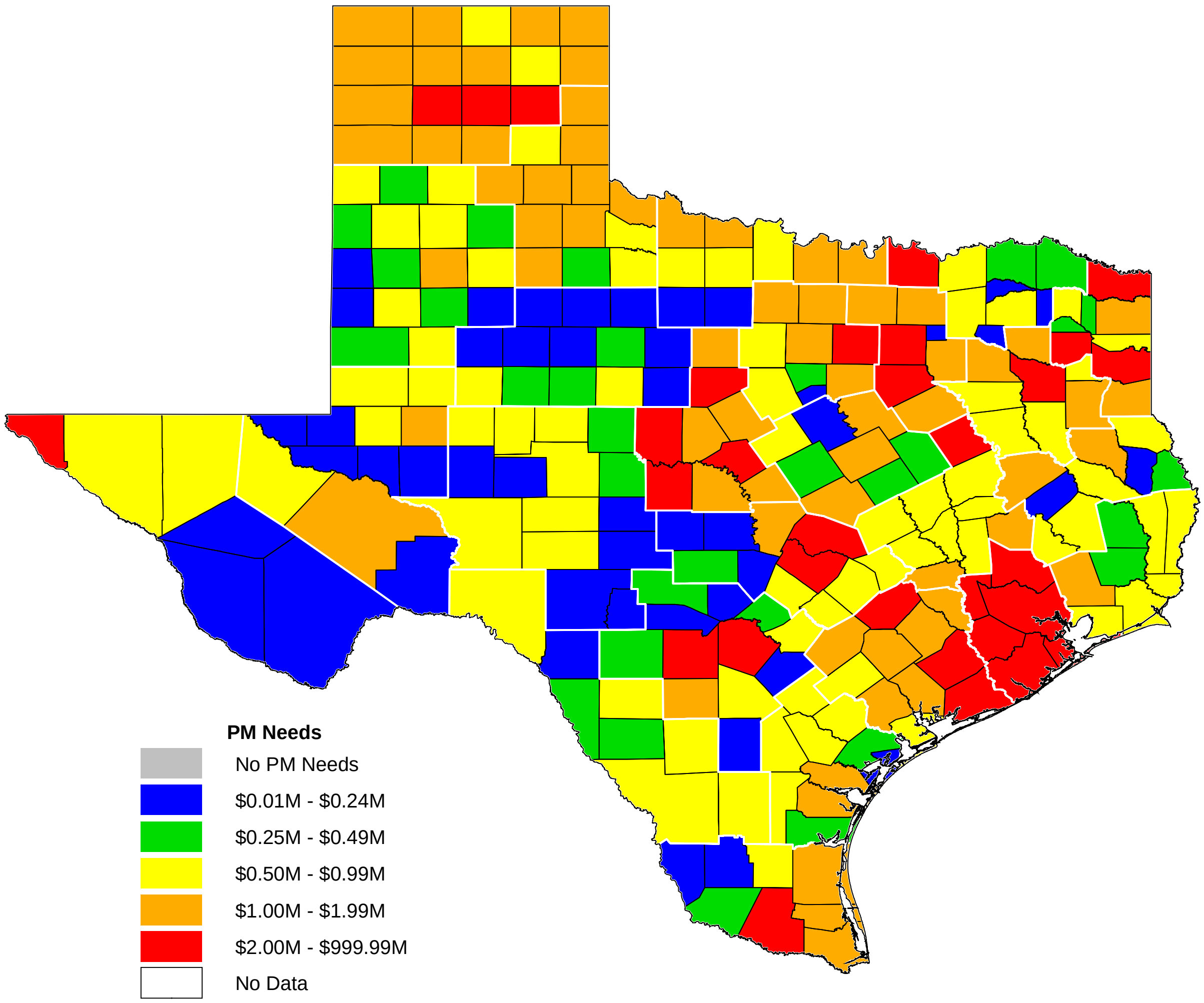
Preventive maintenance needs increased from $248 million in FY 2006 to $275 million in FY 2007, mainly because of increased Deep Rutting on ACP mileage. Treatments triggered by pavement age, ACP Failures, ACP Shallow Rutting, and ACP Longitudinal Cracking also went up. The Deep Rutting preventive maintenance treatments affected nearly 11,900 lane miles.

Increased amounts of Patching do not show up in the Needs Estimate because PMIS does not have any treatments specifically related to Patching. In essence, Patching is the treatment. This was not affected by the decision to remove ACP Patching from the PMIS Condition Score equation in FY 2007.

The improved FY 2007 Ride Quality had no effect on FY 2007 PM needs, because the PMIS Needs Estimate does not use PM treatments to "fix" ride quality.

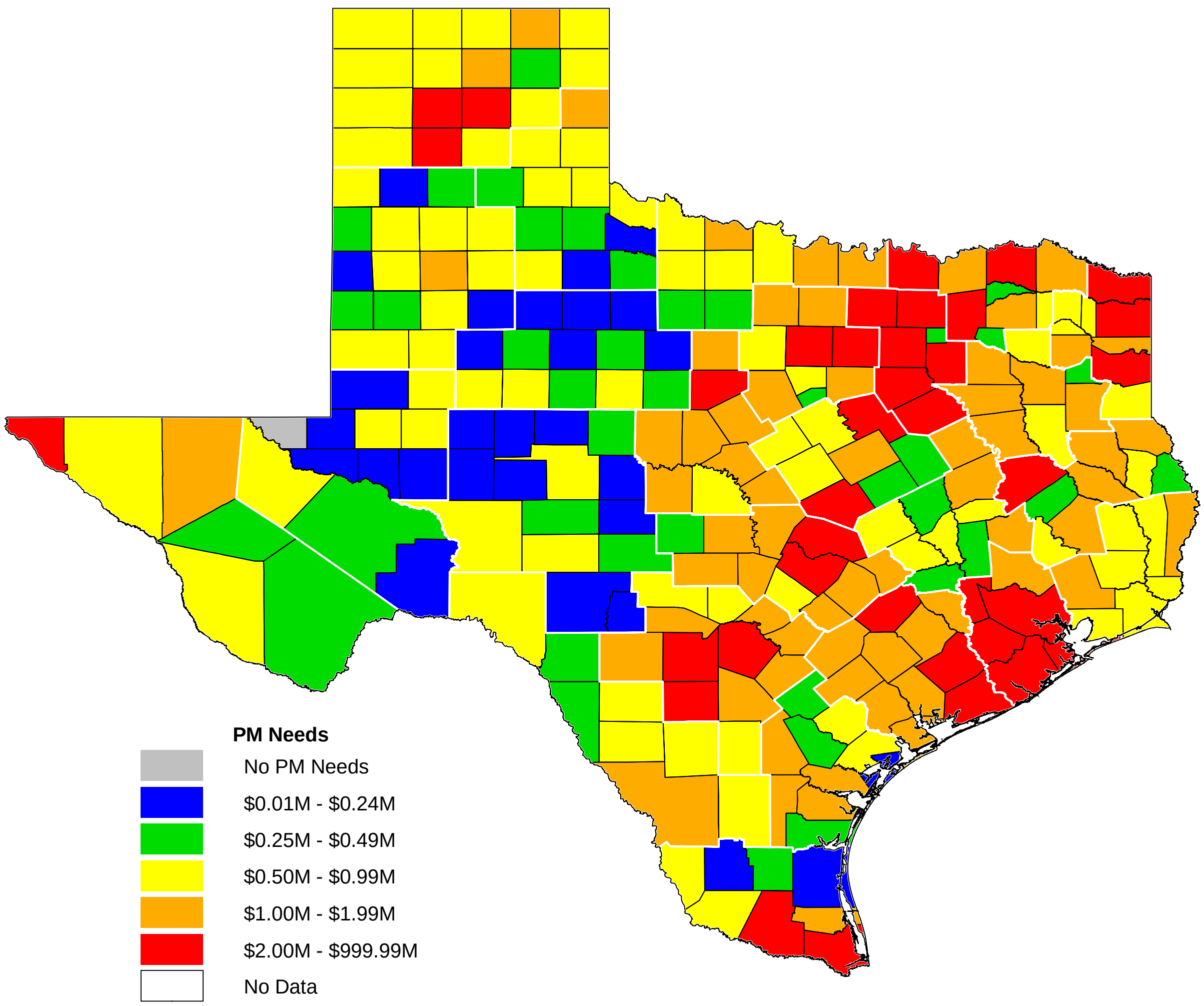
In PMIS, preventive maintenance primarily addresses non-load associated distress types on flexible pavements and JCP. PMIS also uses preventive maintenance to address small amounts of "deep" distress if the pavement is still in relatively good condition (no ride quality problems or other extensive distress). However, PMIS does not use preventive maintenance for CRCP or for correcting any kind of ride quality or subsurface structural problems.

Map 8.1 — Preventive Maintenance Needs, FY 2006.



Statewide Preventive Maintenance Needs (FY 2006) — $248 million

Map 8.2 — Preventive Maintenance Needs, FY 2007.



Statewide Preventive Maintenance Needs (FY 2007) — $275 million

Portions of IH 40 are among the earliest Interstate highways built in Texas. The Texas portion was completed years before it connected with the New Mexico portion in the mid-1970s. Source: TTI.

Location of Rehabilitation Needs, FY 2006-2007

Maps 8.3 and 8.4 show rehabilitation needs in each county for fiscal years 2006 and 2007. Counties in blue have the lowest need (less than $1,250,000) while counties in red have the highest need (more than $10,000,000).

Statewide rehab needs decreased from $1,411 million in FY 2006 to $1,389 million in FY 2007, mainly because of the improvement in overall statewide ride quality.

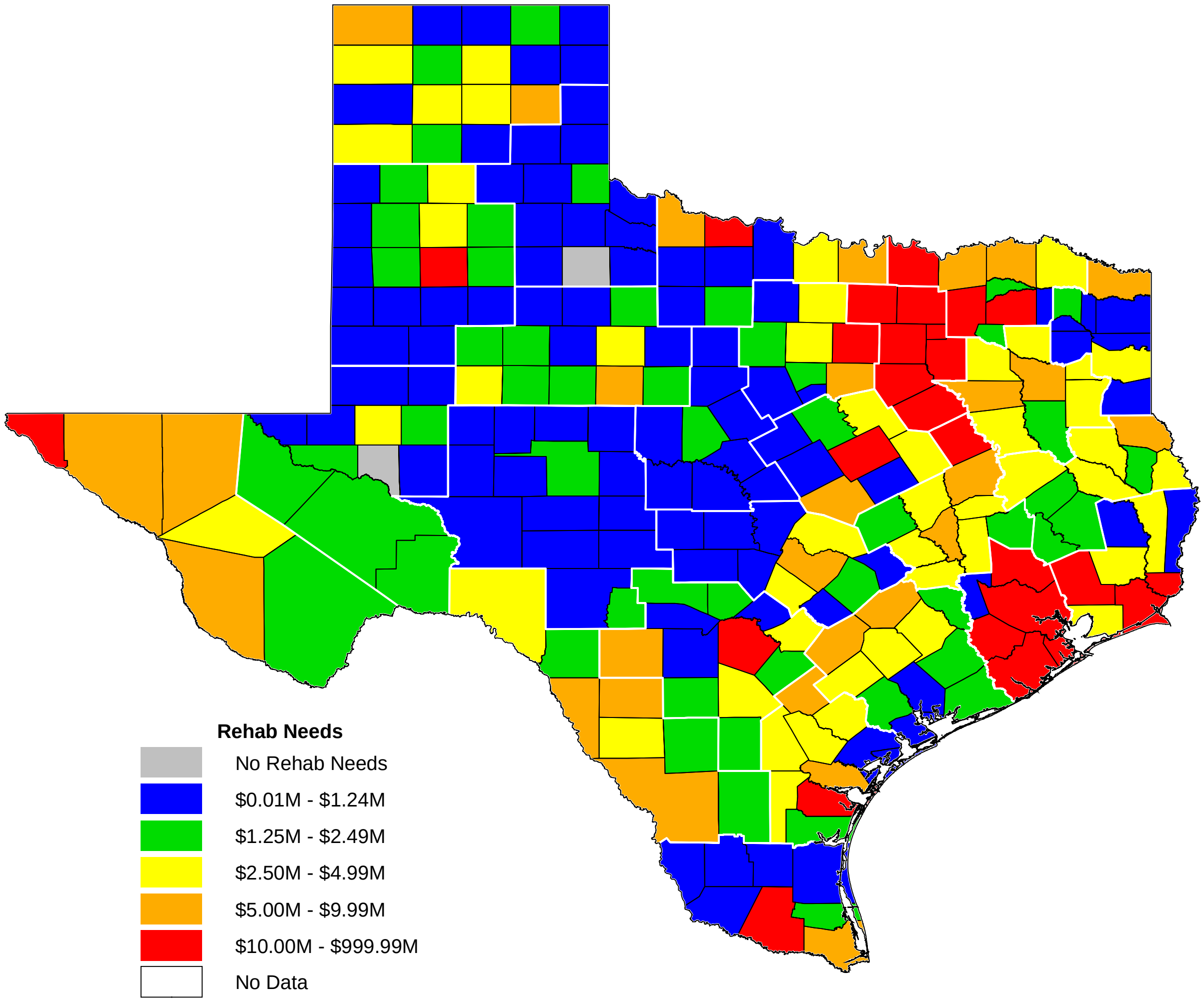
Some rehab treatment types did increase, however. Rehab treatments triggered by CRCP Punchouts, Asphalt Patches, and Concrete Patches increased. Treatments for PMIS Ride Score less than 1.5 also increased, as suggested by the statewide increase in mileage with "Poor" ride quality (shown in Chapter 1).

Ride quality continues to have a major effect on statewide rehab needs. Of the seven rehab treatments that increased the most in FY 2007, six of them were triggered by ride quality.

It should be noted that the PMIS Needs Estimate program places stricter standards for distress and ride quality in high-traffic areas, and these standards tend to produce higher estimated needs for metropolitan areas.

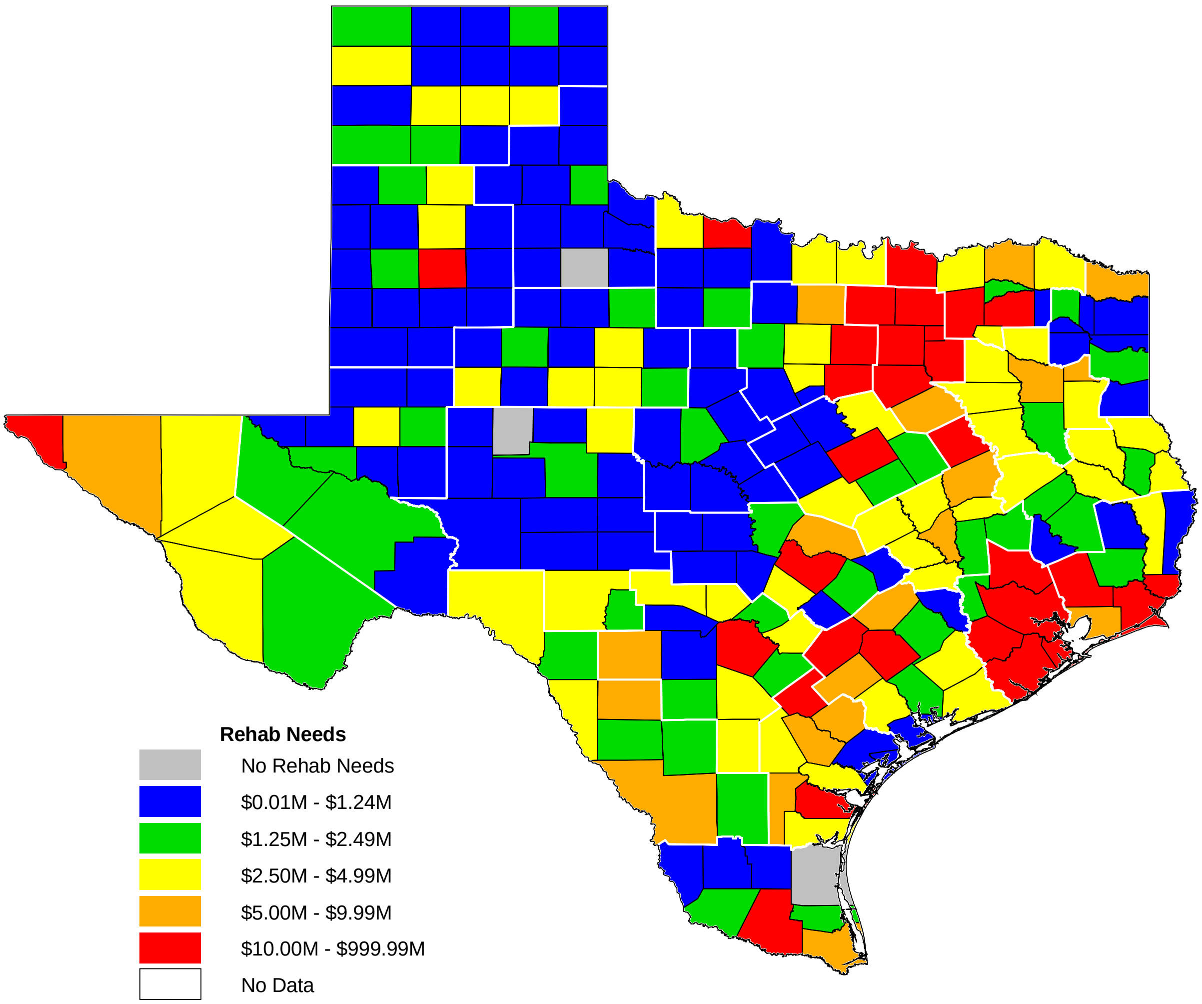
In PMIS, rehabilitation primarily addresses load-associated distress types to restore pavement structural strength, especially on sections with large amounts of "deep" distress. PMIS also uses rehabilitation to correct ride quality problems on rough roads. Pavement sections with smaller amounts of distress, or sections that have not been resurfaced in more than seven years, show up in the PM needs portion of the Needs Estimate.

Map 8.3 — Rehabilitation Needs, FY 2006.



Statewide Rehabilitation Needs (FY 2006) — $1,411 million

Map 8.4 — Rehabilitation Needs, FY 2007.



Statewide Rehabilitation Needs (FY 2007) — $1,389 million

Distribution of Lane Mile and Funding Needs, FY 2006-2007

Figure 8.9 shows the distribution of lane mile needs for fiscal years 2006 and 2007.

The percentage of lane miles needing treatment increased from 31 percent in FY 2006 to 34 percent in FY 2007, mainly because of increased amounts of flexible pavement distress. The percentage of lane miles needing Preventive Maintenance increased by 3 percent, but the percentage of lane miles needing Rehabilitation stayed the same (12 percent).

Figure 8.10 shows the distribution of funding needs for fiscal years 2006 and 2007.

The Preventive maintenance share of the pavement needs increased from 15 percent in FY 2006 to 17 percent in FY 2007. Of course, this decreased the rehab share from 85 percent in FY 2006 to 83 percent in FY 2007. PMIS estimated more mileage needing repair in FY 2007, but at slightly less cost per lane mile so the total needs did not go up as much.

Rehabilitation dominates funding percentages for the simple reason that the treatment costs are so much higher than preventive maintenance. That is why both lane mile and funding percentages must be reviewed when assessing overall pavement needs.

Figures 8.9 and 8.10 show the typical relationship between preventive maintenance and rehabilitation: preventive maintenance <u>does</u> most of the work, but rehabilitation <u>funds</u> most of the work. Using the FY 2007 results as an example, 16.54 percent of the total funding needs could be used for preventive maintenance to treat 21.56 percent of the lane miles; but it would take 83.46 percent of the total funding needs used for rehab to treat 12.03 percent of the lane miles. Preventive maintenance would thus seem to provide "more bang for the buck," but it would not provide the sub-surface structural repair that aging pavements need to carry current and future traffic volume and loads. However, overemphasis on rehabilitation would leave a very large amount of mileage to deteriorate under climate and traffic, and that would cause future rehab needs to increase even more rapidly than before. This would make it even harder to find the necessary funds to treat the deteriorating pavements effectively.

This balance between preventive maintenance and rehabilitation is especially important when developing work programs to meet the statewide pavement condition goal (90 percent "Good" or better) described in Chapter 7. This goal is essentially a rehab program. In most cases, preventive maintenance is not substantial enough to adequately repair mileage with a PMIS Condition Score less than 70. However, repairing the 10-15 percent of lane miles <u>not</u> in "Good" or better condition would take almost all of the current pavement funds, thus leaving nothing for repair of the 85-90 percent of the mileage that might drop below "Good" condition next year.

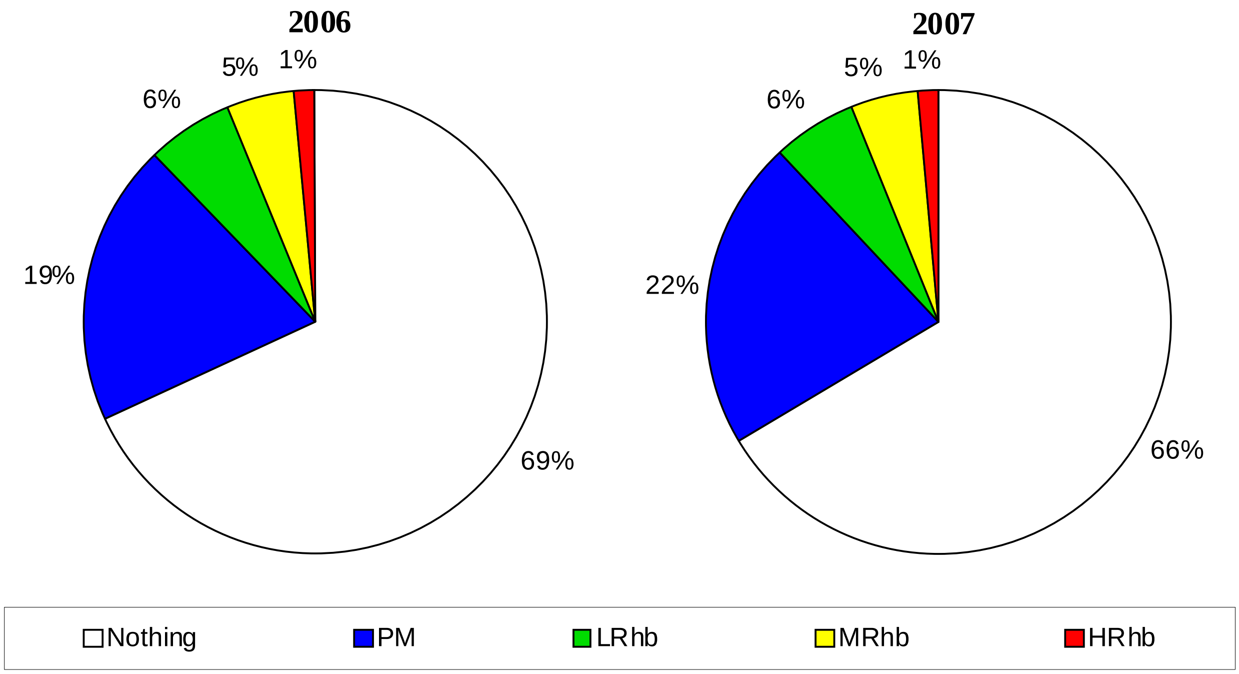


Figure 8.9 — Distribution of Lane Mile Needs, FY 2006-2007.

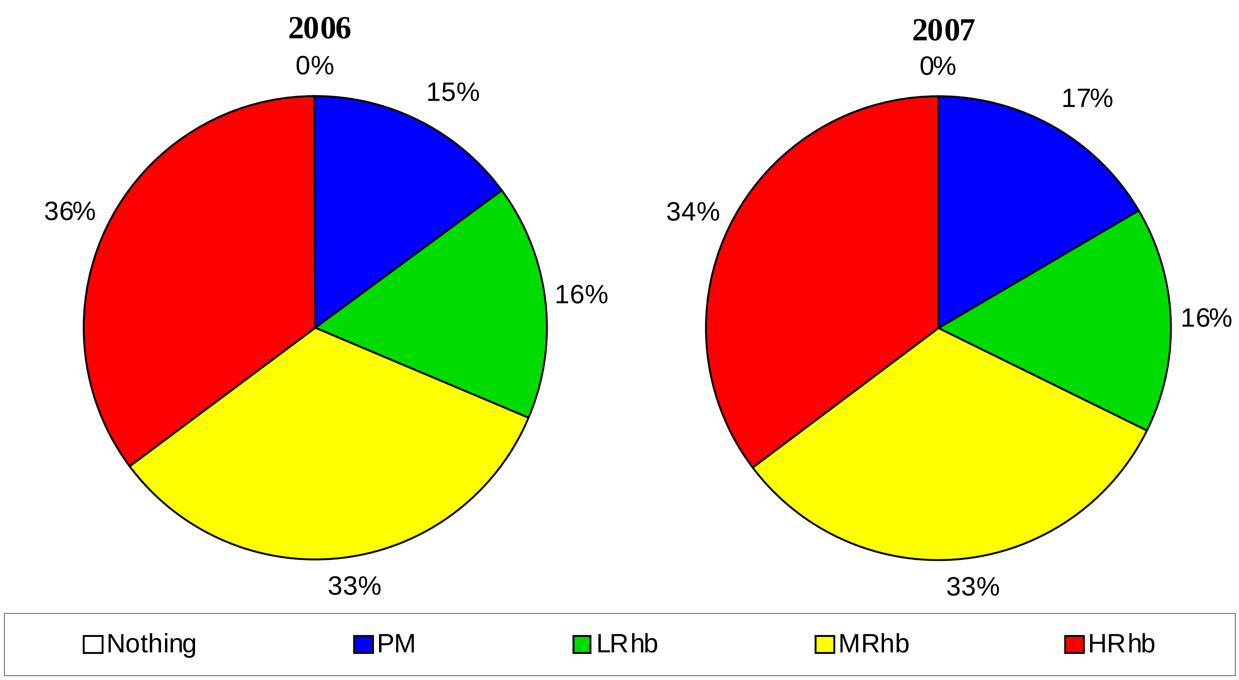


Figure 8.10 — Distribution of Funding Needs, FY 2006-2007.

The longest highway in Texas is US 83. It extends from the Oklahoma state line in the Panhandle near Perryton, to the Mexico border at Brownsville, 899 miles away.

Discussion

Statewide pavement needs in Texas increased very slightly to $1,664 million in FY 2007, despite a drop in rehabilitation needs.

Preventive maintenance needs increased from $248 million in FY 2006 to $275 million in FY 2007, mainly because of increased Deep Rutting on ACP mileage. Treatments triggered by pavement age, ACP Failures, ACP Shallow Rutting, and ACP Longitudinal Cracking also went up. The Deep Rutting preventive maintenance treatments affected nearly 11,900 lane miles.

Statewide rehab needs decreased from $1,411 million in FY 2006 to $1,389 million in FY 2007, mainly because of the improvement in overall statewide ride quality. However, rehab treatments for PMIS Ride Score less than 1.5 increased because of the statewide increase in mileage with "Poor" ride quality (shown in Chapter 1). Rehab treatments triggered by CRCP Punchouts, Asphalt Patches, and Concrete Patches also increased.

This needs estimate is provided to show trends only – it is not a total estimate of all pavement-related needs.

As mentioned in Chapter 1, overall construction costs rose by more than 21 percent in FY 2005 and by another 17 percent in FY 2006. The PMIS Needs Estimate costs used in this Chapter date back to FY 1993 and have not been adjusted to account for changes in treatment costs over time, so actual pavement repair costs would be even higher than shown in this report. Highway construction costs in Texas have risen by more than 97 percent since FY 1997. Assuming a three percent per year inflation rate dating back to FY 1993 suggests that the PMIS Needs Estimate results in this chapter should be increased by 122 percent to reflect April 2007 construction costs.

The PMIS Needs Estimate cost values in this Chapter are also only for pavement-related costs, and do not include right-of-way, bridge repair, capacity, safety, traffic control, or other roadside improvement costs.

Summary

Statewide pavement needs in Texas increased very slightly to $1,664 million in FY 2007, despite a drop in rehabilitation needs. Preventive maintenance needs increased from $248 million in FY 2006 to $275 million in FY 2007, mainly because of increased Deep Rutting on ACP mileage. Rehab needs decreased from $1,411 million in FY 2006 to $1,389 million in FY 2007, mainly because of the improvement in overall statewide ride quality.

On January 20, 1974, the maximum speed limit in Texas was reduced to 55 mph. About 17,200 signs were changed at a cost of about $621,000. In December 1995, the speed limit returned to 70 mph, costing TxDOT about $8 million.

Chapter 9 Summary

The overall condition of Texas pavements got slightly worse in FY 2007 mainly because of increased distress on asphalt pavements. Overall pavement distress got worse, but overall ride quality improved. A prolonged drought that began in mid-FY 2005 and lasted through all of FY 2006, rising material costs, increased competition for limited construction materials, and increased oilfield development traffic contributed to the decline in statewide pavement condition.

Pavement condition and distress trends were mixed, but ride quality improved for each of the four major highway systems (IH, US, SH, and FM) in FY 2007. IH and SH routes improved in all categories – condition, distress, ride, and “deep” distress. US highways improved in distress, “deep” distress, and ride, but the improvements were all very small, and were not enough to keep the overall condition from getting worse. FM roads improved in ride quality, but got worse in condition, distress, and “deep” distress.

ACP condition and distress got worse, but ride quality improved in FY 2007. “Deep” distress on improved because of a large reduction in Alligator Cracking. ACP had the best overall condition and ride quality of the three major pavement types in FY 2007. Shallow Rutting, Deep Rutting, Failures, and Longitudinal Cracking got worse; while Alligator Cracking, Transverse Cracking, Block Cracking, and Patching improved.

CRCP condition and distress improved, but ride quality got worse in FY 2007. “Deep” distress (Spalled Cracks and Asphalt Patches) on CRCP also improved. All CRCP distress types – Spalled Cracks, Punchouts, Asphalt Patches, and Concrete Patches – improved.

JCP condition and ride quality improved, but distress got very slightly worse in FY 2007. “Deep” distress (Failures, Shattered Slabs, and Slabs with Longitudinal Cracks) on JCP also improved. Failed Joints and Cracks, Failures, and Shattered Slabs improved, but Slabs with Longitudinal Cracks and Concrete Patches got worse.

The overall “Combined” level of service maintained on Texas flexible (ACP) pavements got worse in FY 2007, despite an improved level of service for Alligator Cracking. “Low-traffic” and “Medium-traffic” mileage got worse, while “High-traffic” level of service did not change.

PMIS-related performance measures show mixed condition trends for FY 2007. The statewide pavement condition goal percentage of lane miles in “Good” or better condition increased from 86.69 percent in FY 2006 to 86.76 percent in FY 2007. For UTP Category 1, the Distress Score 1-59 measure improved, but the Distress Score 70-89 and Ride Score 0.1-1.9 measures got worse. The Federal ride quality performance measures all improved in FY 2007.

Statewide pavement needs in Texas increased very slightly to $1,664 million in FY 2007, despite a drop in rehabilitation needs. Preventive maintenance needs increased from $248 million in FY 2006 to $275 million in FY 2007, mainly because of increased Deep Rutting on ACP mileage. Rehab needs decreased from $1,411 million in FY 2006 to $1,389 million in FY 2007, mainly because of the improvement in overall statewide ride quality.

Map 9.1 — Location of Texas Counties.

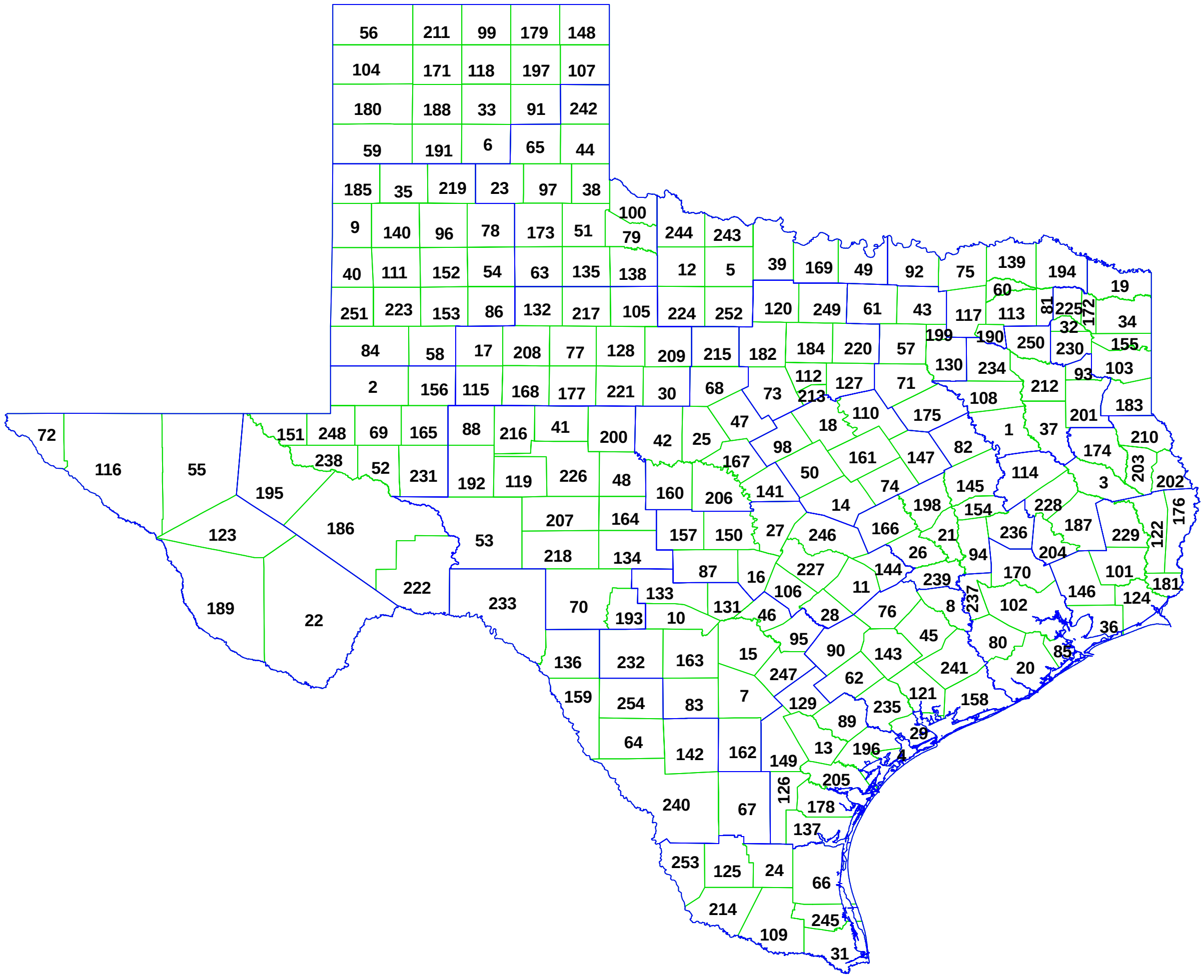


Table 9.1 — Texas Counties.

County			County			County			County		
Number	Name	District	Number	Name	District	Number	Name	District	Number	Name	District
1	Anderson	TYL	65	Donley	CHS	129	Karnes	CRP	192	Reagan	SJT
2	Andrews	ODA	66	Kenedy	PHR	130	Kaufman	DAL	193	Real	SJT
3	Angelina	LFK	67	Duval	LRD	131	Kendall	SAT	194	Red River	PAR
4	Aransas	CRP	68	Eastland	BWD	66	Kenedy	PHR	195	Reeves	ODA
5	Archer	WFS	69	Ector	ODA	132	Kent	ABL	196	Refugio	CRP
6	Armstrong	AMA	70	Edwards	SJT	133	Kerr	SAT	197	Roberts	AMA
7	Atascosa	SAT	71	Ellis	DAL	134	Kimble	SJT	198	Robertson	BRY
8	Austin	YKM	72	El Paso	ELP	135	King	CHS	199	Rockwall	DAL
9	Bailey	LBB	73	Erath	FTW	136	Kinney	LRD	200	Runnels	SJT
10	Bandera	SAT	74	Falls	WAC	137	Kleberg	CRP	201	Rusk	TYL
11	Bastrop	AUS	75	Fannin	PAR	138	Knox	CHS	202	Sabine	LFK
12	Baylor	WFS	76	Fayette	YKM	139	Lamar	PAR	203	San Augustine	LFK
13	Bee	CRP	77	Fisher	ABL	140	Lamb	LBB	204	San Jacinto	LFK
14	Bell	WAC	78	Floyd	LBB	141	Lampasas	BWD	205	San Patricio	CRP
15	Bexar	SAT	79	Foard	CHS	142	Lasalle	LRD	206	San Saba	BWD
16	Blanco	AUS	80	Fort Bend	HOU	143	Lavaca	YKM	207	Schleicher	SJT
17	Borden	ABL	81	Franklin	PAR	144	Lee	AUS	208	Scurry	ABL
18	Bosque	WAC	82	Freestone	BRY	145	Leon	BRY	209	Shackelford	ABL
19	Bowie	ATL	83	Frio	SAT	146	Liberty	BMT	210	Shelby	LFK
20	Brazoria	HOU	84	Gaines	LBB	147	Limestone	WAC	211	Sherman	AMA
21	Brazos	BRY	85	Galveston	HOU	148	Lipscomb	AMA	212	Smith	TYL
22	Brewster	ELP	86	Garza	LBB	149	Live Oak	CRP	213	Somervell	FTW
23	Briscoe	CHS	87	Gillespie	AUS	150	Llano	AUS	214	Starr	PHR
24	Brooks	PHR	88	Glasscock	SJT	151	Loving	ODA	215	Stephens	BWD
25	Brown	BWD	89	Goliad	CRP	152	Lubbock	LBB	216	Sterling	SJT
26	Burleson	BRY	90	Gonzales	YKM	153	Lynn	LBB	217	Stonewall	ABL
27	Burnet	AUS	91	Gray	AMA	154	Madison	BRY	218	Sutton	SJT
28	Caldwell	AUS	92	Grayson	PAR	155	Marion	ATL	219	Swisher	LBB
29	Calhoun	YKM	93	Gregg	TYL	156	Martin	ODA	220	Tarrant	FTW
30	Callahan	ABL	94	Grimes	BRY	157	Mason	AUS	221	Taylor	ABL
31	Cameron	PHR	95	Guadalupe	SAT	158	Matagorda	YKM	222	Terrell	ODA
32	Camp	ATL	96	Hale	LBB	159	Maverick	LRD	223	Terry	LBB
33	Carson	AMA	97	Hall	CHS	160	McCulloch	BWD	224	Throckmorton	WFS
34	Cass	ATL	98	Hamilton	WAC	161	McLennan	WAC	225	Titus	ATL
35	Castro	LBB	99	Hansford	AMA	162	McMullen	SAT	226	Tom Green	SJT
36	Chambers	BMT	100	Hardeman	CHS	163	Medina	SAT	227	Travis	AUS
37	Cherokee	TYL	101	Hardin	BMT	164	Menard	SJT	228	Trinity	LFK
38	Childress	CHS	102	Harris	HOU	165	Midland	ODA	229	Tyler	BMT
39	Clay	WFS	103	Harrison	ATL	166	Milam	BRY	230	Upshur	ATL
40	Cochran	LBB	104	Hartley	AMA	167	Mills	BWD	231	Upton	ODA
41	Coke	SJT	105	Haskell	ABL	168	Mitchell	ABL	232	Uvalde	SAT
42	Coleman	BWD	106	Hays	AUS	169	Montague	WFS	233	Val Verde	LRD
43	Collin	DAL	107	Hemphill	AMA	170	Montgomery	HOU	234	Van Zandt	TYL
44	Collingsworth	CHS	108	Henderson	TYL	171	Moore	AMA	235	Victoria	YKM
45	Colorado	YKM	109	Hidalgo	PHR	172	Morris	ATL	236	Walker	BRY
46	Comal	SAT	110	Hill	WAC	173	Motley	CHS	237	Waller	HOU
47	Comanche	BWD	111	Hockley	LBB	174	Nacogdoches	LFK	238	Ward	ODA
48	Concho	SJT	112	Hood	FTW	175	Navarro	DAL	239	Washington	BRY
49	Cooke	WFS	113	Hopkins	PAR	176	Newton	BMT	240	Webb	LRD
50	Coryell	WAC	114	Houston	LFK	177	Nolan	ABL	241	Wharton	YKM
51	Cottle	CHS	115	Howard	ABL	178	Nueces	CRP	242	Wheeler	CHS
52	Crane	ODA	116	Hudspeth	ELP	179	Ochiltree	AMA	243	Wichita	WFS
53	Crockett	SJT	117	Hunt	PAR	180	Oldham	AMA	244	Wilbarger	WFS
54	Crosby	LBB	118	Hutchinson	AMA	181	Orange	BMT	245	Willacy	PHR
55	Culberson	ELP	119	Irion	SJT	182	Palo Pinto	FTW	246	Williamson	AUS
56	Dallam	AMA	120	Jack	FTW	183	Panola	ATL	247	Wilson	SAT
57	Dallas	DAL	121	Jackson	YKM	184	Parker	FTW	248	Winkler	ODA
58	Dawson	LBB	122	Jasper	BMT	185	Parmer	LBB	249	Wise	FTW
59	Deaf Smith	AMA	123	Jeff Davis	ELP	186	Pecos	ODA	250	Wood	TYL
60	Delta	PAR	124	Jefferson	BMT	187	Polk	LFK	251	Yoakum	LBB
61	Denton	DAL	125	Jim Hogg	PHR	188	Potter	AMA	252	Young	WFS
62	De Witt	YKM	126	Jim Wells	CRP	189	Presidio	ELP	253	Zapata	PHR
63	Dickens	CHS	127	Johnson	FTW	190	Rains	PAR	254	Zavala	LRD
64	Dimmit	LRD	128	Jones	ABL	191	Randall	AMA			

Map 9.2 — Location of TxDOT Districts.

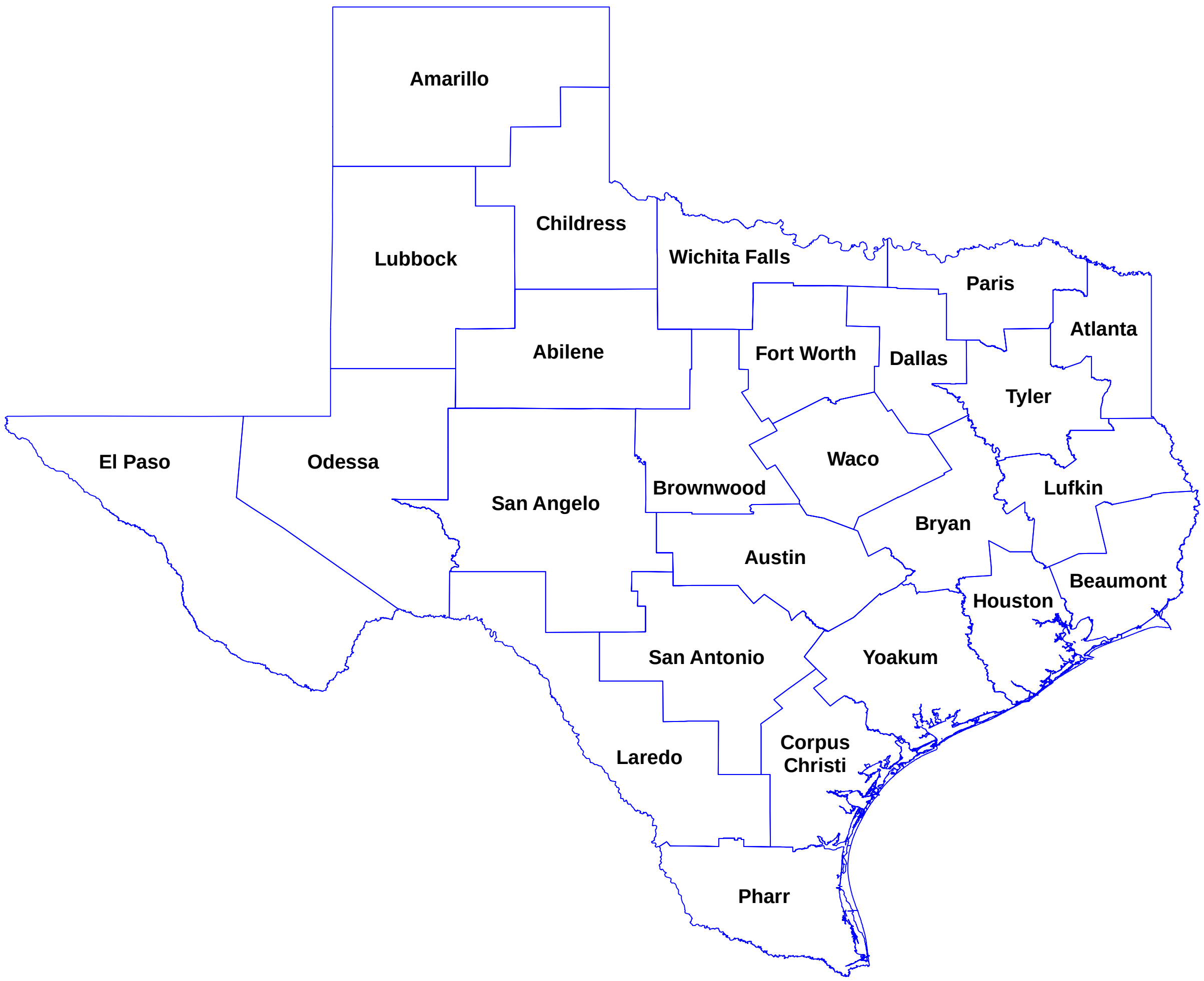


Table 9.2 — TxDOT Districts.

District		District		District		District		District	
Name	Abbreviation	Name	Abbreviation	Name	Abbreviation	Name	Abbreviation	Name	Abbreviation
Abilene	ABL	Brownwood	BWD	El Paso	ELP	Lufkin	LFK	San Antonio	SAT
Amarillo	AMA	Bryan	BRY	Fort Worth	FTW	Odessa	ODA	Tyler	TYL
Atlanta	ATL	Childress	CHS	Houston	HOU	Paris	PAR	Waco	WAC
Austin	AUS	Corpus Christi	CRP	Laredo	LRD	Pharr	PHR	Wichita Falls	WFS
Beaumont	BMT	Dallas	DAL	Lubbock	LBB	San Angelo	SJT	Yoakum	YKM

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