TEXAS DEPARTMENT OF TRANSPORTATION

Condition of Texas Pavements

PMIS Annual Report, FY 2002-2005

Condition of Texas Pavements

Pavement Management Information System (PMIS)
Annual Report FY 2002-2005

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

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What's New in This Report?

- Bar charts of PMIS Condition Score, Distress Score, and Ride Score have been changed from letter class categories ("A," "B," "C," "D," and "F") to descriptive categories ("Very Good," "Good," "Fair," "Poor," and "Very Poor").
- 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 3 ACP distress maps have been changed to show the average rating for each distress type.
- Chapter 7 UTP Category 1 tables have been added that show the percentage of lane miles in each district with Distress Score 1-59, Ride Score 0.1-1.9, Distress Score 70-89, and Distress Score 60-69.
- Chapter 7 also contains a table for the Federal Highway Administration (FHWA) strategic goal for ride quality on National Highway System (NHS) routes: percentage of NHS lane miles with IRI less than 170 inches per mile.

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.
- 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 7 contains expanded information about the Texas Transportation Commission's 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.
- Data analyzed in this report was obtained from all PMIS sections, mainlane roadbeds, Condition Scores greater than 0, and excluding sections under construction. This analysis was consistent for the entire report except for the Statewide Pavement Condition Goal, the UTP Category 1 tables, and the NHS ride quality table in Chapter 7. The Statewide Pavement Condition Goal pages were based on all PMIS sections, mainlanes and frontage roads, Condition Scores greater than 0, and excluding sections under construction. The UTP Category 1 pages were based on all PMIS sections, mainlanes and frontage roads, Distress Score or Ride Score greater than 0 (where applicable), and excluding sections under construction. The NHS ride quality table was based on NHS sections, mainlanes only, with IRI left and right wheelpath greater than 0.

Cover Photo:
SH 70, North of Turkey, Hall County, Childress District.
Photo by Kevin Stillman, TxDOT.

Executive Summary

This report describes the condition of Texas pavements in Fiscal Year 2005 and during the four-year FY 2002-2005 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.

The overall condition of Texas pavements improved in FY 2005 to the highest level in four years because of improved distress, even though statewide ride quality got worse. In the third year of the Texas Transportation Commission's ten-year statewide pavement condition goal (90 percent "Good" or better by FY 2012), the percentage of lane miles (mainlanes and frontage roads) in "Good" or better condition was 87.34 percent, up from 87.02 percent in FY 2004. The rate of improvement slowed, though, and if the FY 2005 rate continues, it will not be possible to meet the FY 2012 pavement condition goal.

Pavement condition and distress improved, but ride quality got worse, for all highway systems. IH mileage had the best overall ride quality but the worst overall distress; US had the best overall condition; SH had the worst overall condition; and FM had the best overall distress but the worst overall ride quality. By pavement type, ACP condition and distress improved, but ride quality got worse; CRCP condition, distress, and ride quality improved; and JCP condition, distress, and ride quality got worse.

Five of the eight ACP distress types – Shallow Rutting, Deep Rutting, Failures, Alligator Cracking, and Transverse Cracking – increased in FY 2005. A large decrease in the amount of ACP Patching offset the other distress increases and lowered overall ACP distress. All CRCP distress types decreased, with Spalled Cracks showing the largest decrease. For JCP, three of the five distress types – Failed Joints and Cracks, Failures, and Shattered Slabs – decreased, but increases in the amount of Slabs with Longitudinal Cracks and Concrete Patching were enough to increase overall JCP distress.

The overall level of service maintained on Texas flexible (ACP) pavements got worse in FY 2005, despite a slight improvement in Alligator Cracking level of service. All traffic levels — "High," "Medium," and "Low" — provided a lower level of service in FY 2005.

UTP Category 1 performance measures showed decreasing lane miles needing repair based on pavement distress, but increasing lane miles needing repair because of ride quality.

The total funding needed to repair Texas pavements increased to $1,590 million in FY 2005, despite improvements in overall distress and condition. Total pavement needs decreased for IH, US, SH, and CRCP; but increased for FM, ACP, and JCP. Rehabilitation needs increased to $1,263 million, and preventive maintenance needs increased to $327 million. Increased amounts of ACP Deep Rutting, Longitudinal Cracking on high-traffic ACP, ACP Transverse Cracking, and ride quality problems on ACP and JCP caused the increase in statewide pavement needs.

The "Texas Highway Department" was created on April 4, 1917, during the 35th session of the Texas Legislature. The department began operations on June 4, 1917. In 1975, the Legislature increased the responsibilities of the Texas Highway Department by merging it with the Texas Mass Transportation Commission to form the "State Department of Highways and Public Transportation." Then in 1991, the Legislature combined the State Department of Highways and Public Transportation, the Department of Aviation, and the Texas Motor Vehicle Commission to create the Texas Department of Transportation (TxDOT).

Table of Contents

List of Figures

List of Maps

List of Tables

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.

Average PMIS Scores

Figure 1.1 shows average PMIS Scores (Condition, Distress, and Ride) statewide from fiscal years (FY) 2002 through 2005. Average pavement condition and distress increased, but ride quality decreased in FY 2005.

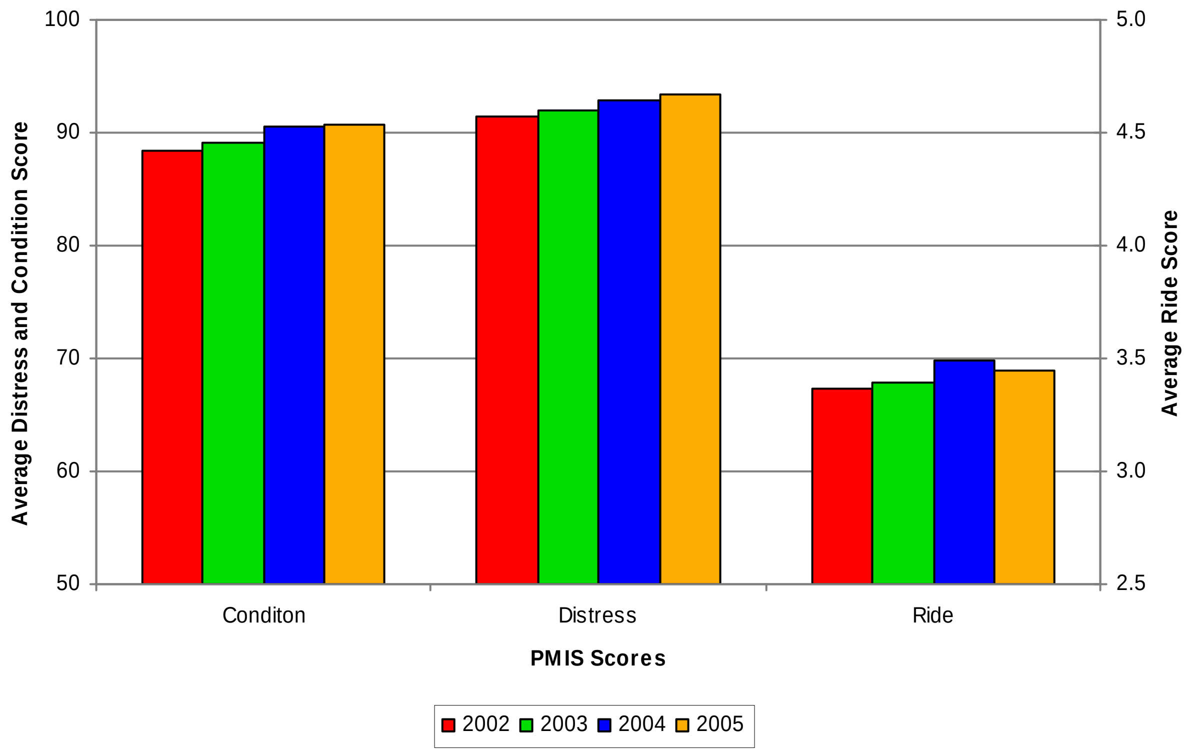


Figure 1.1 — Average PMIS Scores (with Ride), FY 2002-2005.

Figure 1.2 shows average PMIS Scores (Condition, Distress, and IRI) statewide from fiscal years (FY) 2002 through 2005.

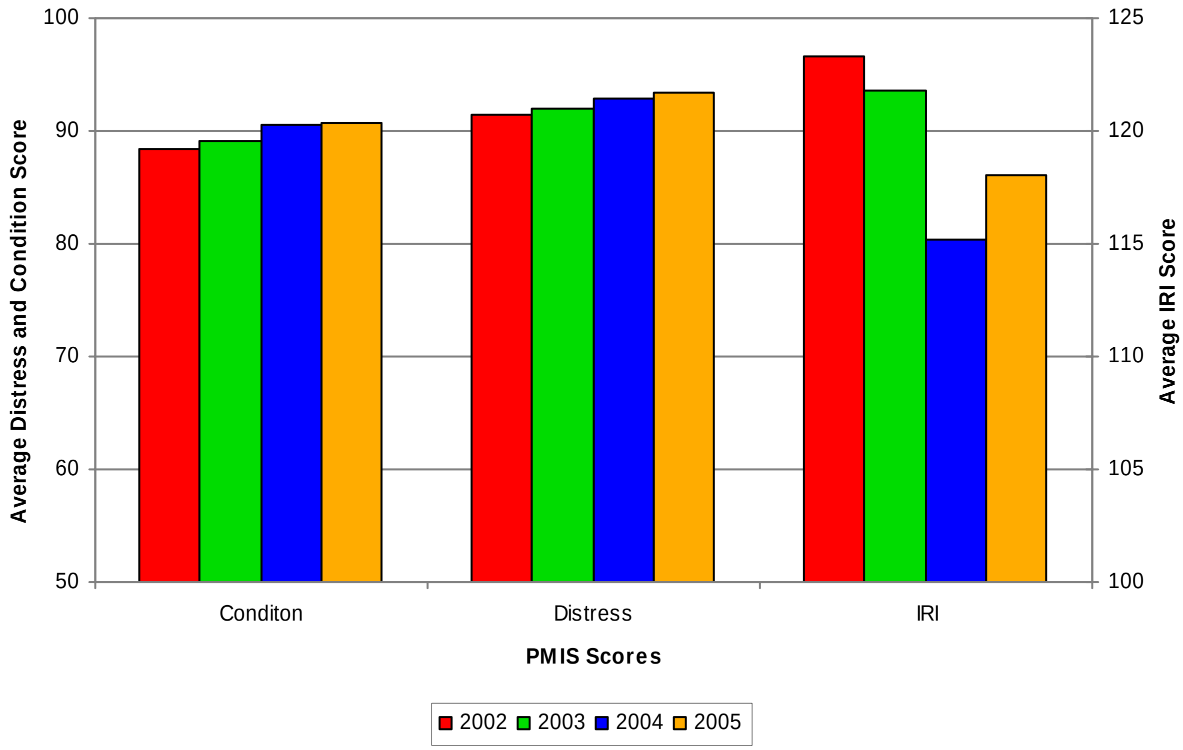


Figure 1.2 — Average PMIS Scores (with IRI), FY 2002-2005.

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 areas, it also provides advance warning of pavement problems in high-traffic, high-speed, areas where scheduling treatments might be more difficult.

Figure 1.3 shows the statewide distribution of Condition Score classes for fiscal years 2002 through 2005. The Condition Score is a combination of ride quality measurements and distress ratings, adjusted for traffic and speed.

74.84 percent of the mainlane mileage was in "Very Good" condition in FY 2005.

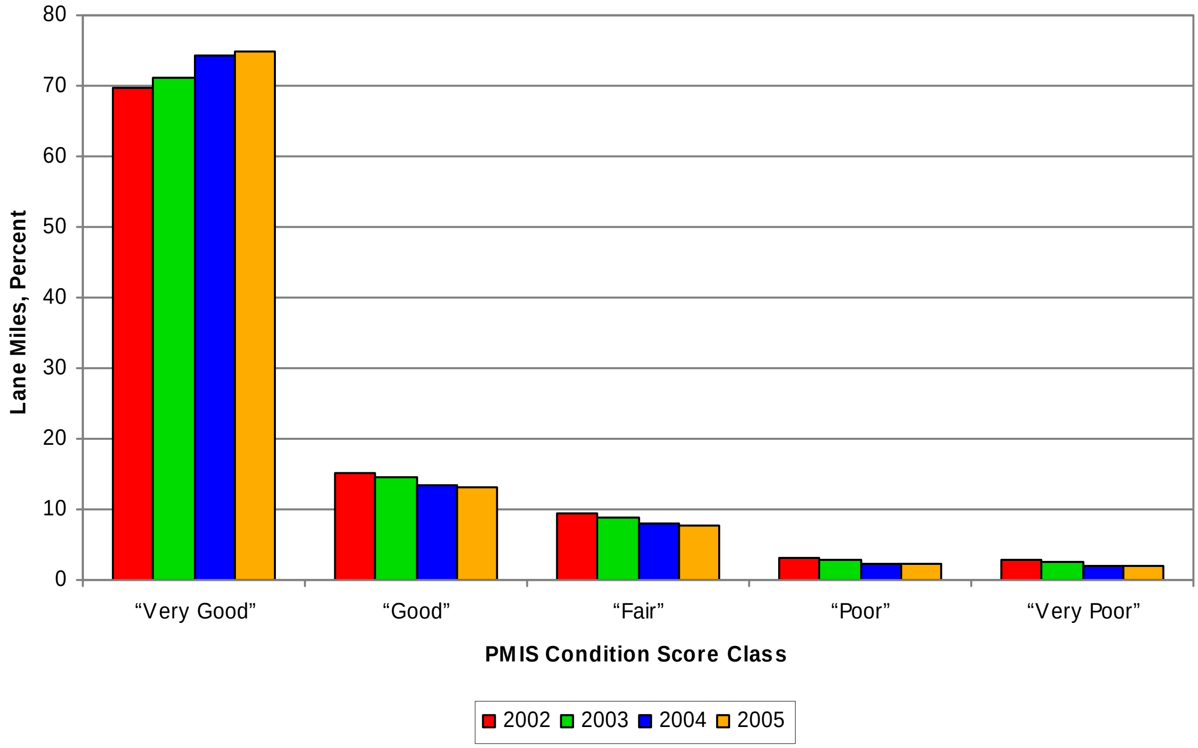


Figure 1.3 — Condition Score Classes, FY 2002-2005.

The Condition Score Classes show that:

- "Very Good" mileage increased (from 74.18% in 2004 to 74.84% in 2005)
- "Good" mileage decreased (from 13.36% in 2004 to 13.09% in 2005)
- "Fair" mileage decreased (from 8.05% in 2004 to 7.77% in 2005)
- "Poor" mileage increased (from 2.36% in 2004 to 2.40% in 2005)
- "Very Poor" mileage decreased (from 2.06% in 2004 to 1.90% in 2005).

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.

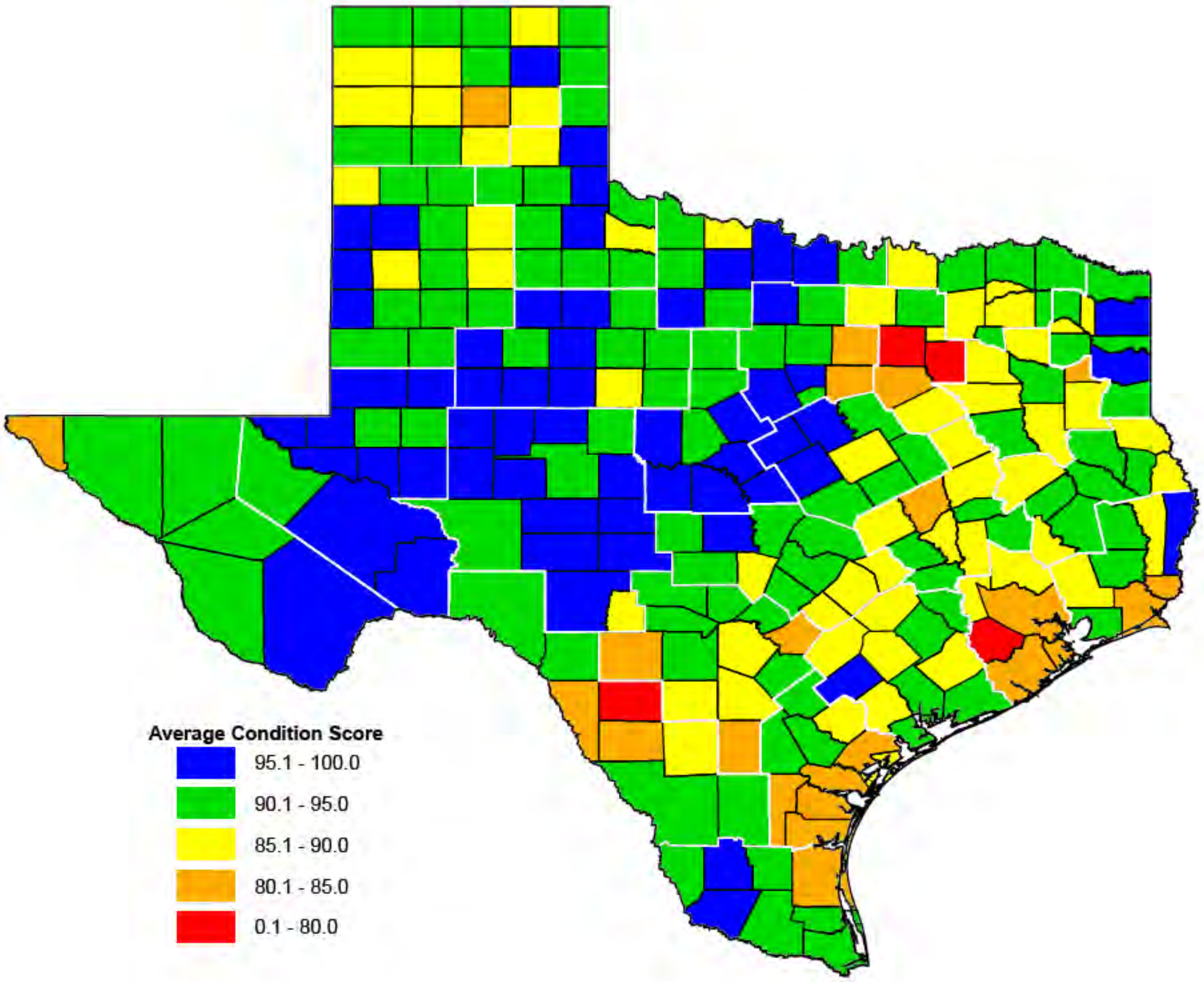
Condition Score Maps, FY 2004-2005

Maps 1.1 and 1.2 show average PMIS Condition Scores in each county for fiscal years 2004 and 2005. 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.

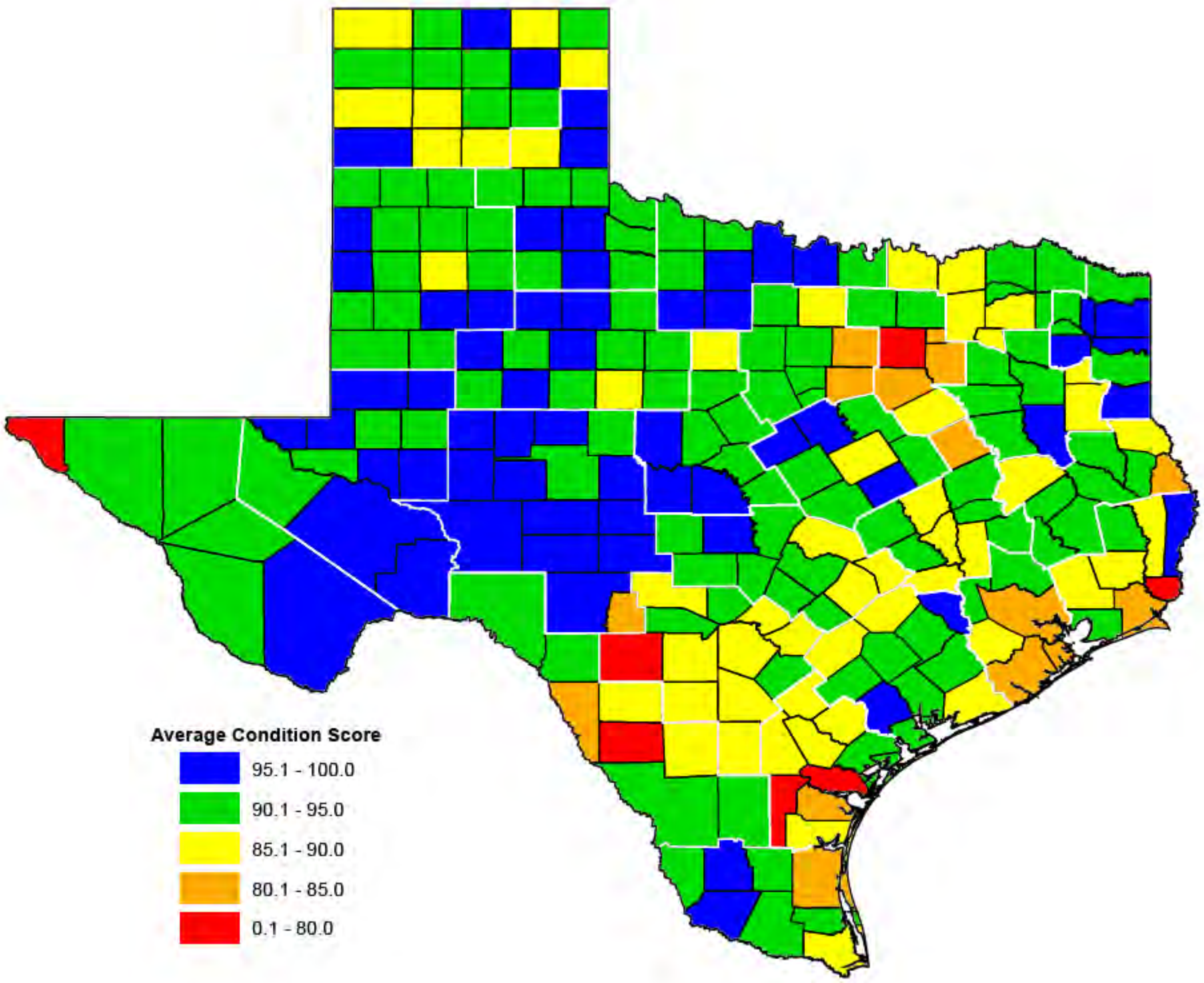
Overall pavement condition improved in FY 2005 because of improved distress, despite worsening ride quality. As will be discussed in Chapters 2-5, condition improved for all highway systems, and for all pavement types except JCP. Many, but not all, areas of the state provide "Very Good" (90-100) pavement condition.

The Condition Score maps show that Texas pavements provide mainly good condition, in terms of distress and ride quality.

Map 1.1 — Average Condition Scores, FY 2004.



Map 1.2 — Average Condition Scores, FY 2005.



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.

Figure 1.4 shows the statewide distribution of Distress Score classes for fiscal years 2002 through 2005. Distress Scores are determined from rating visually-apparent pavement distresses such as rutting, cracking, patching, and various types of failures.

80.52 percent of mainlane mileage was "Very Good" in terms of pavement distress in FY 2005.

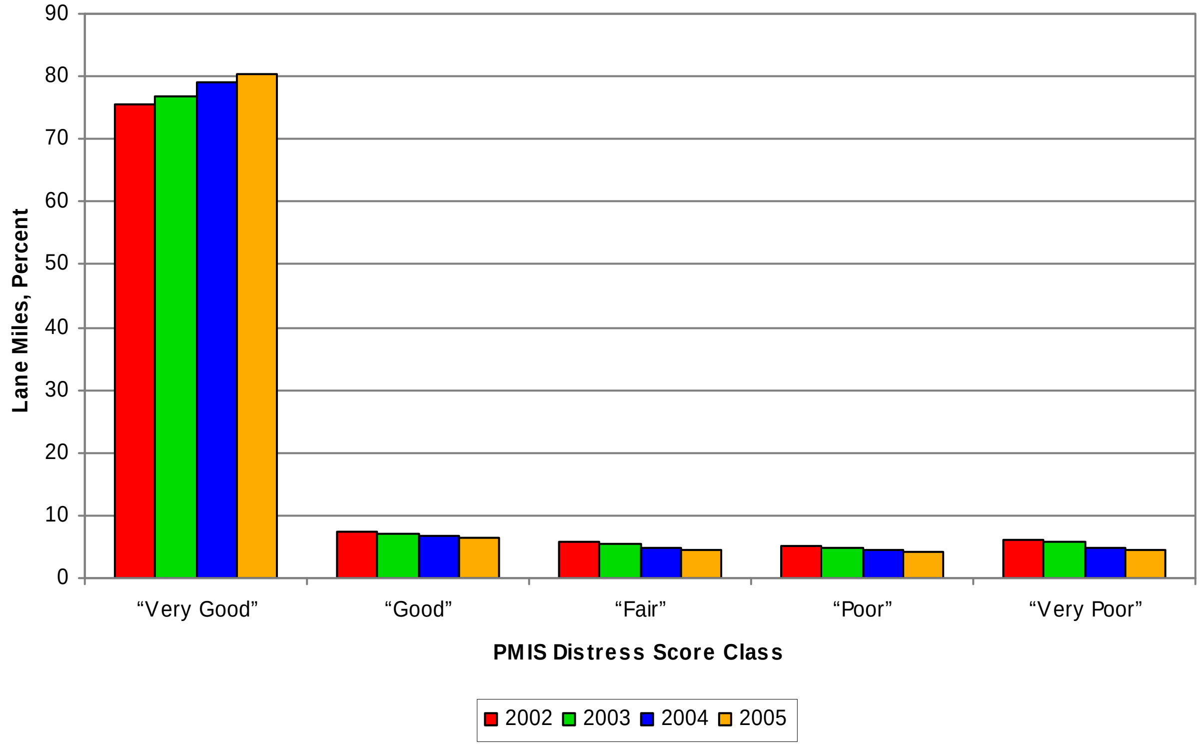


Figure 1.4 — Distress Score Classes, FY 2002-2005.

The Distress Score Classes show that:

- "Very Good" mileage increased (from 79.06% in 2004 to 80.52% in 2005)
- "Good" mileage decreased (from 6.68% in 2004 to 6.46% in 2005)
- "Fair" mileage decreased (from 4.86% in 2004 to 4.55% in 2005)
- "Poor" mileage decreased (from 4.53% in 2004 to 4.08% in 2005)
- "Very Poor" mileage decreased (from 4.87% in 2004 to 4.39% in 2005).

Almost two-thirds of the cars operating in 1916 were Fords — the classic Model T and its antecedents — which could be bought new for as little as $200. If car prices had increased at a modest 4 percent per year since then, the 1916 Ford Model T would sell for about $6,561 in 2005.

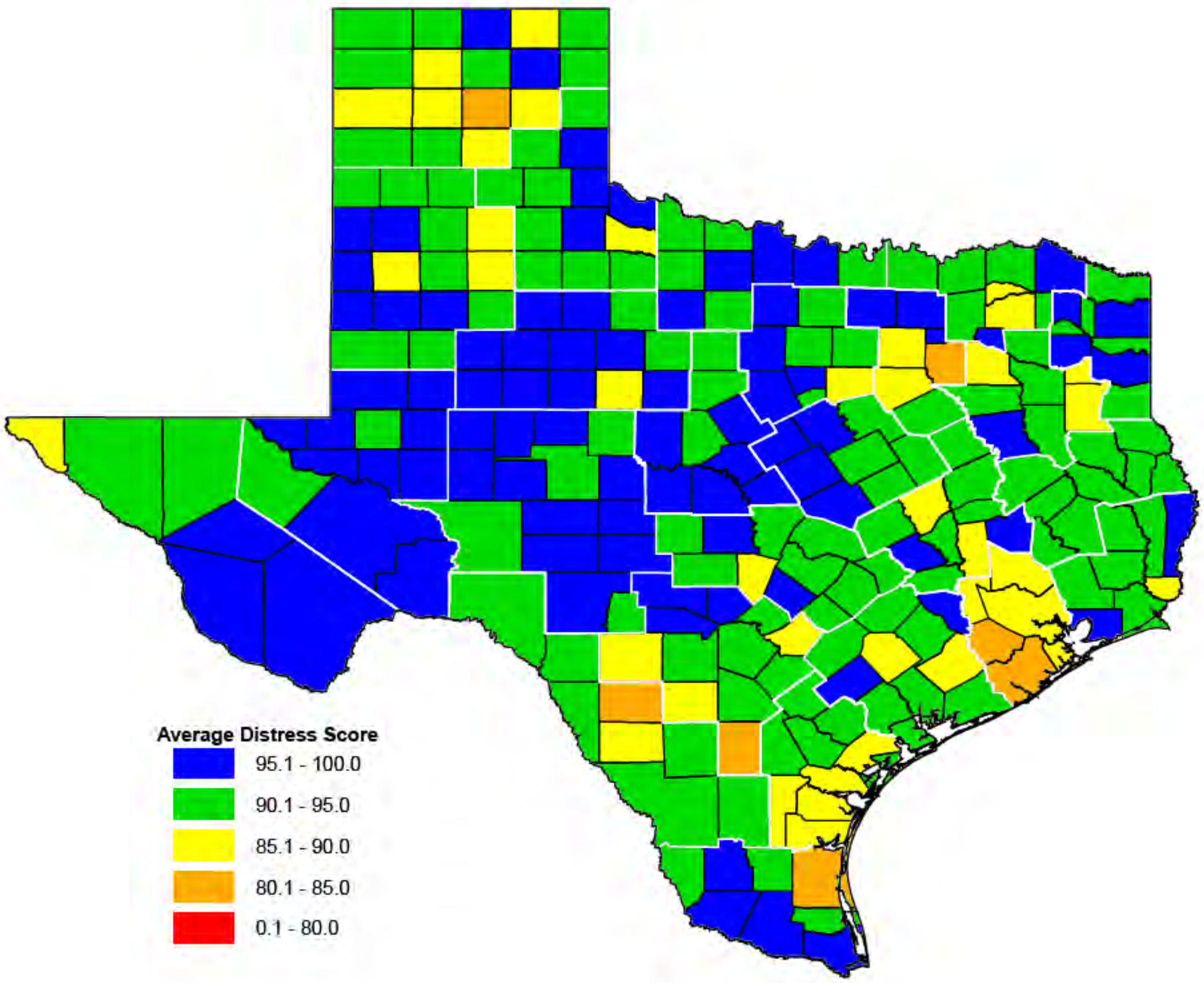
Distress Score Maps, FY 2004-2005

Maps 1.3 and 1.4 show average PMIS Distress Scores in each county for fiscal years 2004 and 2005. 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.

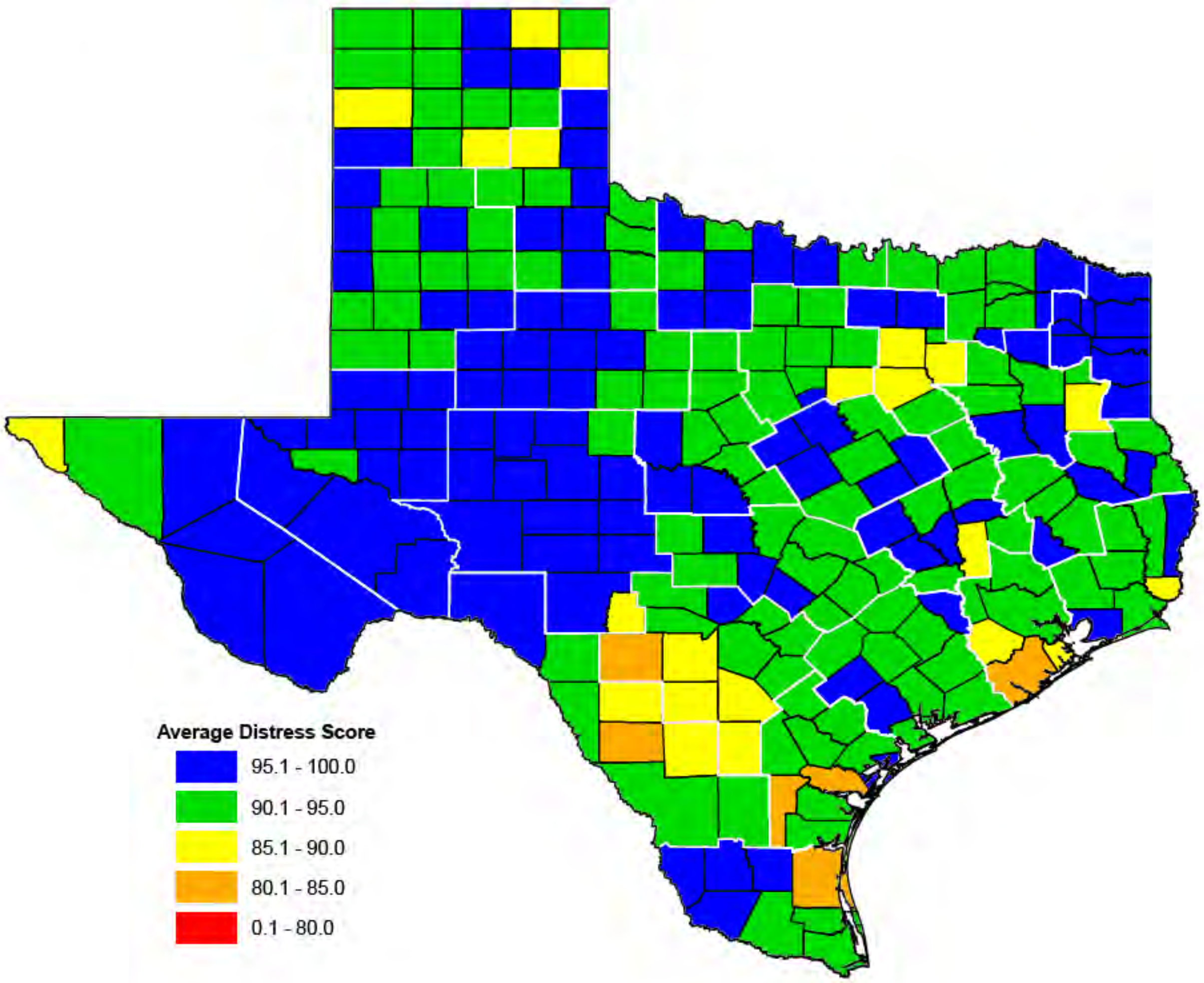
Overall pavement distress improved in FY 2005. As will be discussed in Chapters 2-5, pavement distress improved for all highway systems, and for all pavement types except JCP. All distress types improved, except for ACP Shallow Rutting, ACP Deep Rutting, ACP Failures, ACP Alligator Cracking, ACP Transverse Cracking, JCP Slabs with Longitudinal Cracks, and JCP Concrete Patches.

The Distress Score maps show an overall improvement, with many counties getting better and fewer counties getting worse. 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). Although most counties are in the "Very Good" (90-100) or "Good" (80-89) ranges, there are some areas with higher distress. However, no counties had an average Distress Score in the Red category ("Very Poor" 0.1-80.0) in FY 2004 or FY 2005.

Map 1.3 — Average Distress Scores, FY 2004.



Map 1.4 — Average Distress Scores, FY 2005.



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 1.3 — 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.

Figure 1.5 shows the statewide distribution of Ride Score classes for fiscal years 2002 through 2005. Ride Scores are measured using calibrated automated ride quality measuring equipment developed by TxDOT.

24.94 percent of the mainlane mileage had “Very Good” ride quality in FY 2005.

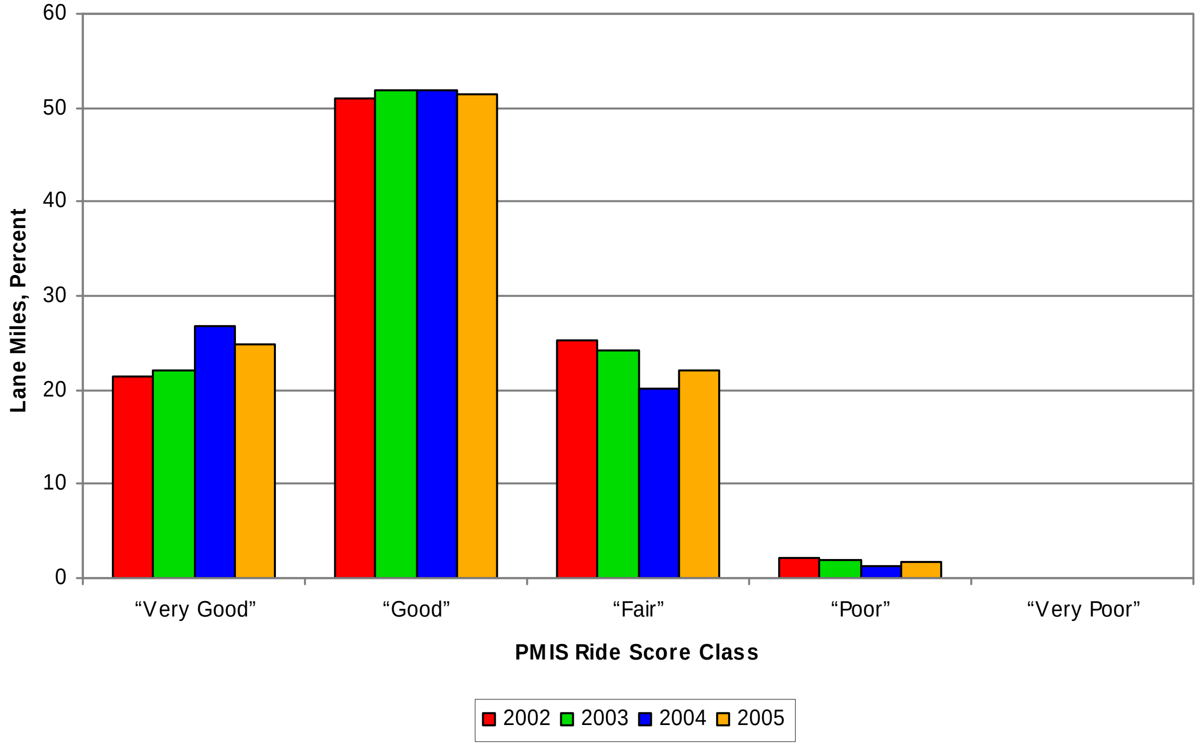


Figure 1.5 — Ride Score Classes, FY 2002-2005.

The Ride Score Classes show that:

- “Very Good” mileage decreased (from 26.74% in 2004 to 24.94% in 2005)
- “Good” mileage decreased (from 51.81% in 2004 to 51.33% in 2005)
- “Fair” mileage increased (from 20.07% in 2004 to 22.05% in 2005)
- “Poor” mileage increased (from 1.32% in 2004 to 1.62% in 2005)
- “Very Poor” mileage remained the same (0.05% in 2004 to 0.05% in 2005).

The longest state highway in Texas is State Highway 16, which extends 541.9 miles from Zapata in South Texas to 30 miles south of Wichita Falls. Even at more than 500 miles, though, Texas 16 is only the ninth longest highway in Texas.

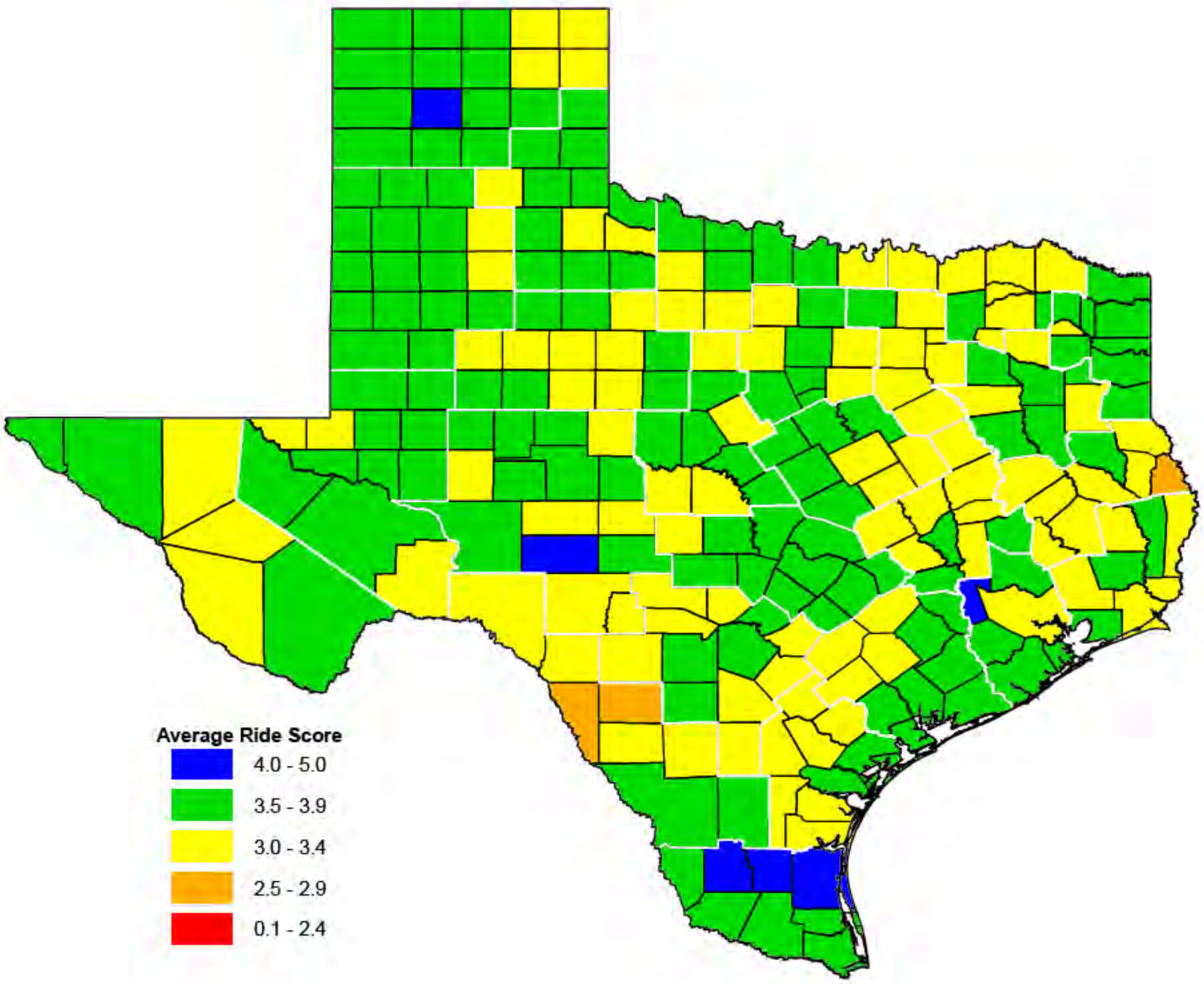
Ride Score Maps, 2004-2005

Maps 1.5 and 1.6 on the following pages show average PMIS Ride Scores in each county for fiscal years 2004 and 2005. 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.

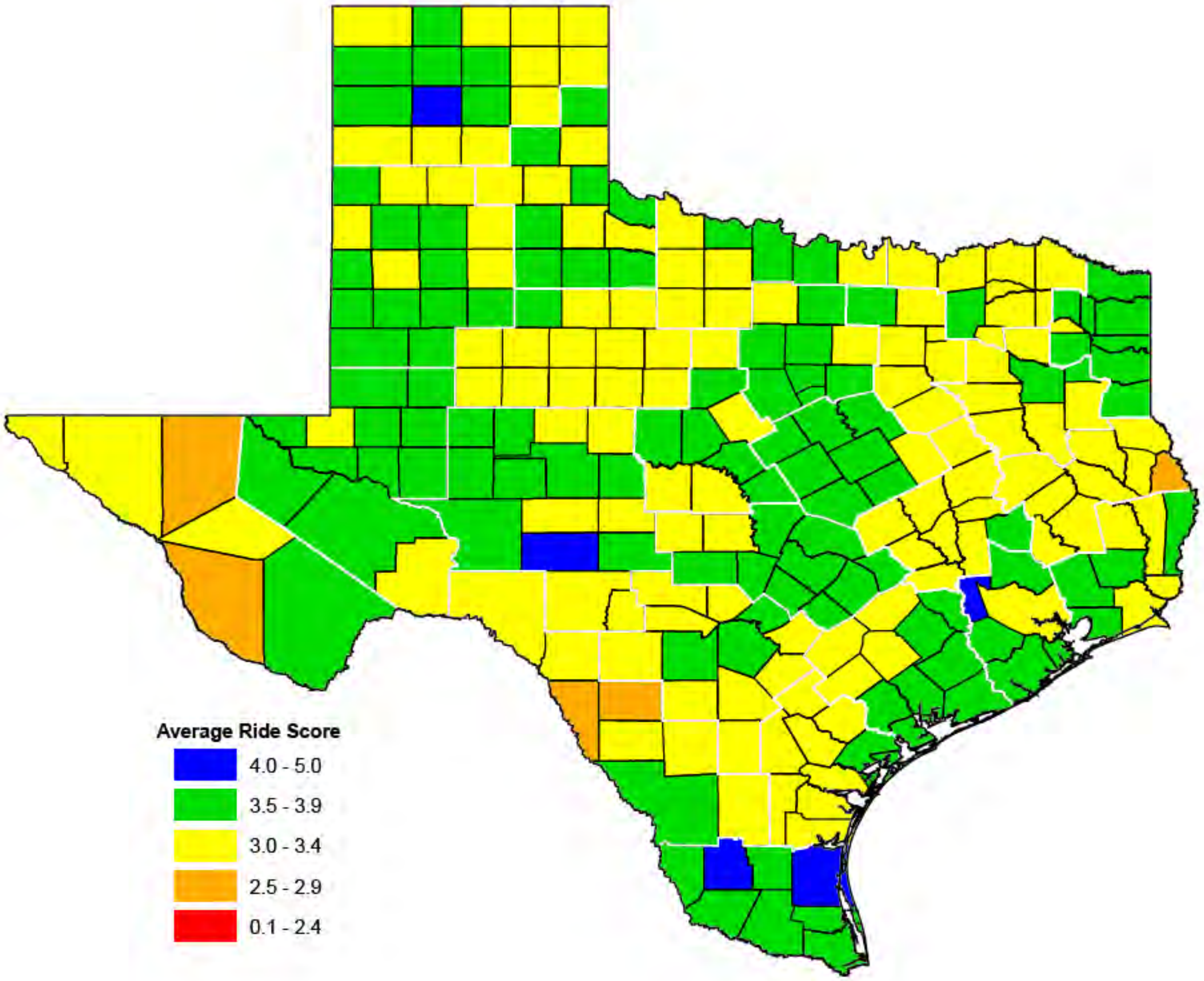
Overall ride quality got worse in FY 2005. As will be discussed in Chapters 2-5, ride quality got worse for all highway systems, and for all pavement types except CRCP.

The Ride Score maps show a drop in statewide ride quality, with many counties dropping into the Yellow (average Ride Score 3.0-3.4) and Orange (average Ride Score 2.5-2.9) categories. No counties had an average ride quality in the Red category (average Ride Score 0.1-2.4) in FY 2004 or 2005.

Map 1.5 — Average Ride Scores, FY 2004.



Map 1.6 — Average Ride Scores, FY 2005.



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, based on the construction specification for ride quality, as shown below:

Table 1.4 — 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 based on the construction specification for ride quality, and thus are not the same as the Ride Score categories shown in Table 1.3. For example, the "Very Good" Ride Score category in Table 1.3 (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.

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

Figure 1.6 shows the statewide distribution of IRI Score classes for fiscal years 2002 through 2005. 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.

6.27 percent of the mainlane mileage had "Very Good" ride value in FY 2005.

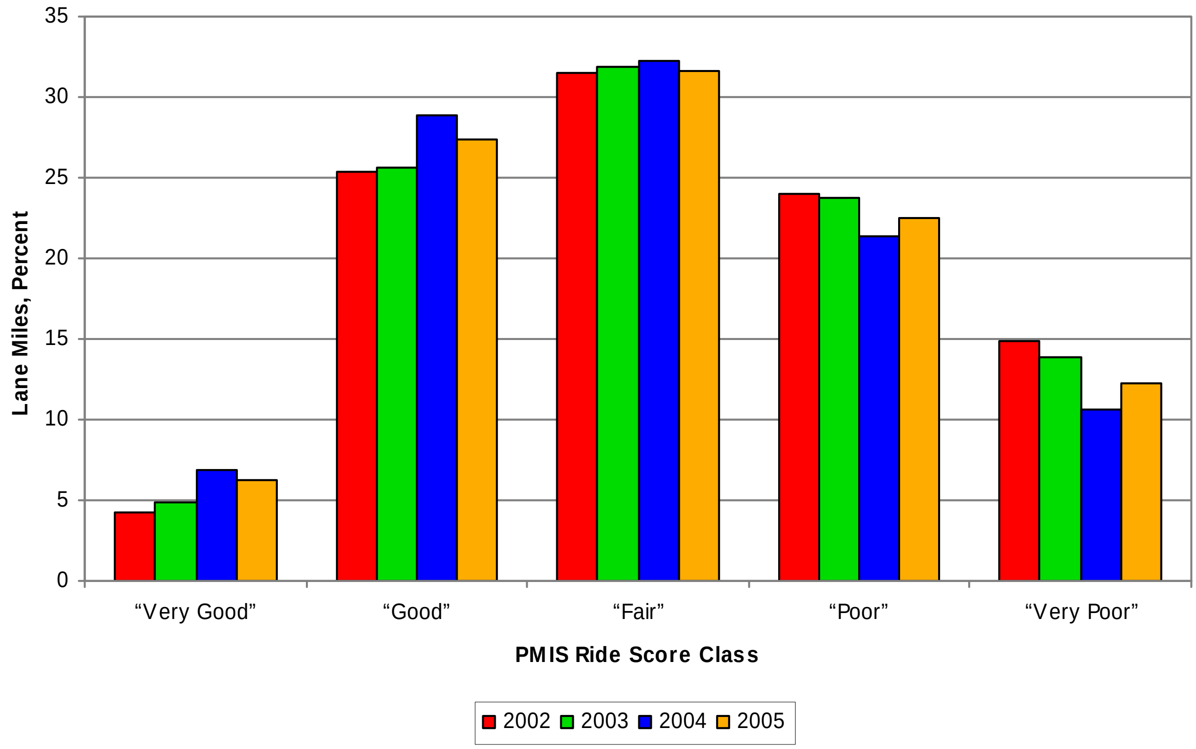


Figure 1.6 — IRI Score Classes, FY 2002-2005.

The IRI Score Classes show that:

- "Very Good" mileage decreased (from 6.81% in 2004 to 6.27% in 2005)
- "Good" mileage decreased (from 28.94% in 2004 to 27.43% in 2005)
- "Fair" mileage decreased (from 32.28% in 2004 to 31.64% in 2005)
- "Poor" mileage increased (from 21.36% in 2004 to 22.44% in 2005)
- "Very Poor" mileage increased (from 10.61% in 2004 to 12.22% in 2005).

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

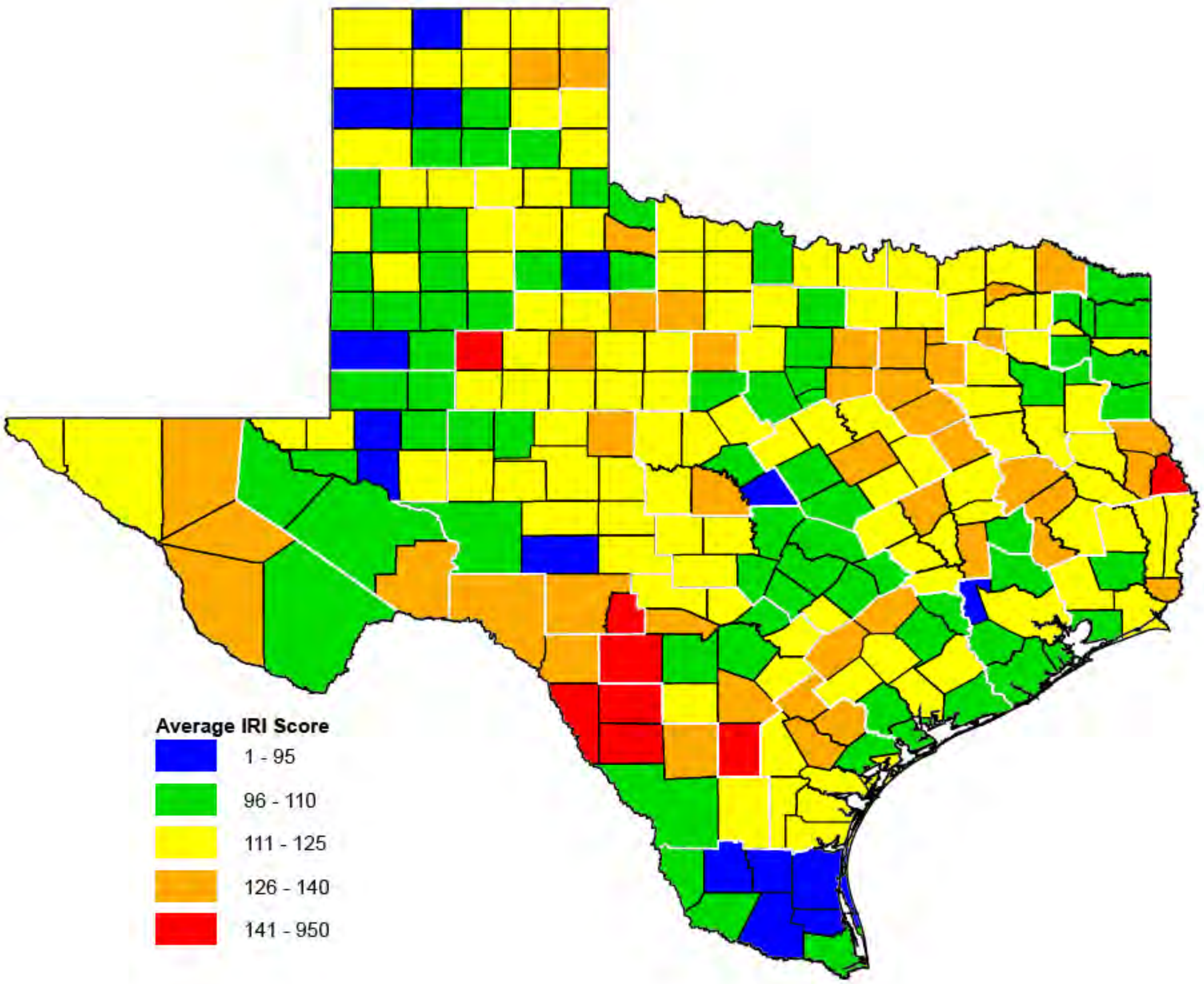
IRI Score Maps, 2004-2005

Maps 1.7 and 1.8 on the following pages show average PMIS IRI Scores in each county for fiscal years 2004 and 2005. 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.

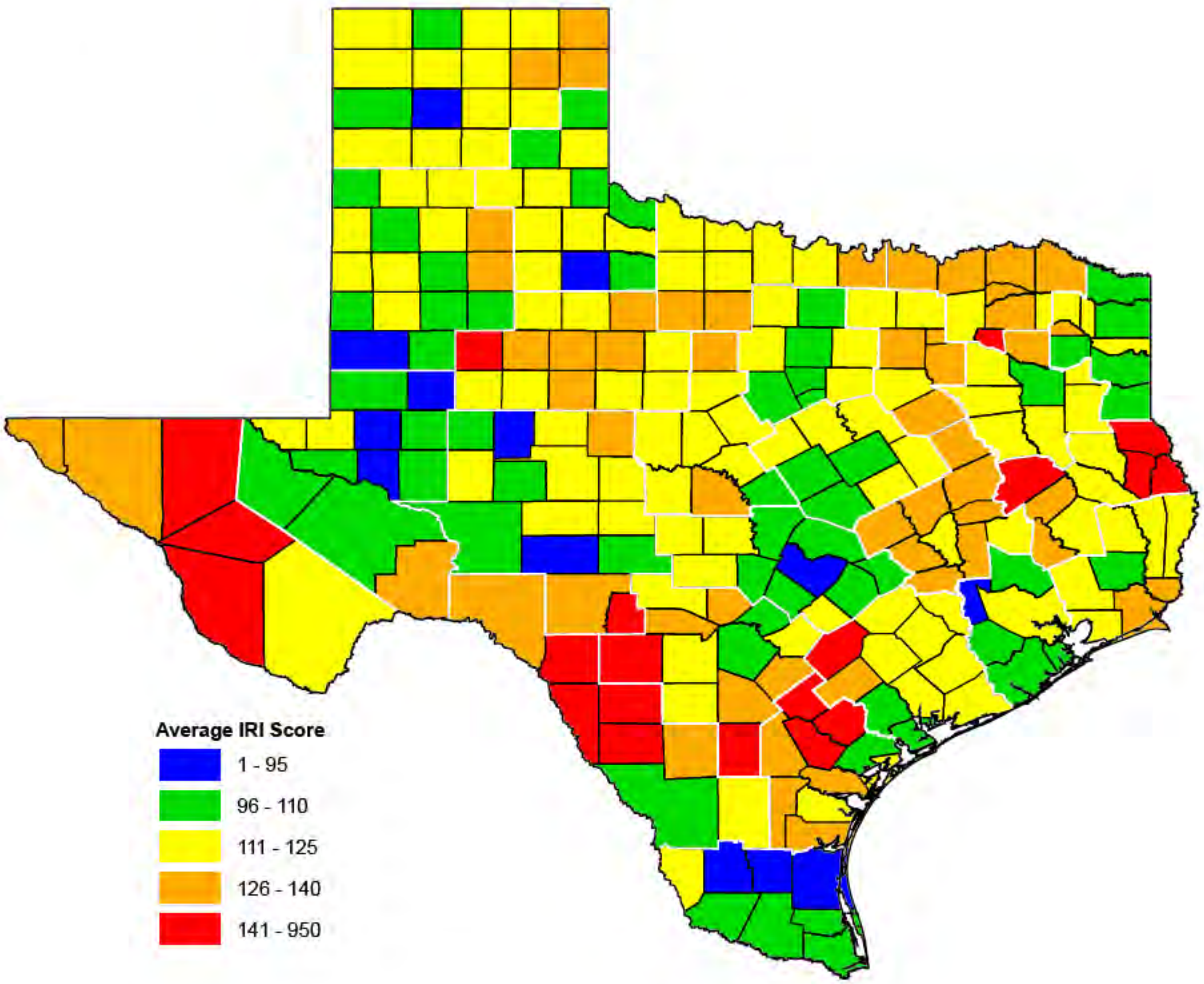
Overall ride quality values got worse in FY 2005. As will be discussed in Chapters 2-5, ride quality values got worse for all highway systems, and for all pavement types except CRCP.

The IRI Score maps show a drop in statewide ride quality, with many counties dropping into the Orange (average IRI Score 126-140) and Red (average IRI Score 141-950) categories.

Map 1.7 — Average IRI Scores, FY 2004.



Map 1.8 — Average IRI Scores, FY 2005.



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 1.7 shows average PMIS Condition Scores for each highway system for fiscal years 2002 through 2005. Average pavement condition improved in FY 2005 statewide and for all highway systems.

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

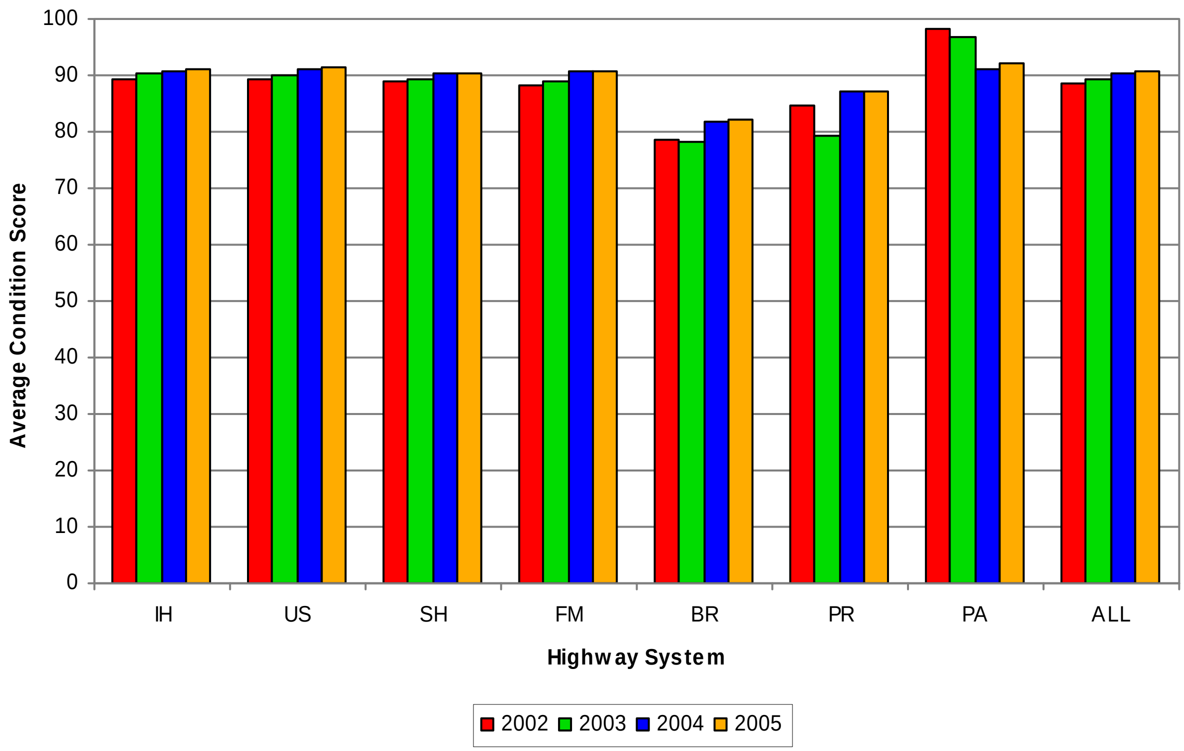


Figure 1.7 — Average Condition Scores, by Highway System, FY 2002-2005.

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 1.8 shows average PMIS Condition Scores for each pavement type for fiscal years 2002 through 2005. Average pavement condition improved in FY 2005 statewide and for ACP ("flexible") and CRCP, but got worse for JCP.

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

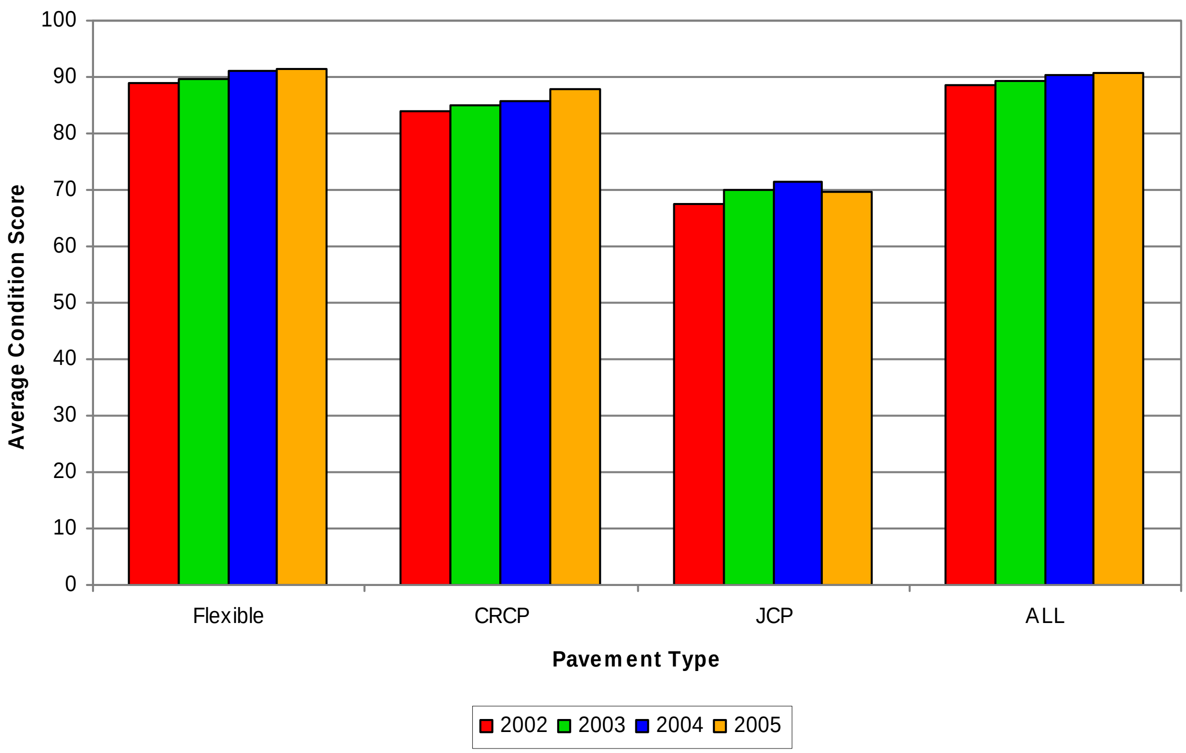


Figure 1.8 — Average Condition Scores, by Pavement Type, FY 2002-2005.

Lane Miles in PMIS, by Highway System

Table 1.5 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 1.5 — Total Lane Miles in PMIS, by Highway System, FY 2002-2005.

Highway System	Fiscal Year			
	2002	2003	2004	2005
Interstate Highways, mainlanes only	14,938.8	14,958.2	15,049.6	15,066.0
Interstate Highways, frontage roads	9,236.5	9,252.0	9,227.8	9,296.7
United States Highways	37,768.1	37,874.6	37,983.0	38,294.9
State Highways	39,767.3	39,797.4	40,002.7	40,343.1
Farm to Market Highways	84,380.4	84,537.8	84,615.2	84,688.6
Business Routes	2,808.2	2,843.7	2,952.7	2,966.0
Park Roads	693.6	694.9	694.7	694.5
Principal Arterial Streets	49.6	52.3	52.3	65.5
STATEWIDE	189,642.5	190,010.9	190,578.0	191,415.3

Lane Miles in PMIS, by Pavement Type

Table 1.6 shows the total lane miles in PMIS for each of the major pavement types.

Table 1.6 — Total Lane Miles in PMIS, by Pavement Type, FY 2002-2005.

Pavement Type	Fiscal Year			
	2002	2003	2004	2005
Flexible or Asphalt Concrete Pavements (ACP)	176,709.1	176,774.0	176,807.4	177,071.9
Continuously Reinforced Concrete Pavement (CRCP)	8,826.2	9,119.1	9,426.3	9,940.3
Jointed Concrete Pavement (JCP)	4,107.2	4,117.8	4,344.3	4,403.1
STATEWIDE	189,642.5	190,010.9	190,578.0	191,415.3

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 Mileage 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 1.7 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 1.7 — Rated/Measured Mileage in PMIS, by Highway System, FY 2002-2005.

Highway System	Fiscal Year			
	2002	2003	2004	2005
Interstate Highways	13,792.6	14,087.2	14,250.2	14,131.3
United States Highways	33,277.5	33,131.2	33,831.6	33,979.9
State Highways	36,507.8	36,622.1	37,048.4	37,339.8
Farm to Market Highways	82,219.0	82,552.3	82,800.2	82,987.7
Business Routes	2,581.5	2,493.9	2,693.3	2,735.6
Park Roads	515.0	543.6	555.4	535.3
Principal Arterial Streets	24.8	28.3	40.3	41.8
STATEWIDE	168,918.2	169,458.6	171,219.4	171,751.4

Rated/Measured Mileage in PMIS, by Pavement Type

Table 1.8 shows the total lane miles (mainlanes only) rated/measured in PMIS, by pavement type.

Table 1.8 — Rated/Measured Mileage in PMIS, by Pavement Type, FY 2002-2005.

Pavement Type	Fiscal Year			
	2002	2003	2004	2005
Flexible or Asphalt Concrete Pavements (ACP)	158,768.0	159,116.4	160,262.8	160,309.0
Continuously Reinforced Concrete Pavement (CRCP)	7,344.9	7,595.5	8,016.4	8,339.8
Jointed Concrete Pavement (JCP)	2,805.3	2,746.7	2,940.2	3,102.6
STATEWIDE	168,918.2	169,458.6	171,219.4	171,751.4

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.

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. Future plans are to replace the acoustic sensors with a scanning laser that can measure rut depths across the full width of the travel lane at highway speed.

Discussion

The overall condition of Texas pavements improved in FY 2005 to the highest level in four years because of improved distress, even though statewide ride quality got worse.

As will be discussed in Chapters 2-5, pavement condition and distress improved in FY 2005 for all highway systems and pavement types, except for JCP. However, ride quality got worse in FY 2005 for all highway systems and pavement types, except for CRCP.

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.

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. In July 2002, TxDOT Administration established two- and ten-year goals for each district, using FY 2002 PMIS results as the baseline. As will be discussed in Chapter 7, FY 2005 PMIS results showed continued progress made towards the ten-year pavement condition goal, but the rate of improvement was not large enough to ensure meeting the ten-year goal. As more miles are improved above the condition goal, the burden will shift to routine and preventive maintenance to keep that mileage above the goal, while still fixing those miles that remain below the condition goal

Chapter 7 will describe the ten-year statewide pavement condition goal in more detail.

Pavement condition in Texas is improving, despite worsening ride quality, because of reductions in the amount of pavement distress. TxDOT resurfaced 14 percent of State-maintained mileage in FY 2003 and 13 percent of State-maintained mileage in FY 2004. It appears that this extensive amount of resurfacing is reducing pavement distress, but is not necessarily improving ride quality. Although pavement condition has been steadily improving during the last four years, it will be necessary to monitor these improvements to make sure that they last for more than just a few years. Periodic monitoring and occasional repair will be needed to maintain the statewide improvements that have been made during the last four years.

Summary

The overall condition of Texas pavements improved in FY 2005 to the highest level in four years because of improved distress, even though statewide ride quality got worse.

The longest Farm to Market Road is FM 168 at 139.421 miles, that goes from near Brownfield in Terry County to near Amarillo in Randall County. The shortest Farm to Market Road is FM 742, a length of 0.175 mile, in McLennan County.

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 2002 through 2005. Average pavement condition improved in FY 2005 statewide and for all highway systems. This is the same chart from Figure 1.7, and is repeated here for ease of reference.

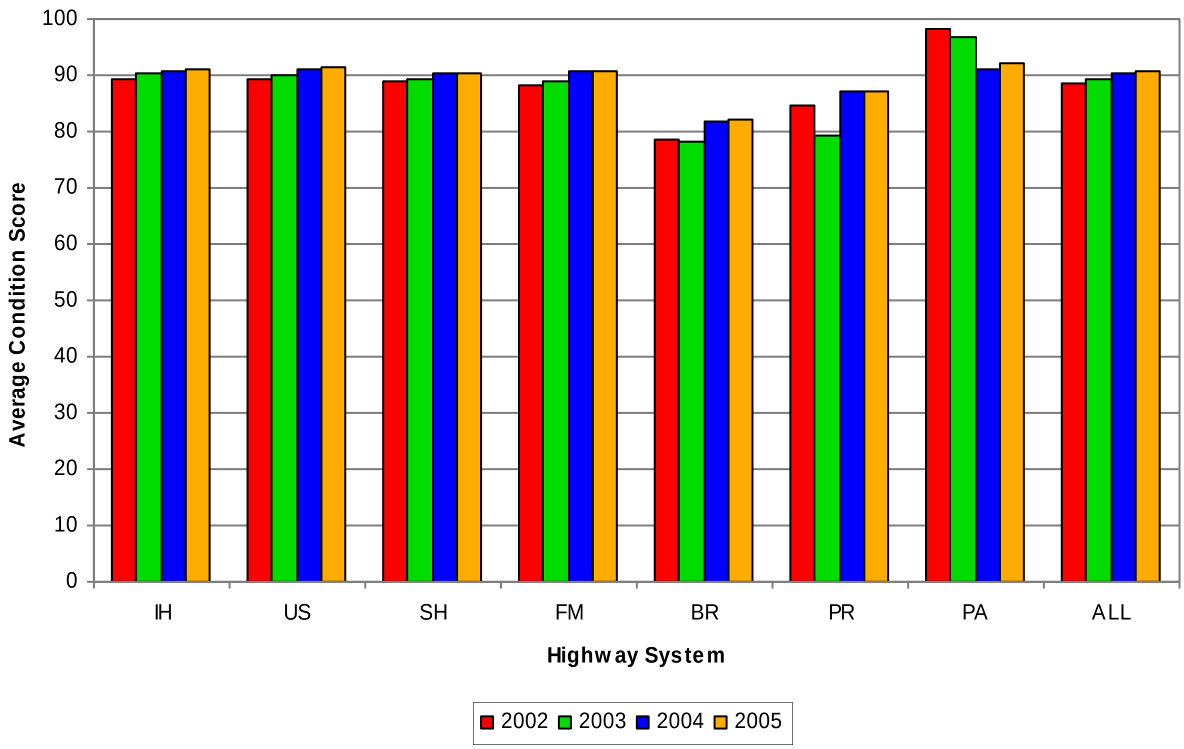


Figure 2.1 — Average Condition Scores, by Highway System, FY 2002-2005.

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.

One- and two-digit Interstate highway numbers are reserved for routes between cities or states. Three-digit Interstate highway numbers are reserved for spurs and loops in urban areas. Spurs begin with an odd-number (for example, IH 110 in El Paso), while loops begin with an even-number (for example, IH 410 in San Antonio). The last two digits indicate the lowest-number Interstate highway that the spur or loop connects to.

Interstate Highway (IH) System

Figure 2.2 shows the statewide distribution of Condition Score classes for the Interstate system for fiscal years 2002 through 2005.

76.50 percent of the IH lane miles were in "Very Good" condition in FY 2005.

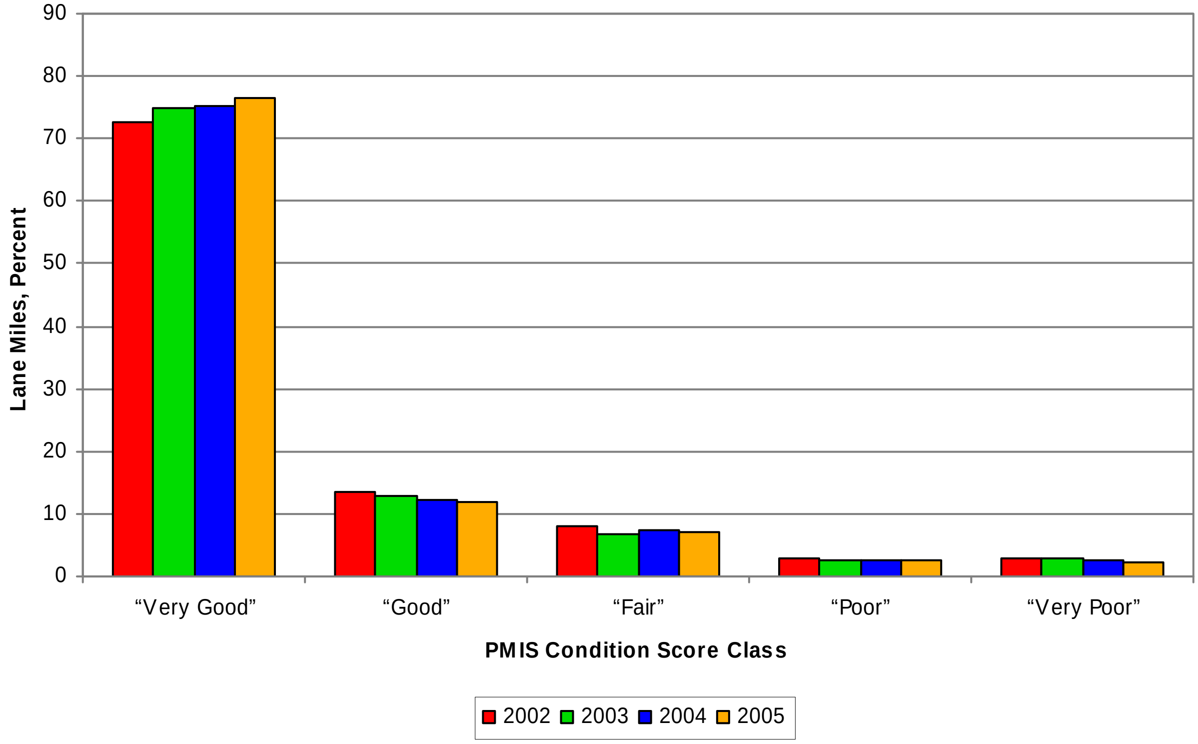
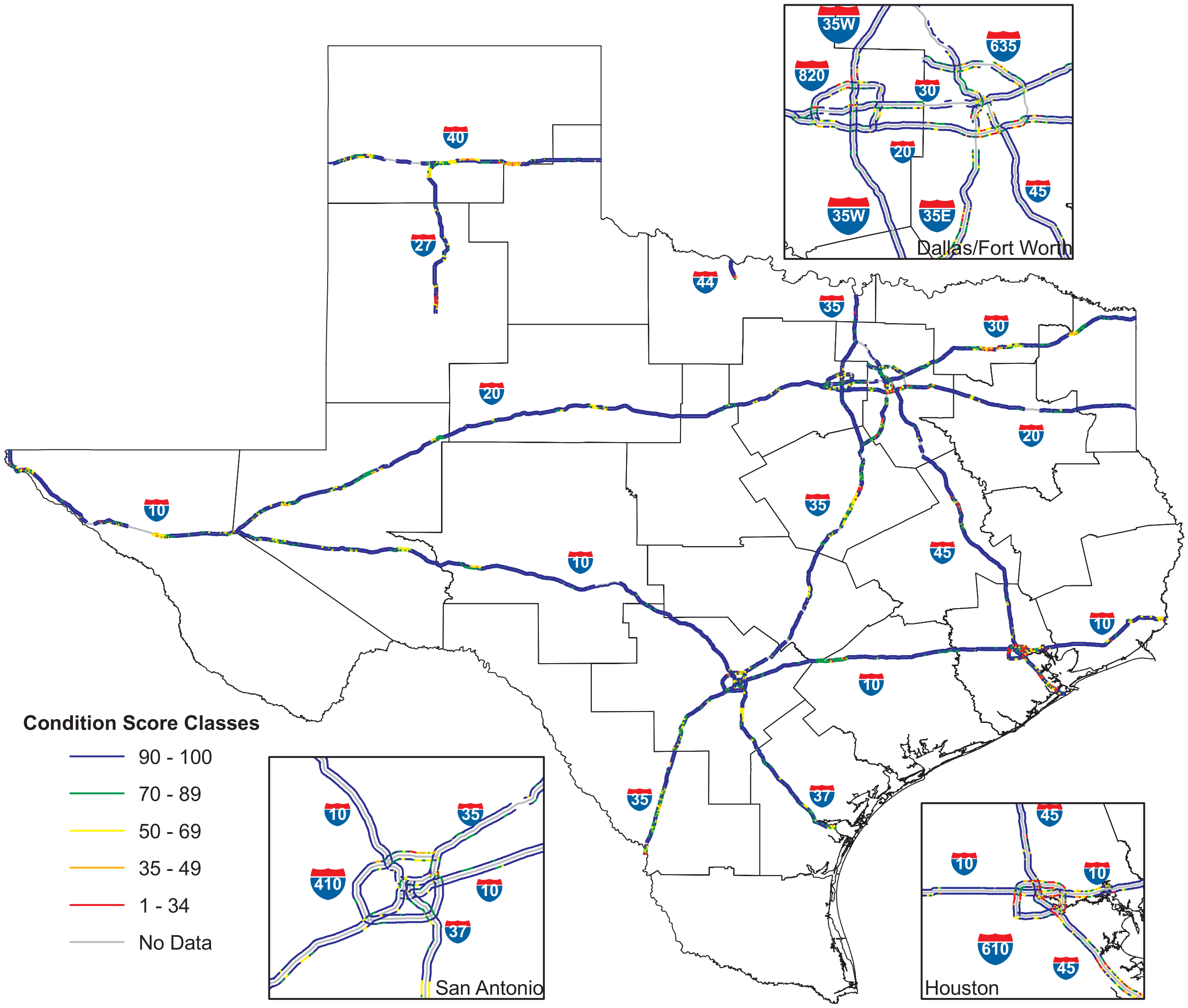


Figure 2.2 — IH System Condition Score Classes, FY 2002-2005.

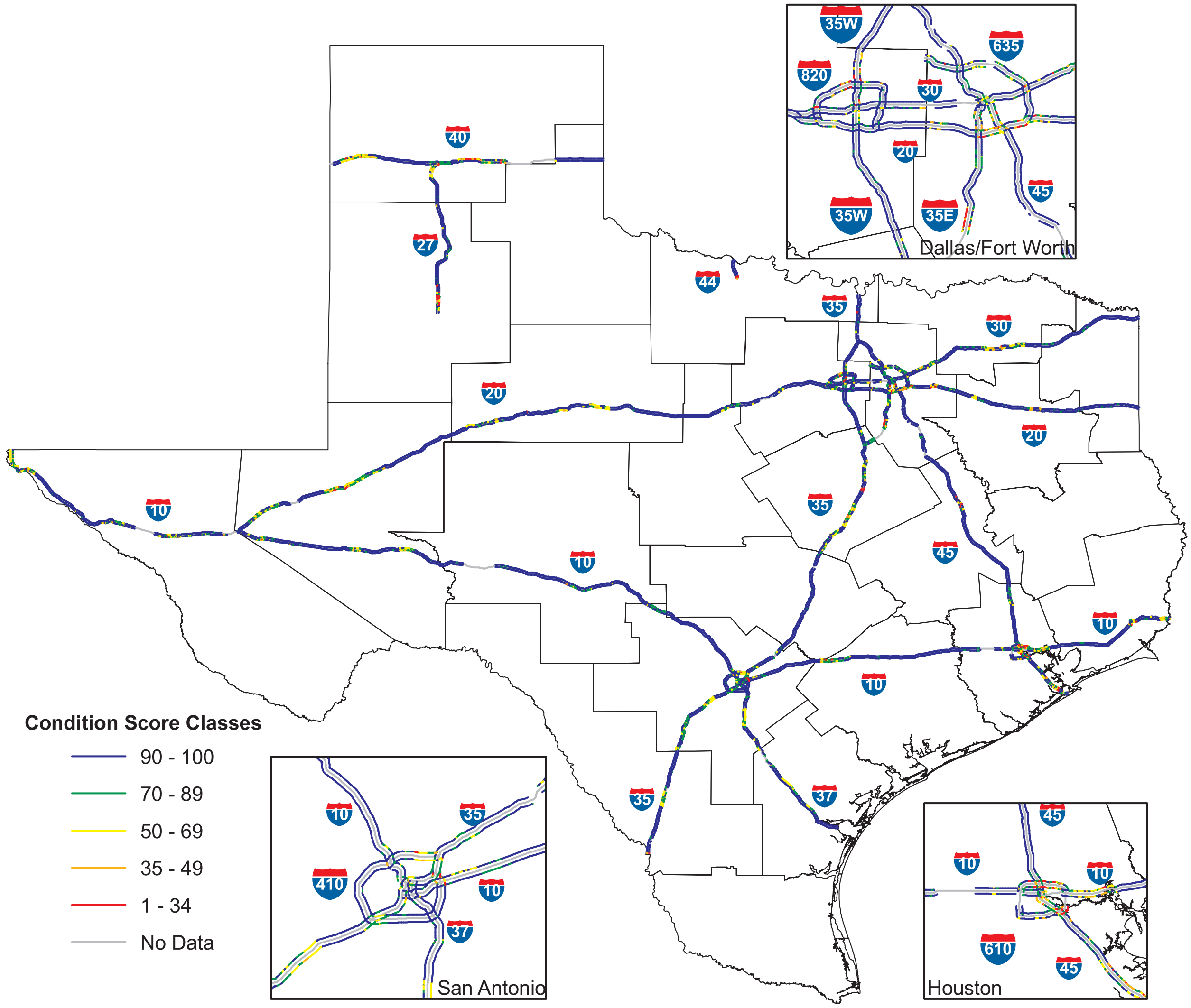
The Condition Score Classes for Interstate Highways show that:

- "Very Good" mileage increased (from 75.33% in 2004 to 76.50% in 2005)
- "Good" mileage decreased (from 12.29% in 2004 to 11.74% in 2005)
- "Fair" mileage decreased (from 7.26% in 2004 to 7.11% in 2005)
- "Poor" mileage decreased (from 2.49% in 2004 to 2.43% in 2005)
- "Very Poor" mileage decreased (from 2.63% in 2004 to 2.22% in 2005).

Map 2.1 — IH System Condition Score Classes, FY 2004.



Map 2.2 — IH System Condition Score Classes, FY 2005.



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.

Figure 2.3 shows the statewide distribution of the Distress Score classes for the Interstate system for fiscal years 2002 through 2005.

80.71 percent of the IH lane miles were "Very Good" in terms of pavement distress in FY 2005.

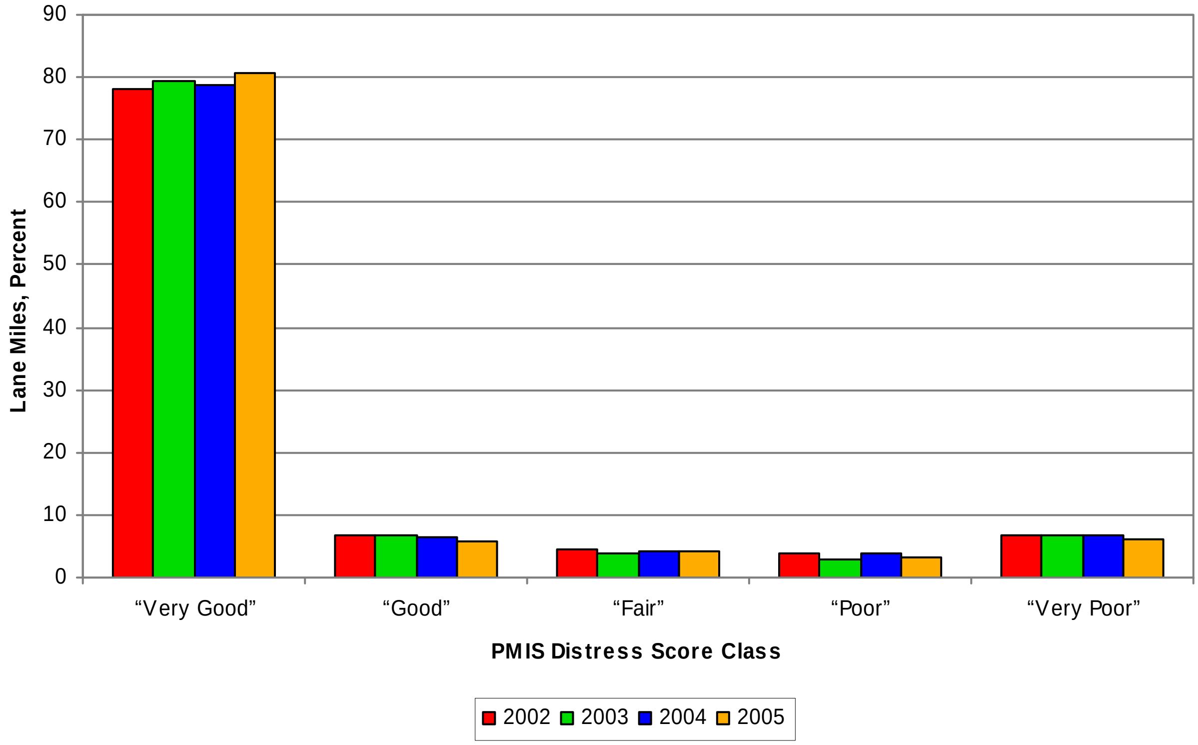
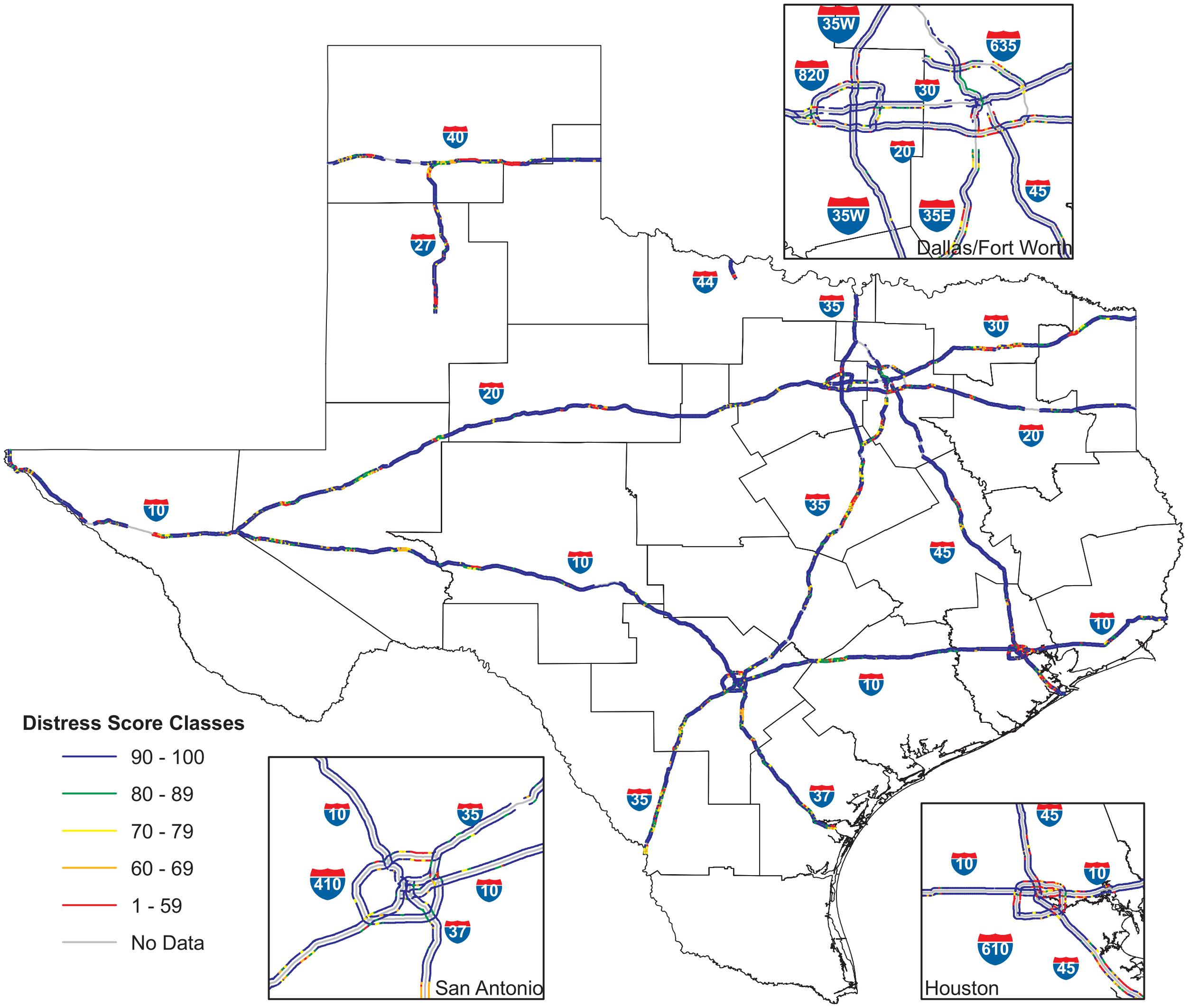


Figure 2.3 — IH System Distress Score Classes, FY 2002-2005.

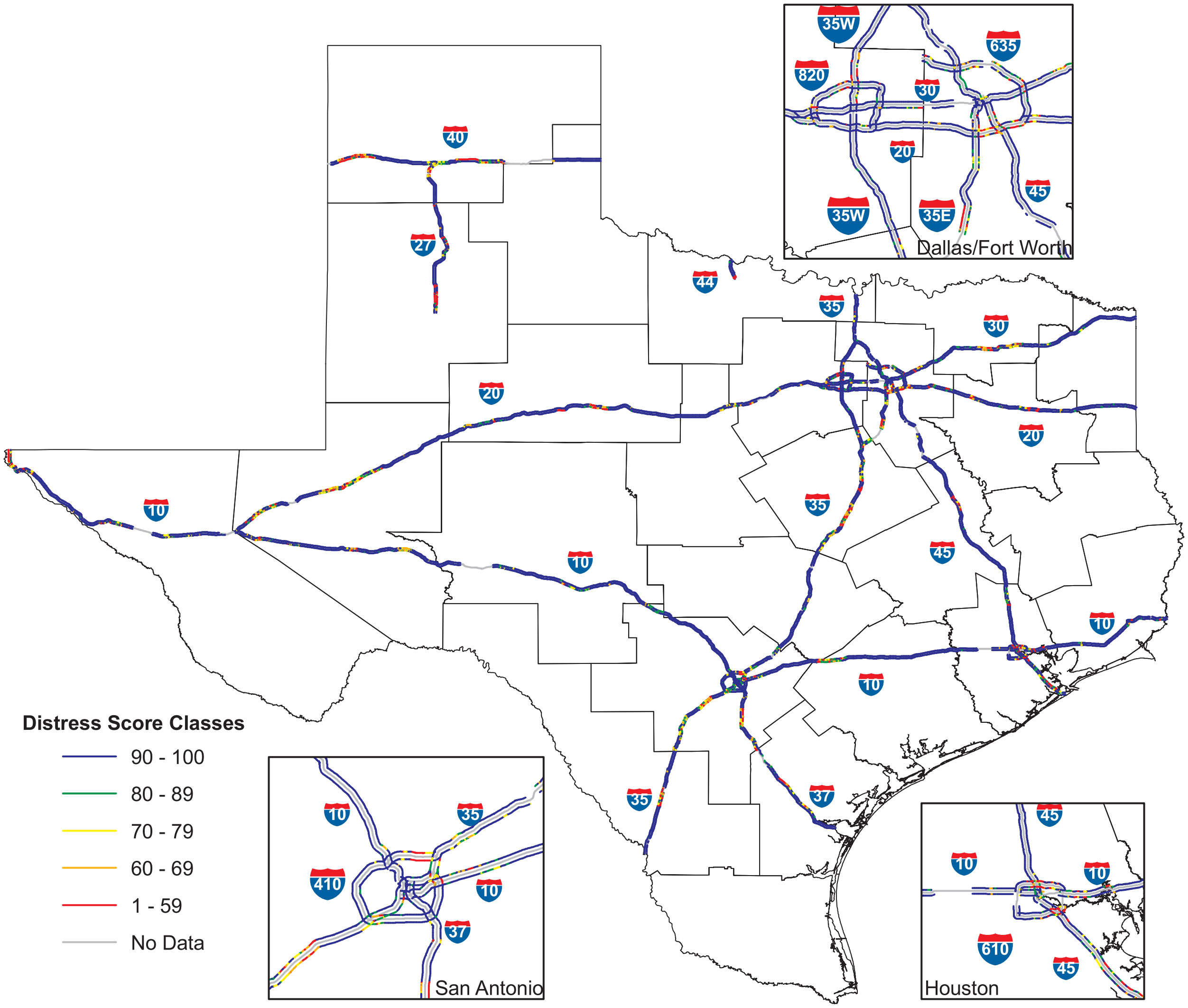
The Distress Score Classes for Interstate Highways show that:

- "Very Good" mileage increased (from 78.86% in 2004 to 80.71% in 2005)
- "Good" mileage decreased (from 6.52% in 2004 to 5.72% in 2005)
- "Fair" mileage increased (from 4.11% in 2004 to 4.18% in 2005)
- "Poor" mileage decreased (from 3.82% in 2004 to 3.30% in 2005)
- "Very Poor" mileage decreased (from 6.70% in 2004 to 6.09% in 2005).

Map 2.3 — IH System Distress Score Classes, FY 2004.



Map 2.4 — IH System Distress Score Classes, FY 2005.



The three longest Interstate highways in Texas are: IH 10, 878.614 miles; IH 20, 636.081 miles; and IH 35/35E, 503.951 miles.

Figure 2.4 shows the statewide distribution of the Ride Score classes for the Interstate system for fiscal years 2002 through 2005. In general, the average person would consider 5.86 percent of IH pavements in Texas to be "rough."

58.17 percent of the IH lane miles had "Very Good" ride quality in FY 2005.

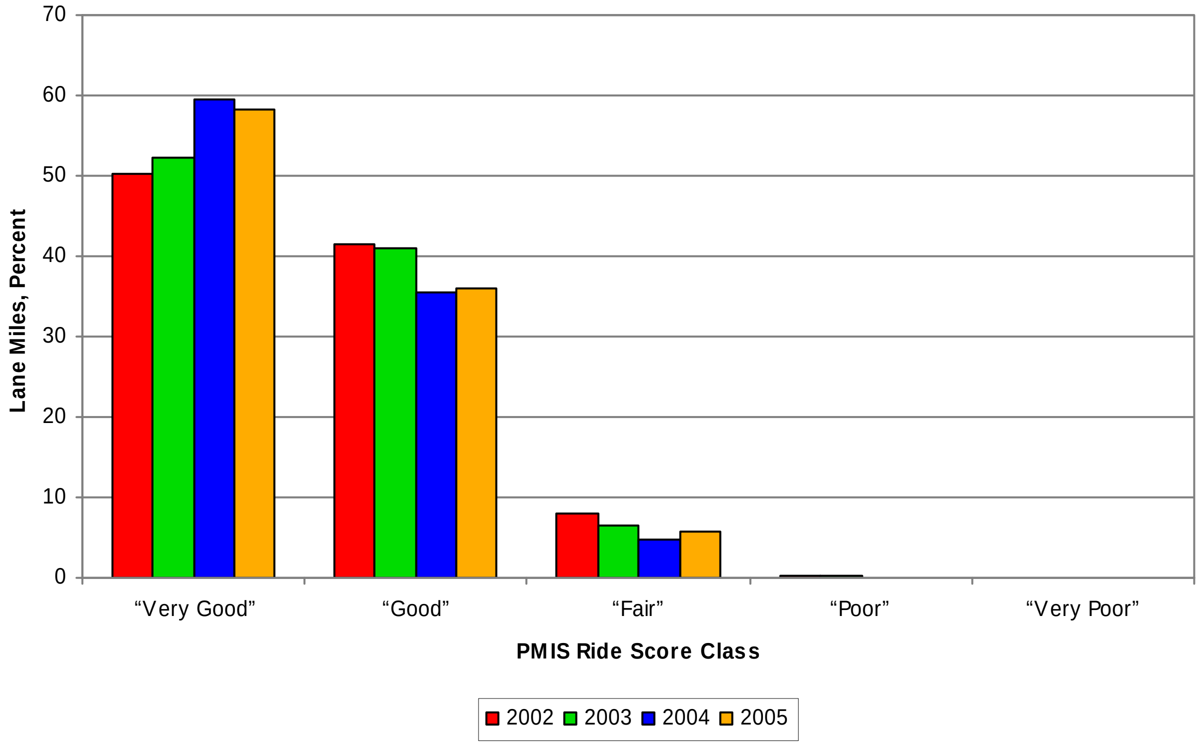
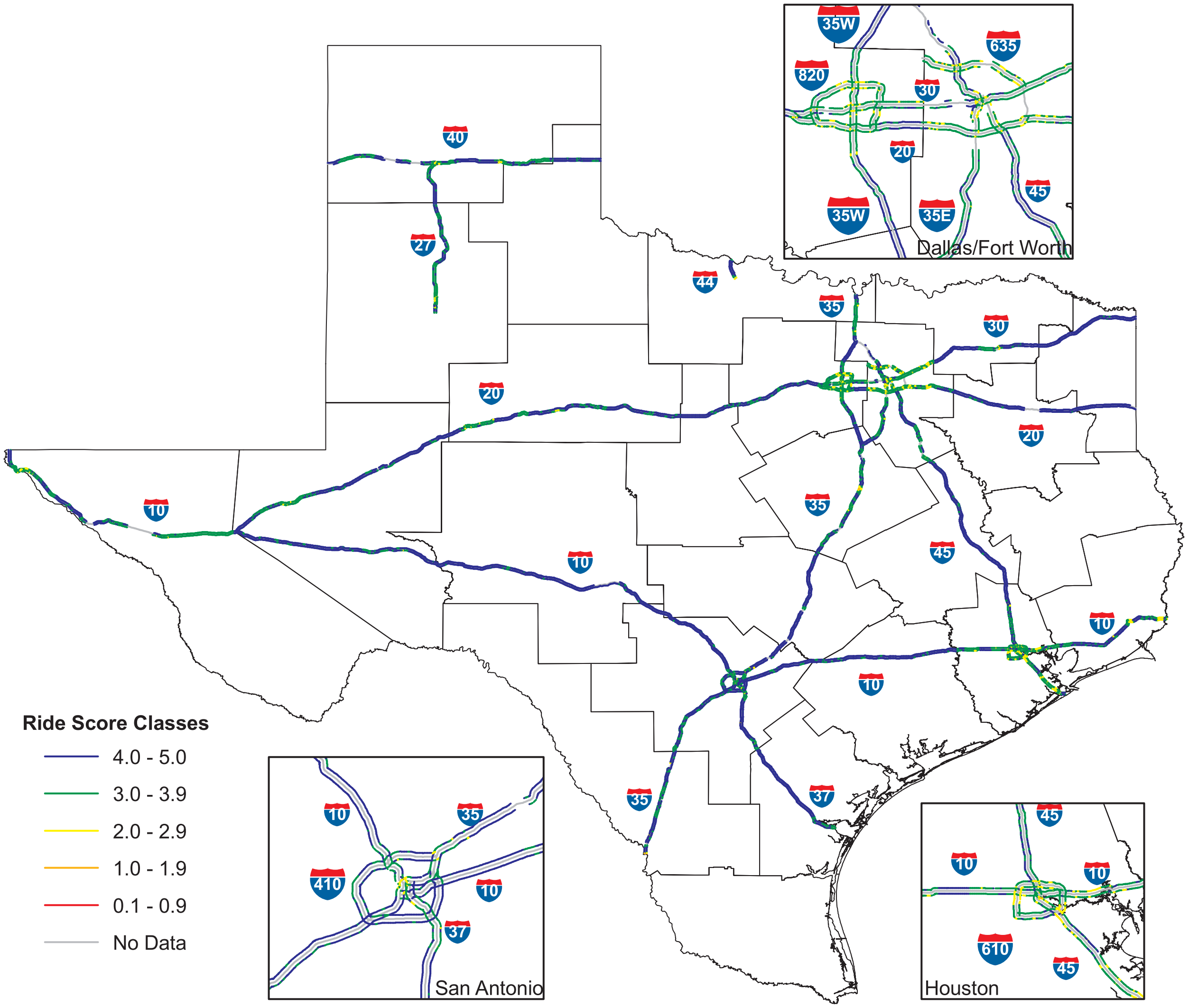


Figure 2.4 — IH System Ride Score Classes, FY 2002-2005.

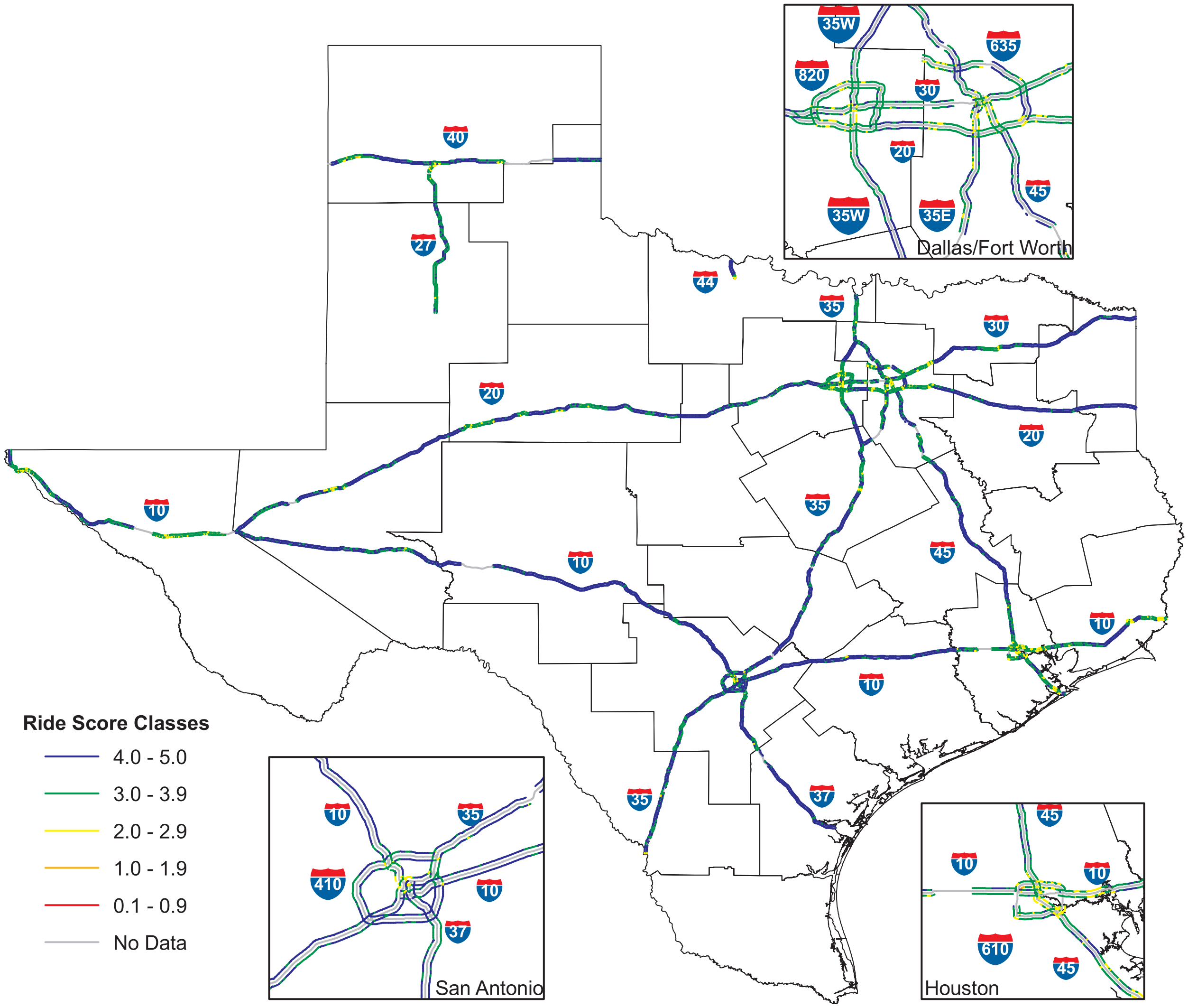
The Ride Score Classes for Interstate Highways show that:

- "Very Good" mileage decreased (from 59.60% in 2004 to 58.17% in 2005)
- "Good" mileage increased (from 35.55% in 2004 to 35.97% in 2005)
- "Fair" mileage increased (from 4.77% in 2004 to 5.77% in 2005)
- "Poor" mileage increased (from 0.07% in 2004 to 0.09% in 2005)
- "Very Poor" mileage decreased (from 0.01% in 2004 to 0.00% in 2005).

Map 2.5 — IH System Ride Score Classes, FY 2004.



Map 2.6 — IH System Ride Score Classes, FY 2005.



Interstate and US highway routes with odd numbers run north and south; even-numbered routes run east and west. Mile markers on Interstate highways increase in the northbound and eastbound directions. Reference markers on non-Interstate routes increase in the southbound and eastbound directions.

Figure 2.5 shows the statewide distribution of the IRI Score classes for the Interstate system for fiscal years 2002 through 2005. In general, the average person would consider 32.40 percent of IH pavements in Texas to be “rough,” based on IRI. This is not the same as the 5.86 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.

21.54 percent of the IH lane miles had “Very Good” IRI scores in FY 2005.

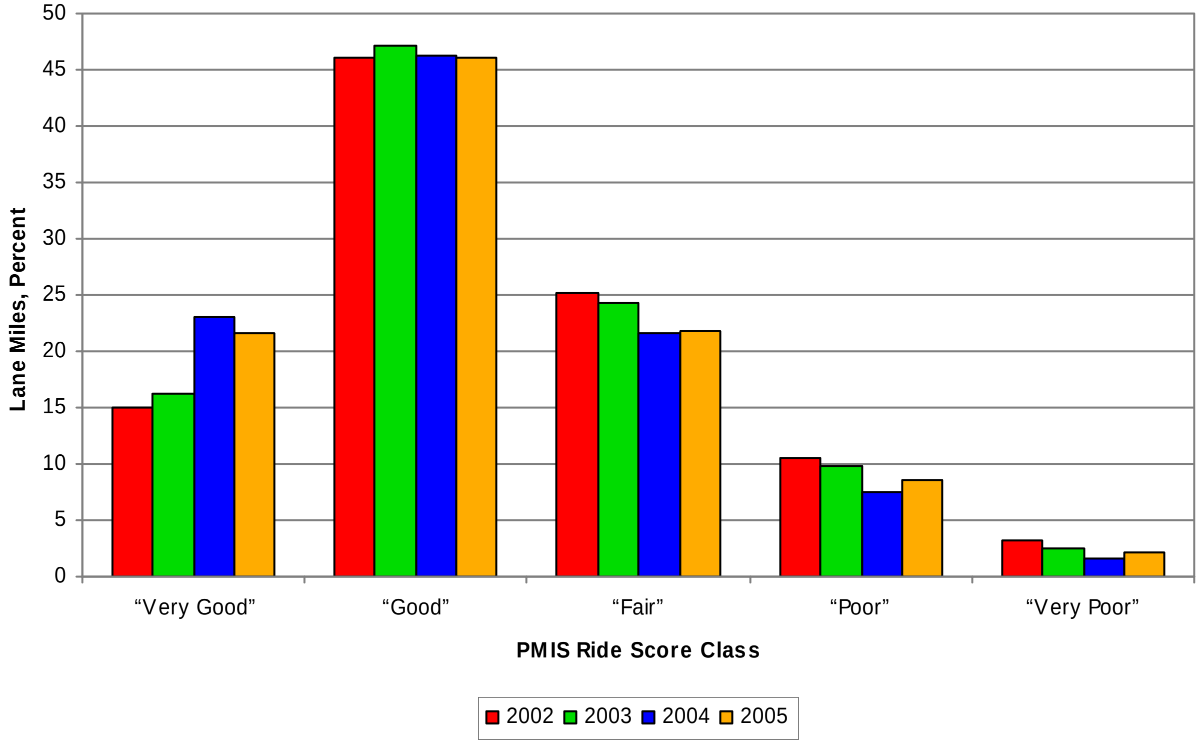
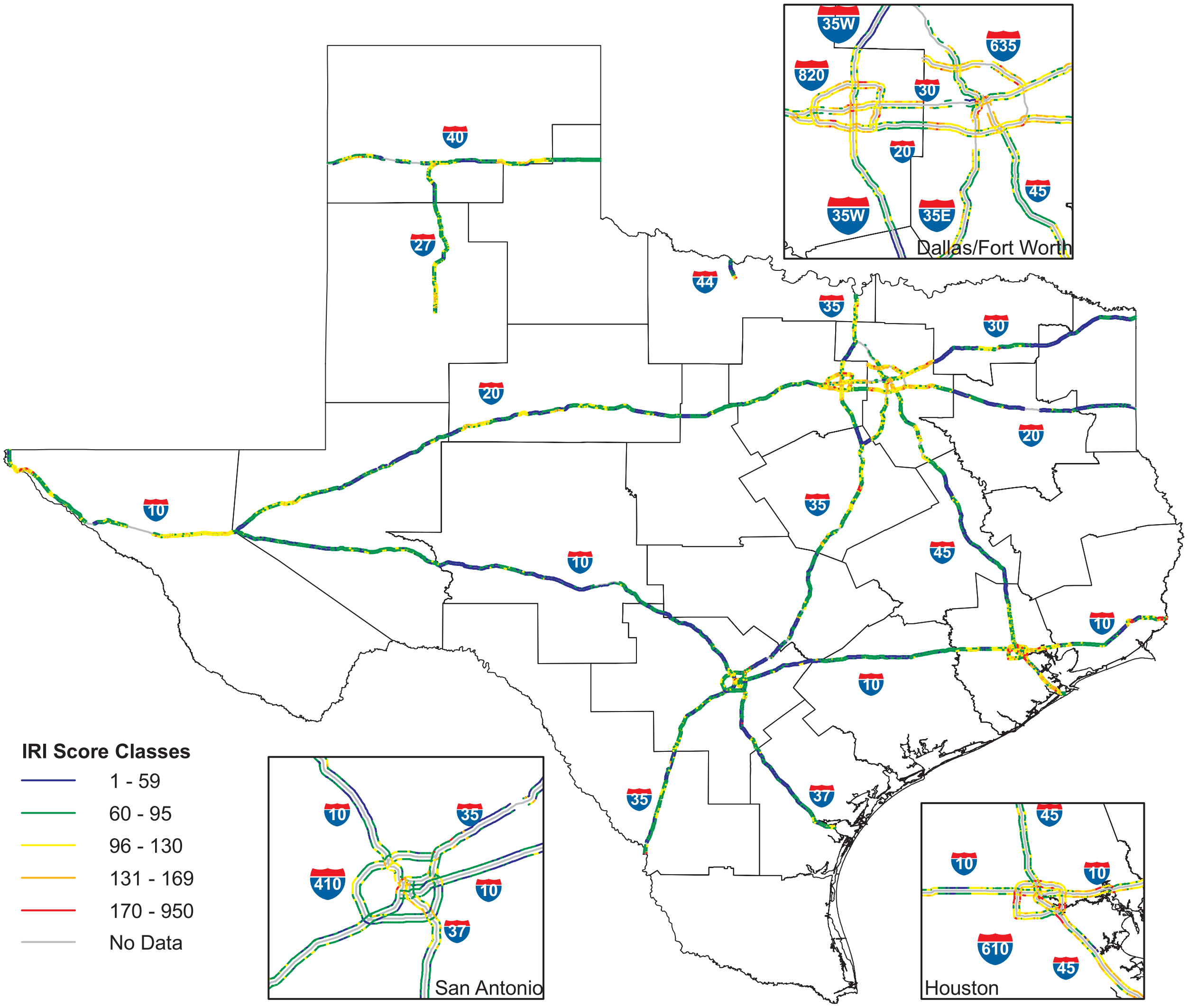


Figure 2.5 — IH System IRI Score Classes, FY 2002-2005.

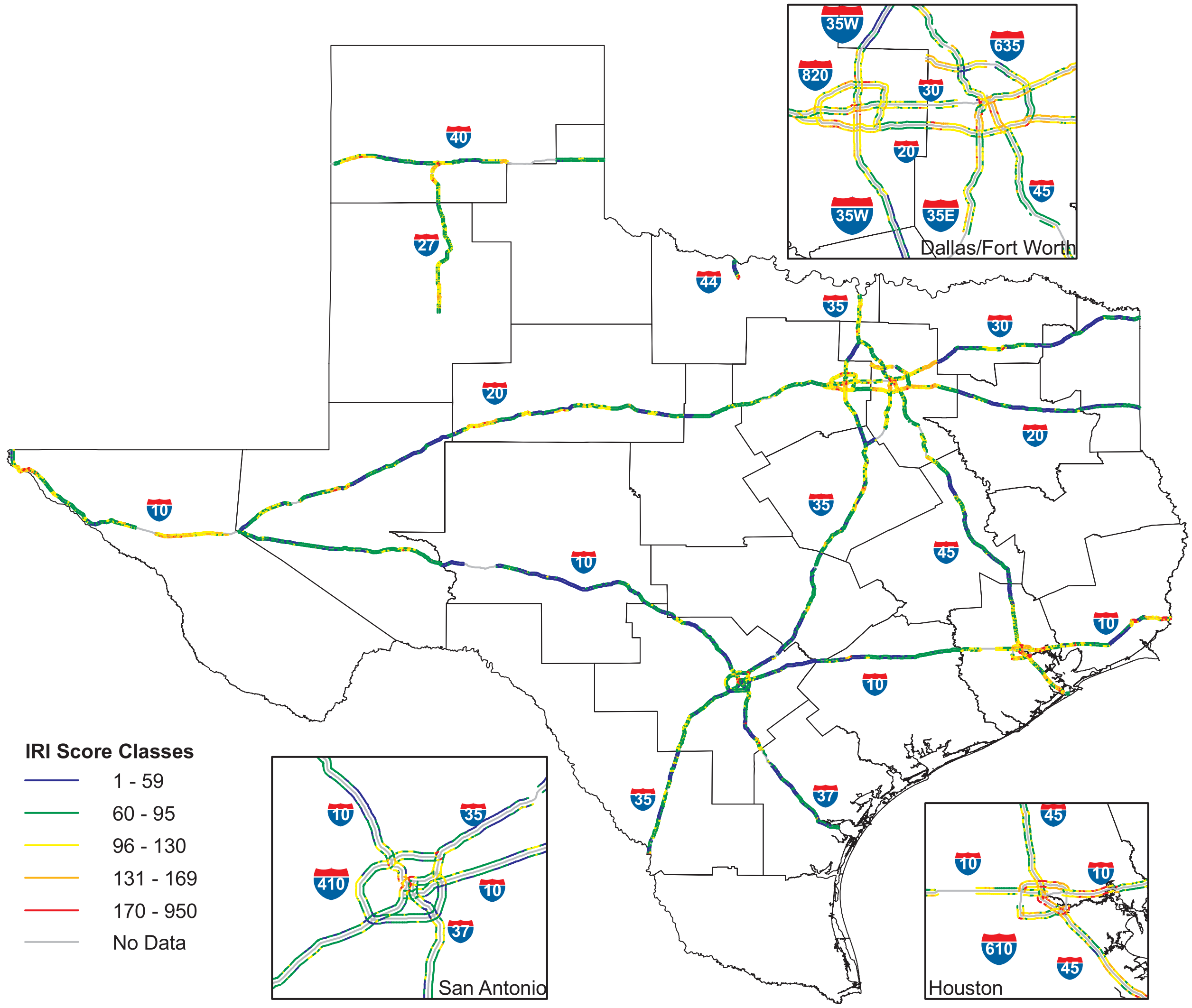
The IRI Score Classes for Interstate Highways show that:

- “Very Good” mileage decreased (from 23.02% in 2004 to 21.54% in 2005)
- “Good” mileage decreased (from 46.22% in 2004 to 46.06% in 2005)
- “Fair” mileage increased (from 21.58% in 2004 to 21.71% in 2005)
- “Poor” mileage increased (from 7.49% in 2004 to 8.54% in 2005)
- “Very Poor” mileage increased (from 1.69% in 2004 to 2.15% in 2005).

Map 2.7 — IH System IRI Score Classes, FY 2004.



Map 2.8 — IH System IRI Score Classes, FY 2005.



United States (US) Highway System

Figure 2.6 shows the statewide distribution of Condition Score classes for the US Highway system for fiscal years 2002 through 2005.

76.93 percent of the US lane miles were in "Very Good" condition in FY 2005.

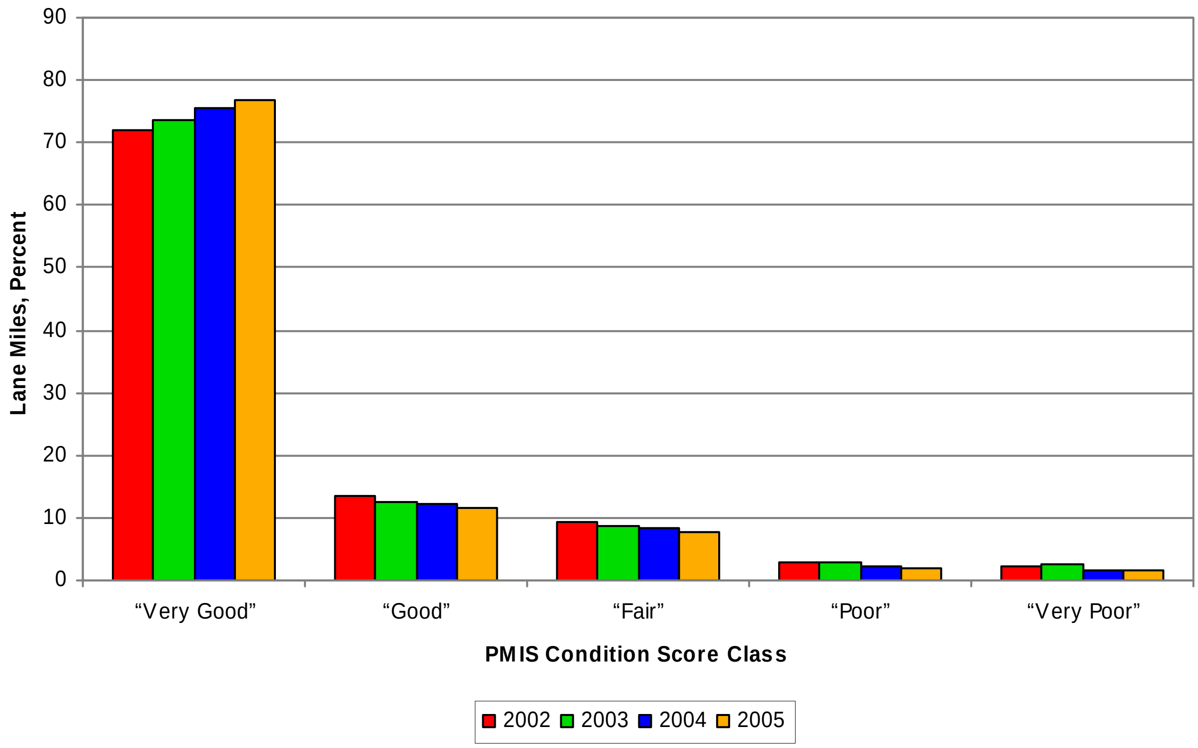


Figure 2.6 — US System Condition Score Classes, FY 2002-2005.

The Condition Score Classes for US Highways show that:

- "Very Good" mileage increased (from 75.66% in 2004 to 76.93% in 2005)
- "Good" mileage decreased (from 12.27% in 2004 to 11.73% in 2005)
- "Fair" mileage decreased (from 8.26% in 2004 to 7.77% in 2005)
- "Poor" mileage decreased (from 2.13% in 2004 to 2.02% in 2005)
- "Very Poor" mileage decreased (from 1.67% in 2004 to 1.55% in 2005).

Figure 2.7 shows the statewide distribution of the Distress Score classes for the US system for fiscal years 2002 through 2005.

80.41 percent of the US lane miles were "Very Good" in terms of pavement distress in FY 2005.

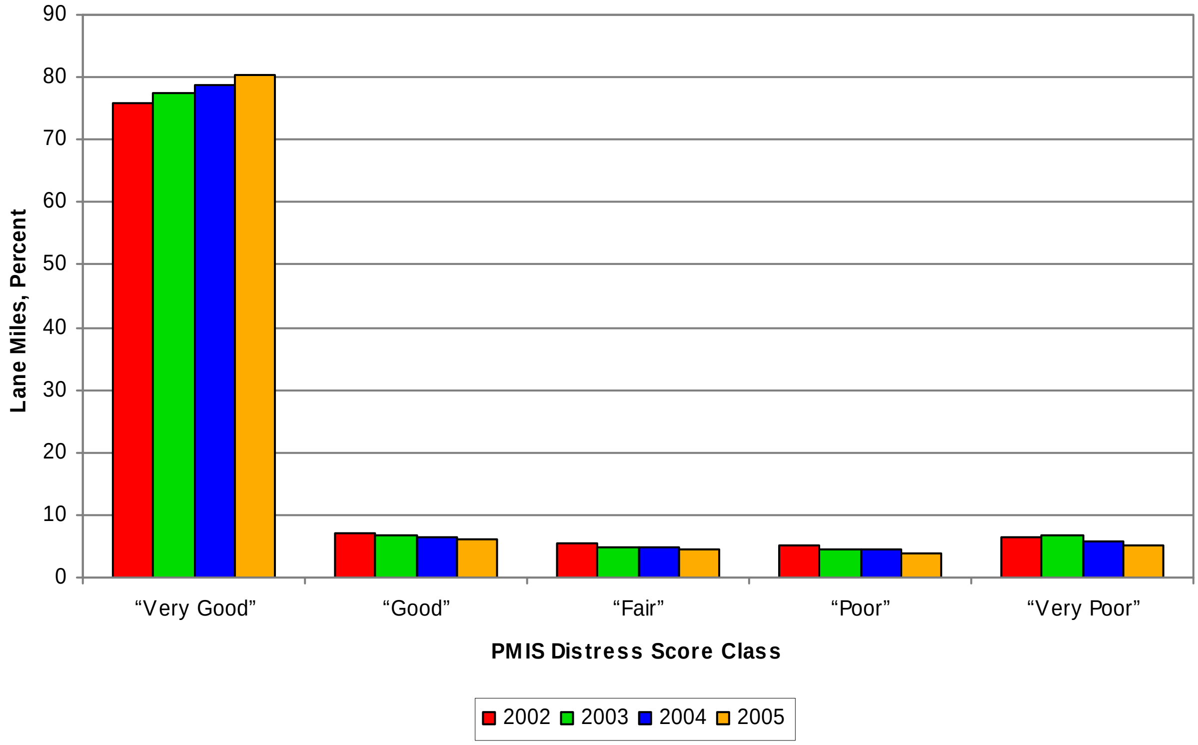


Figure 2.7 — US System Distress Score Classes, FY 2002-2005.

The Distress Score Classes for US Highways show that:

- "Very Good" mileage increased (from 78.83% in 2004 to 80.41% in 2005)
- "Good" mileage decreased (from 6.36% in 2004 to 6.08% in 2005)
- "Fair" mileage decreased (from 4.78% in 2004 to 4.49% in 2005)
- "Poor" mileage decreased (from 4.39% in 2004 to 3.98% in 2005)
- "Very Poor" mileage decreased (from 5.64% in 2004 to 5.03% in 2005).

Figure 2.8 shows the statewide distribution for the Ride Score classes for the US Highway system for fiscal years 2002 through 2005. In general, the average person would consider 6.84 percent of US pavements in Texas to be "rough."

43.45 percent of the US lane miles had "Very Good" ride quality in FY 2005.

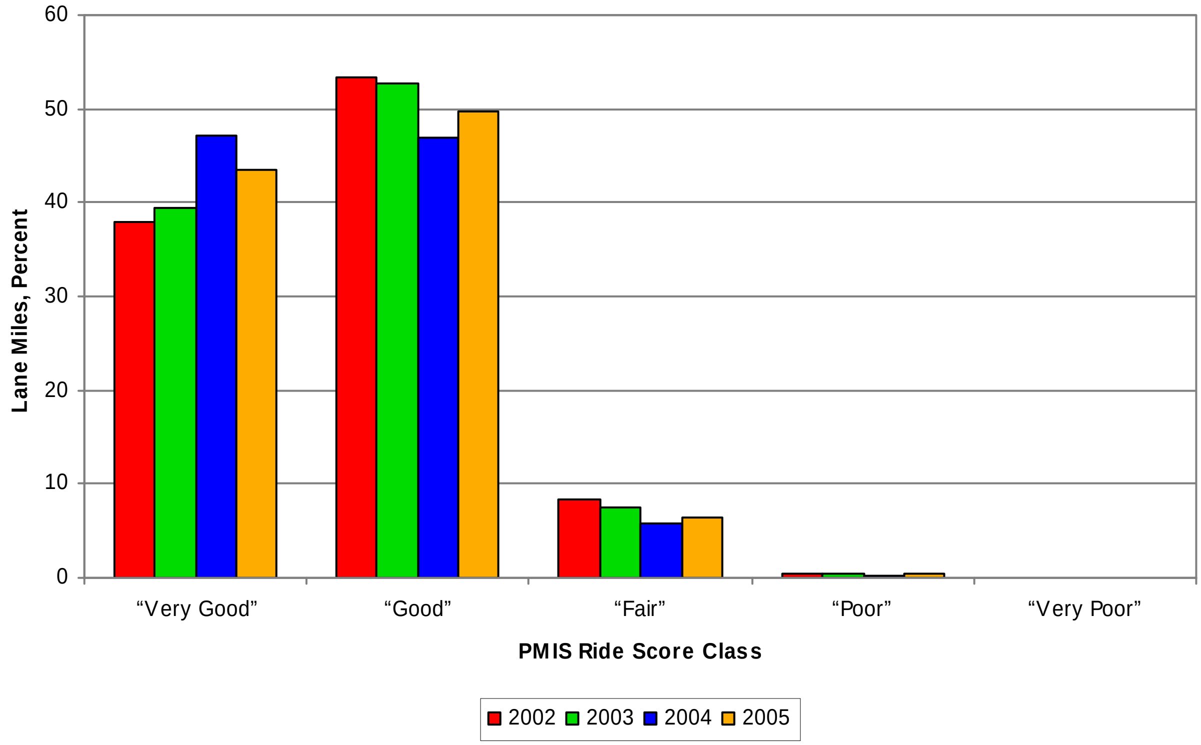


Figure 2.8 — US System Ride Score Classes, FY 2002-2005.

The Ride Score Classes for US Highways show that:

- "Very Good" mileage decreased (from 47.10% in 2004 to 43.45% in 2005)
- "Good" mileage increased (from 46.88% in 2004 to 49.71% in 2005)
- "Fair" mileage increased (from 5.69% in 2004 to 6.45% in 2005)
- "Poor" mileage increased (from 0.30% in 2004 to 0.38% in 2005)
- "Very Poor" mileage decreased (from 0.03% in 2004 to 0.00% in 2005).

Figure 2.9 shows the statewide distribution for the IRI Score classes for the US Highway system for fiscal years 2002 through 2005. In general, the average person would consider 43.34 percent of US pavements in Texas to be "rough," based on IRI. This is not the same as the 6.84 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.

11.87 percent of the US lane miles had "Very Good" IRI scores in FY 2005.

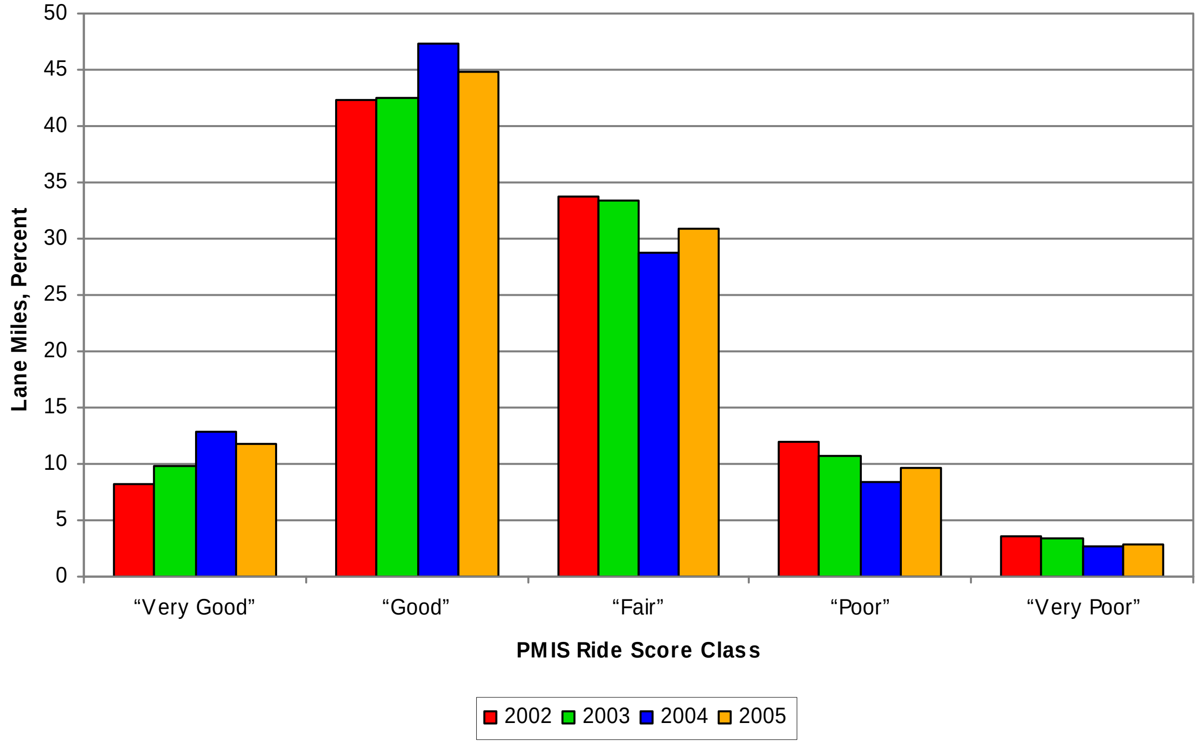


Figure 2.9 — US System IRI Score Classes, FY 2002-2005.

The IRI Score Classes for US Highways show that:

- "Very Good" mileage decreased (from 12.90% in 2004 to 11.87% in 2005)
- "Good" mileage decreased (from 47.34% in 2004 to 44.79% in 2005)
- "Fair" mileage increased (from 28.67% in 2004 to 30.89% in 2005)
- "Poor" mileage increased (from 8.40% in 2004 to 9.58% in 2005)
- "Very Poor" mileage increased (from 2.69% in 2004 to 2.88% in 2005).

State Highway (SH) System

Figure 2.10 shows the statewide distribution for the Condition Score classes for the SH system for fiscal years 2002 through 2005.

74.66 percent of the SH lane miles were in "Very Good" condition in FY 2005.

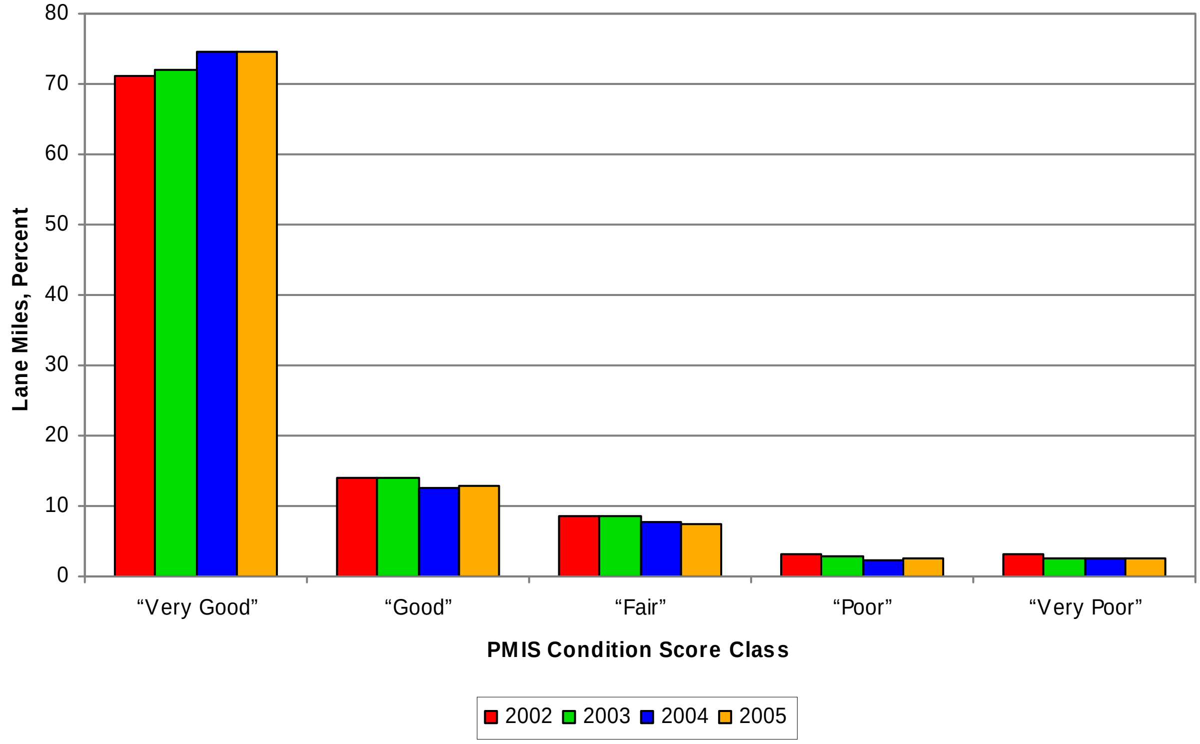


Figure 2.10 — SH System Condition Score Classes, FY 2002-2005.

The Condition Score Classes for State Highways show that:

- "Very Good" mileage increased (from 74.65% in 2004 to 74.66% in 2005)
- "Good" mileage increased (from 12.57% in 2004 to 12.83% in 2005)
- "Fair" mileage decreased (from 7.76% in 2004 to 7.39% in 2005)
- "Poor" mileage increased (from 2.41% in 2004 to 2.60% in 2005)
- "Very Poor" mileage decreased (from 2.61% in 2004 to 2.52% in 2005).

Figure 2.11 shows the statewide distribution of the Distress Score classes for the SH system for fiscal years 2002 through 2005.

81.12 percent of the SH lane miles were "Very Good" in terms of pavement distress in FY 2005.

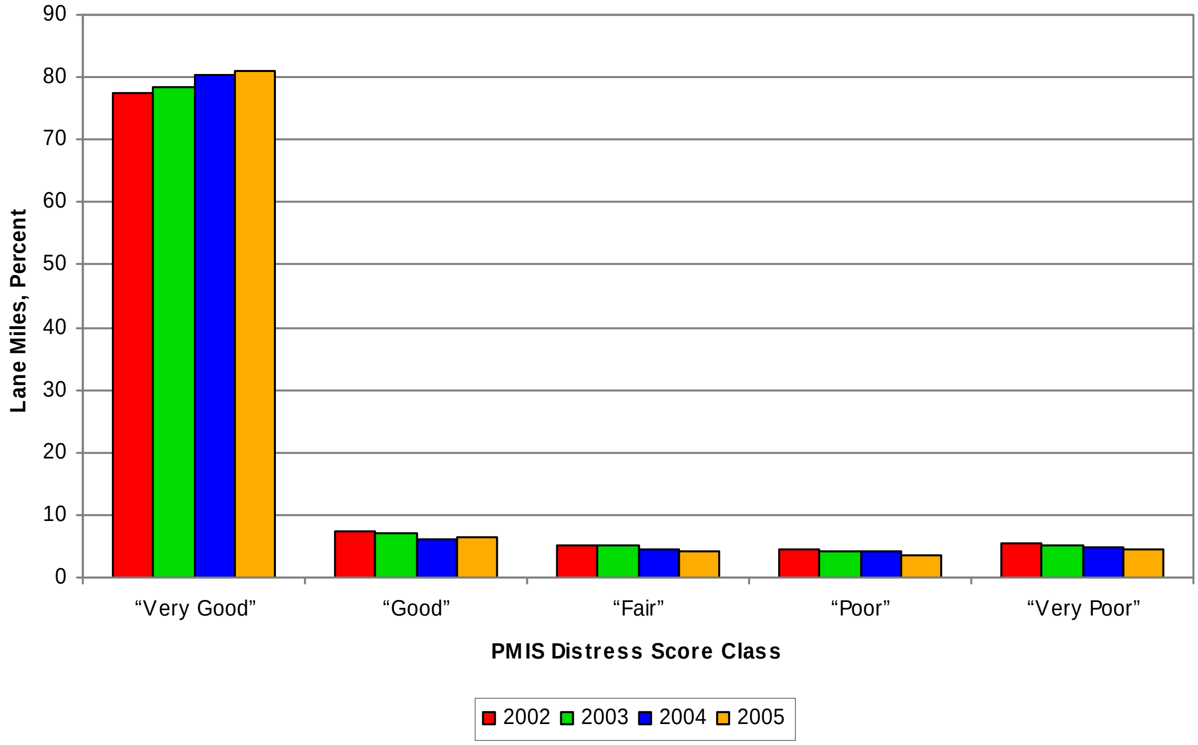


Figure 2.11 — SH System Distress Score Classes, FY 2002-2005.

The Distress Score Classes for State Highways show that:

- "Very Good" mileage increased (from 80.22% in 2004 to 81.12% in 2005)
- "Good" mileage increased (from 6.20% in 2004 to 6.53% in 2005)
- "Fair" mileage decreased (from 4.58% in 2004 to 4.19% in 2005)
- "Poor" mileage decreased (from 4.23% in 2004 to 3.64% in 2005)
- "Very Poor" mileage decreased (from 4.77% in 2004 to 4.51% in 2005).

Figure 2.12 shows the statewide distribution for the Ride Score classes for the SH system for fiscal years 2002 through 2005. In general, the average person would consider 14.76 percent of SH pavements in Texas to be "rough."

30.51 percent of the SH lane miles had "Very Good" ride quality in FY 2005.

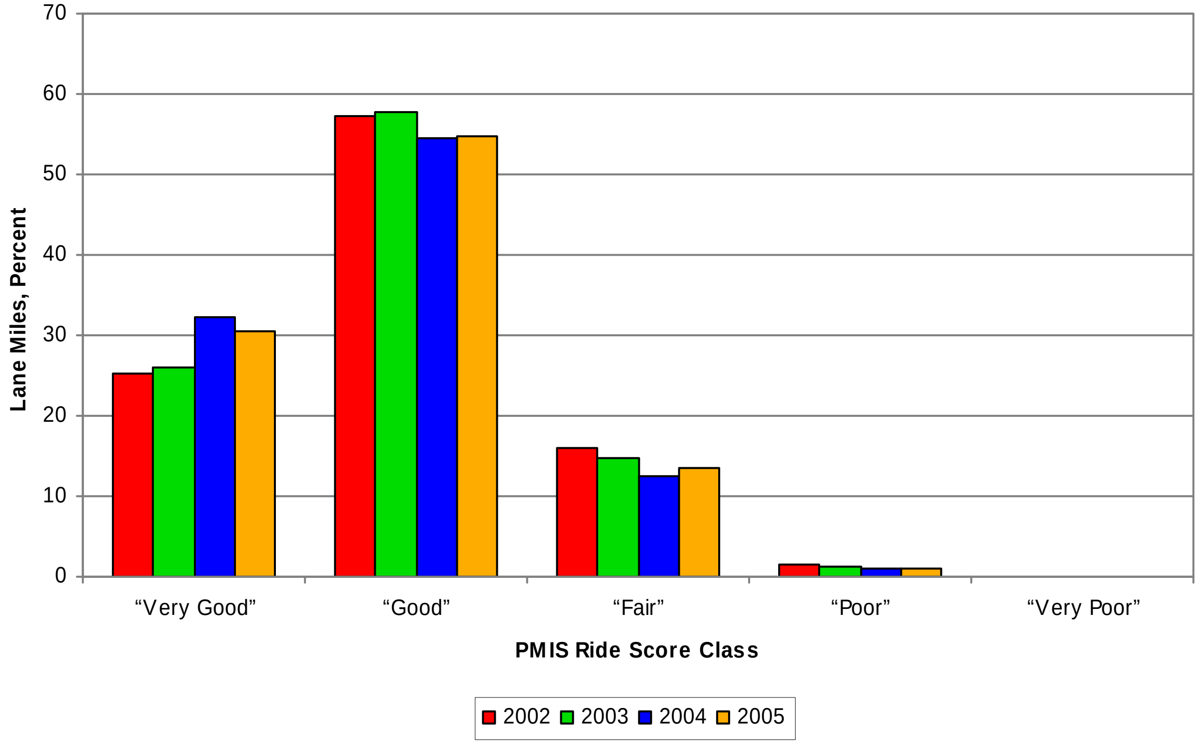


Figure 2.12 — SH System Ride Score Classes, FY 2002-2005.

The Ride Score Classes for State Highways show that:

- "Very Good" mileage decreased (from 32.14% in 2004 to 30.51% in 2005)
- "Good" mileage increased (from 54.44% in 2004 to 54.73% in 2005)
- "Fair" mileage increased (from 12.38% in 2004 to 13.62% in 2005)
- "Poor" mileage increased (from 0.98% in 2004 to 1.07% in 2005)
- "Very Poor" mileage increased (from 0.05% in 2004 to 0.07% in 2005).

Figure 2.13 shows the statewide distribution for the IRI Score classes for the SH system for fiscal years 2002 through 2005. In general, the average person would consider 57.71 percent of SH pavements in Texas to be “rough,” based on IRI. This is not the same as the 14.76 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.

6.65 percent of the SH lane miles had “Very Good” IRI scores in FY 2005.

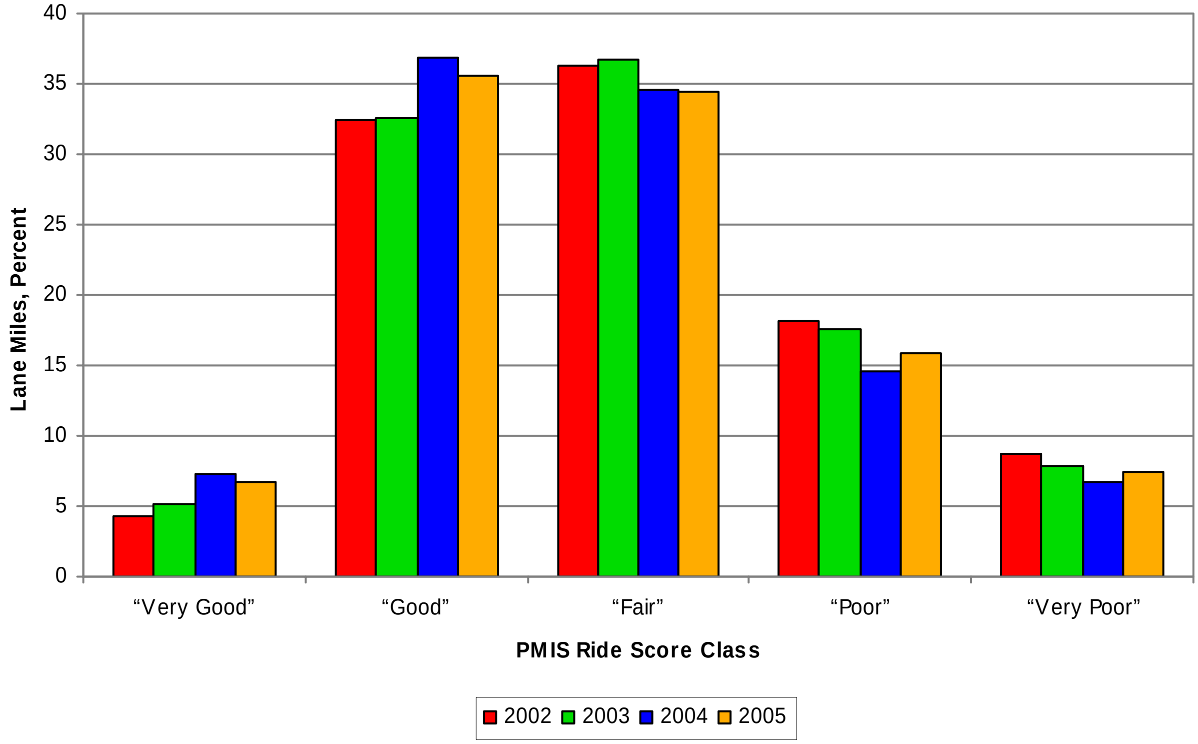


Figure 2.13 — SH System IRI Score Classes, FY 2002-2005.

The IRI Score Classes for State Highways show that:

- “Very Good” mileage decreased (from 7.34% in 2004 to 6.65% in 2005)
- “Good” mileage decreased (from 36.85% in 2004 to 35.64% in 2005)
- “Fair” mileage decreased (from 34.57% in 2004 to 34.45% in 2005)
- “Poor” mileage increased (from 14.60% in 2004 to 15.85% in 2005)
- “Very Poor” mileage increased (from 6.65% in 2004 to 7.41% in 2005).

Farm-to-Market (FM) Roads

Figure 2.14 shows the statewide distribution of the Condition Score classes for FM roads for fiscal years 2002 through 2005.

74.33 percent of the FM miles were in "Very Good" condition in FY 2005.

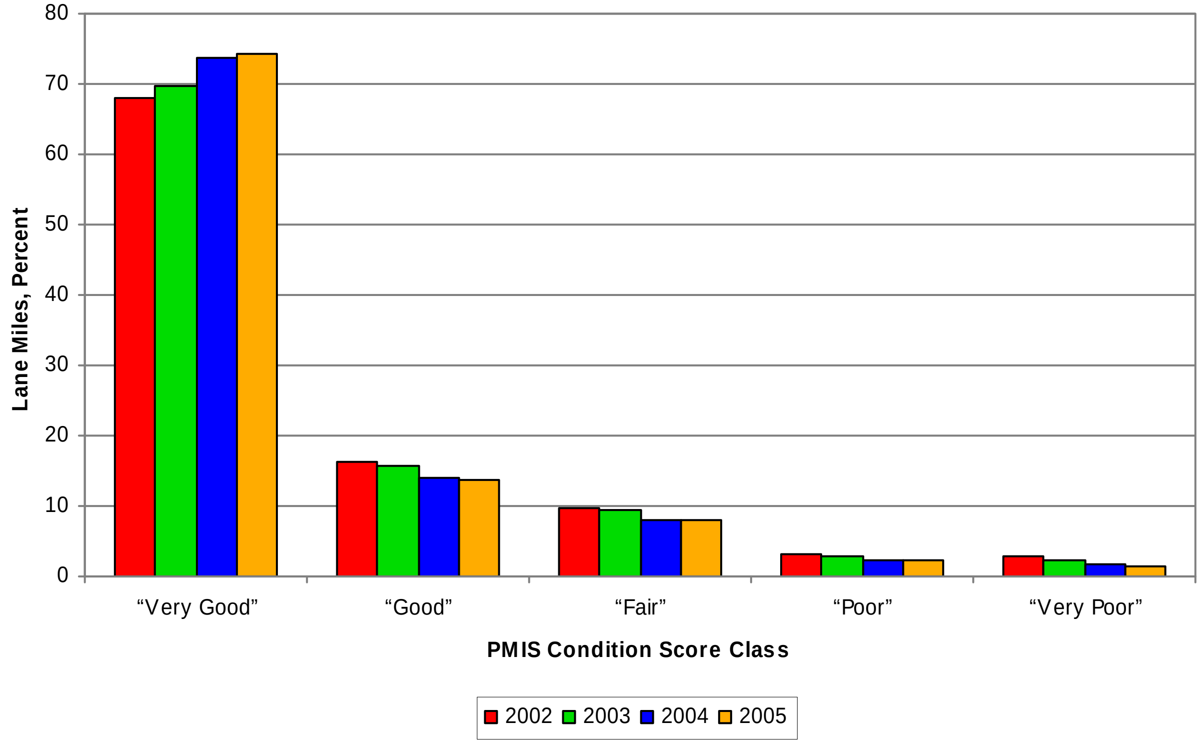


Figure 2.14 — FM Roads Condition Score Classes, FY 2002-2005.

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

- "Very Good" mileage increased (from 73.81% in 2004 to 74.33% in 2005)
- "Good" mileage decreased (from 14.11% in 2004 to 13.84% in 2005)
- "Fair" mileage decreased (from 8.10% in 2004 to 7.96% in 2005)
- "Poor" mileage increased (from 2.27% in 2004 to 2.32% in 2005)
- "Very Poor" mileage decreased (from 1.71% in 2004 to 1.55% in 2005).

Figure 2.15 shows the statewide distribution of the Distress Score classes for FM roads for fiscal years 2002 through 2005.

80.50 percent of FM lane miles were "Very Good" in terms of pavement distress in FY 2005.

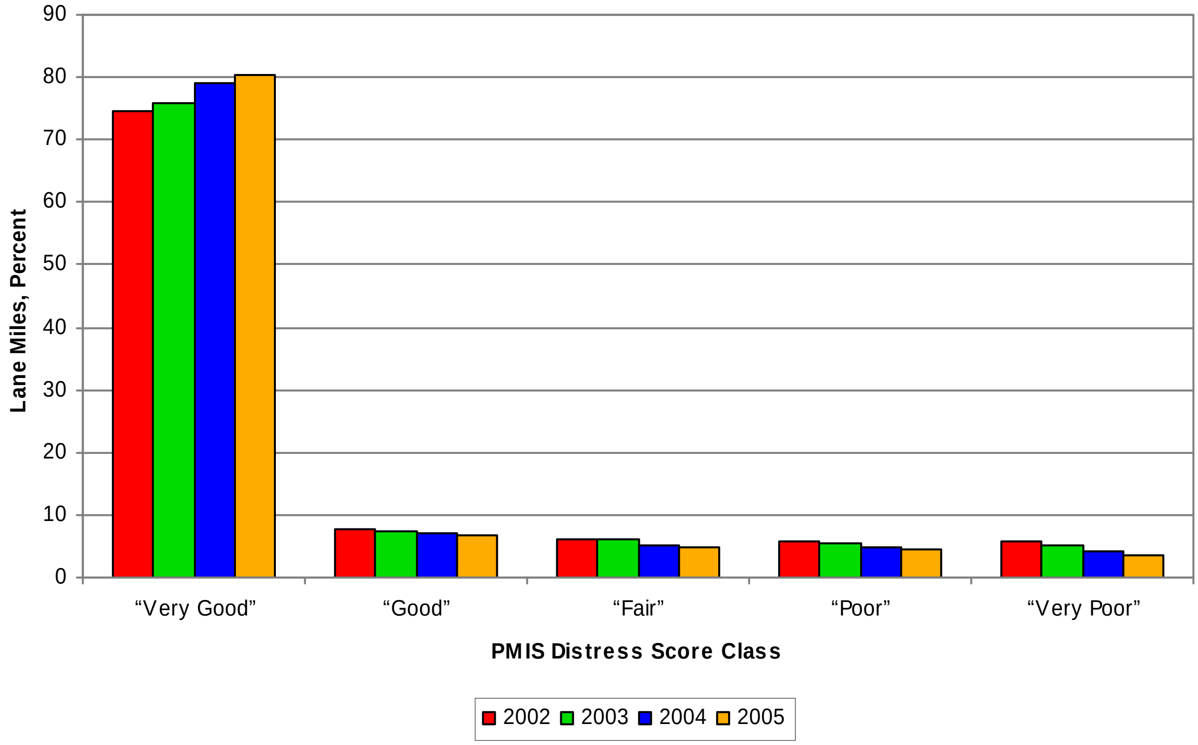


Figure 2.15 — FM Roads Distress Score Classes, FY 2002-2005.

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

- "Very Good" mileage increased (from 78.94% in 2004 to 80.50% in 2005)
- "Good" mileage decreased (from 6.91% in 2004 to 6.63% in 2005)
- "Fair" mileage decreased (from 5.10% in 2004 to 4.74% in 2005)
- "Poor" mileage decreased (from 4.87% in 2004 to 4.47% in 2005)
- "Very Poor" mileage decreased (from 4.18% in 2004 to 3.66% in 2005).

Figure 2.16 shows the statewide distribution of the Ride Score classes for FM roads for fiscal years 2002 through 2005. In general, the average person would consider 37.42 percent of FM roads in Texas to be "rough."

9.49 percent of the FM lane miles had "Very Good" ride quality in FY 2005.

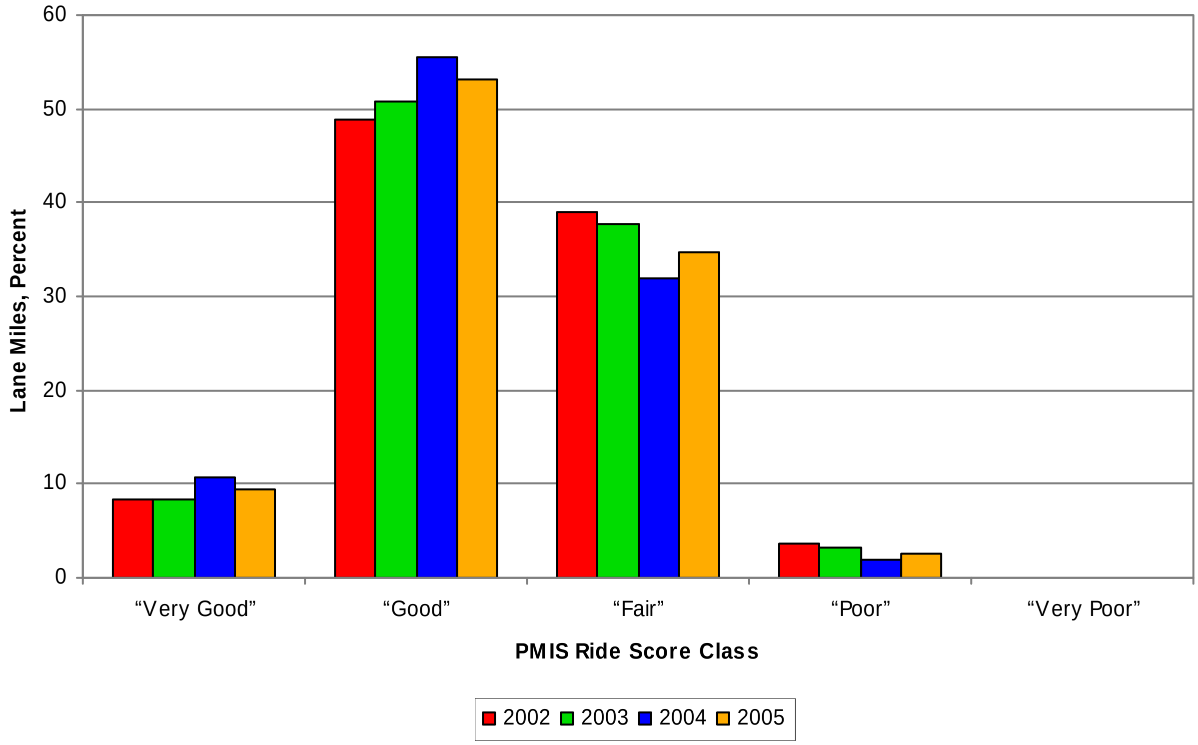


Figure 2.16 — FM Roads Ride Score Classes, FY 2002-2005.

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

- "Very Good" mileage decreased (from 10.67% in 2004 to 9.49% in 2005)
- "Good" mileage decreased (from 55.48% in 2004 to 53.09% in 2005)
- "Fair" mileage increased (from 31.83% in 2004 to 34.81% in 2005)
- "Poor" mileage increased (from 1.97% in 2004 to 2.55% in 2005)
- "Very Poor" mileage increased (from 0.05% in 2004 to 0.06% in 2005).

Figure 2.17 shows the statewide distribution of the IRI Score classes for FM roads for fiscal years 2002 through 2005. In general, the average person would consider 85.03 percent of FM roads in Texas to be "rough," based on IRI. This is not the same as the 37.42 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.

1.35 percent of the FM lane miles had "Very Good" IRI scores in FY 2005.

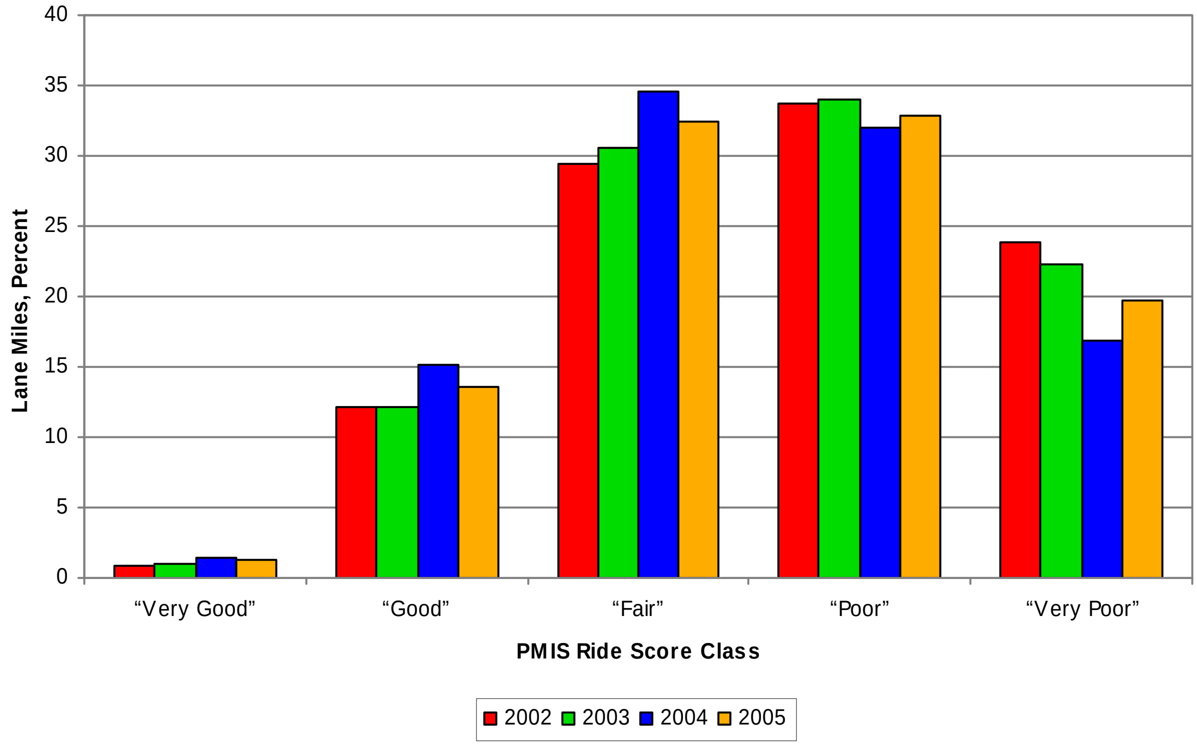


Figure 2.17 — FM Roads IRI Score Classes, FY 2002-2005.

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

- "Very Good" mileage decreased (from 1.46% in 2004 to 1.35% in 2005)
- "Good" mileage decreased (from 15.17% in 2004 to 13.63% in 2005)
- "Fair" mileage decreased (from 34.53% in 2004 to 32.43% in 2005)
- "Poor" mileage increased (from 31.98% in 2004 to 32.91% in 2005)
- "Very Poor" mileage increased (from 16.86% in 2004 to 19.69% in 2005).

The three shortest Interstate highways in Texas are: IH 110 in El Paso county, 0.919 miles; IH 345 in Dallas County, 1.400 miles; and IH 44 in Wichita county, 14.765 miles.

Discussion

Pavement condition and distress improved to the highest level in four years for each of the four major highway systems (IH, US, SH, and FM) in FY 2005. However, ride quality got worse for each of the major highway systems in FY 2005, after having improved in FY 2003 and FY 2004.

For Interstate highways (IH), FY 2005 condition and distress improved, but ride quality worsened. The worsening IH ride quality was caused by ACP and JCP — IH CRCP ride quality actually improved in FY 2005. IH still had the best overall ride quality of the major highway systems in FY 2005, though, as it did in FY 1998-2004. IH had the worst overall distress of the major highway systems in FY 2005, as it did in FY 2004.

For US highways, FY 2005 condition and distress improved, but ride quality worsened. The US system had the best overall condition of the major highway systems in FY 2005, as it did in FY 2002 and FY 2004.

For State highways (SH), FY 2005 condition and distress improved, but ride quality worsened. The SH system had the worst overall condition of the major highway systems in FY 2005, as it did in FY 2004.

For Farm-to-Market roads (FM), FY 2005 condition and distress improved, but ride quality worsened. FM had the worst overall ride quality of the major highway systems in FY 2005, as it did in FY 2001-2004. For the first time in four years, though, FM had the best overall distress in FY 2005, after having had the worst overall distress in FY 2002 and FY 2003.

Summary

Pavement condition and distress improved to the highest level in four years for each of the four major highway systems (IH, US, SH, and FM) in FY 2005. However, ride quality got worse for each of the major highway systems in FY 2005, after having improved in FY 2003 and FY 2004. For FY 2005, IH mileage had the best overall ride quality but the worst overall distress; US had the best overall condition; SH had the worst overall condition; and FM had the best overall distress but the worst overall ride quality.

In 1956, Congress appropriated $25 billion for construction of the Interstate system from 1957 through 1968. As of 1991, total cost of the Interstate system had increased to $128.900 billion. The breakdown of these total costs were: Preliminary Engineering, 4.5 percent; Right of Way, 13.1 percent; and Construction, 82.4 percent.

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 92.51 percent of the TxDOT-maintained lane mileage but carry only 72.46 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.

Causes of Flexible Pavement Distresses

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

- Structural (“load-associated”) distress types caused primarily by excessive traffic load or weakened pavement structure. Load associated distress types for flexible pavement are Shallow Rutting, Deep Rutting, Alligator Cracking (“fatigue cracking”), and Failures.
- Surface (“non load-associated”) distress types, caused primarily by extremes in rainfall or temperature, or by pavement age. Non load-associated distress types for flexible pavement are Longitudinal Cracking, Transverse Cracking, Block Cracking, and Patching.

By analyzing the flexible pavement distress types, it is possible to distinguish pavements that need structural rehabilitation from those that can be adequately repaired by preventive maintenance or resurfacing. It is also possible to identify areas, or highway corridors, which will be severely damaged by increases in traffic or load.

The first half of this chapter will analyze the load-associated surface distresses and the second half will analyze the non load-associated distresses.

Condition Score Classes for Flexible Pavement

Figure 3.1 shows the statewide distribution of Condition Score classes for flexible pavements for fiscal years 2002 through 2005.

75.64 percent of the flexible lane miles were in "Very Good" condition in FY 2005.

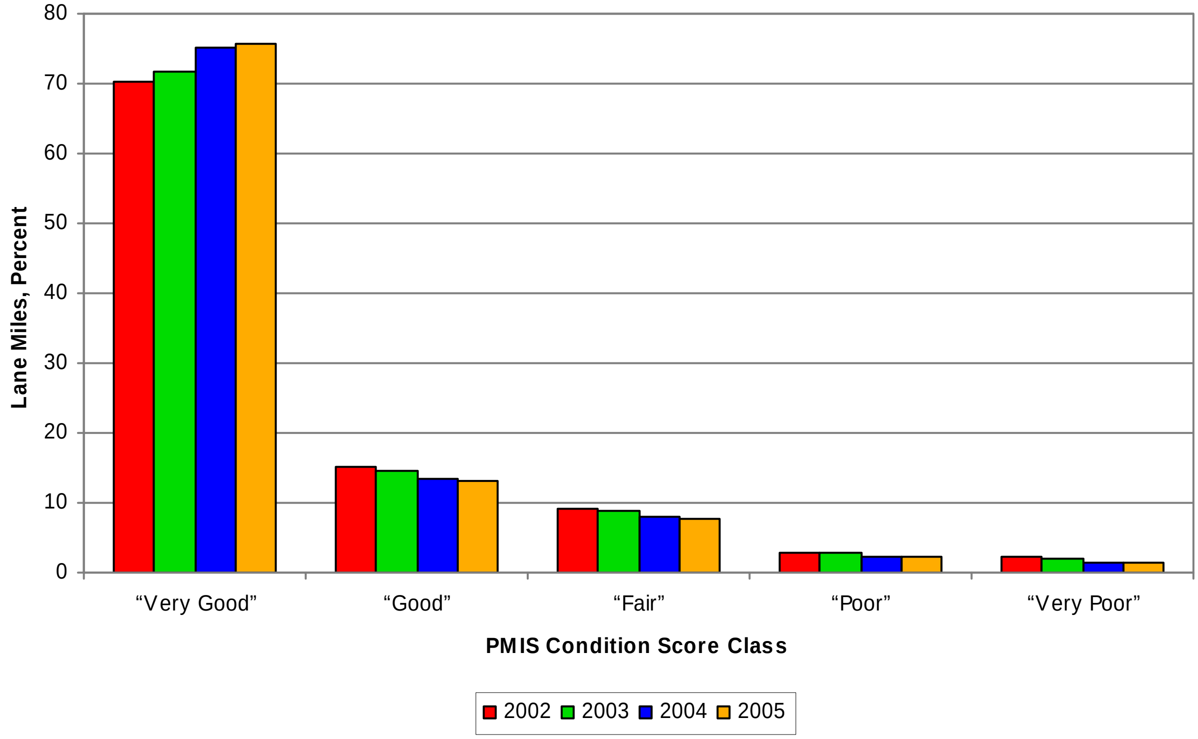


Figure 3.1 — Condition Score Classes for Flexible Pavement, FY 2002-2005.

The Condition Score Classes for Flexible Pavement shows that:

- "Very Good" mileage increased (from 75.02% in 2004 to 75.64% in 2005)
- "Good" mileage decreased (from 13.32% in 2004 to 13.05% in 2005)
- "Fair" mileage decreased (from 7.94% in 2004 to 7.63% in 2005)
- "Poor" mileage increased (from 2.16% in 2004 to 2.20% in 2005)
- "Very Poor" mileage decreased (from 1.55% in 2004 to 1.46% in 2005).

Distress Score Classes for Flexible Pavement

Figure 3.2 shows the statewide distribution of the Distress Score classes for flexible pavements for fiscal years 2002 through 2005.

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.

80.50 percent of flexible miles were "Very Good" in terms of pavement distress in FY 2005.

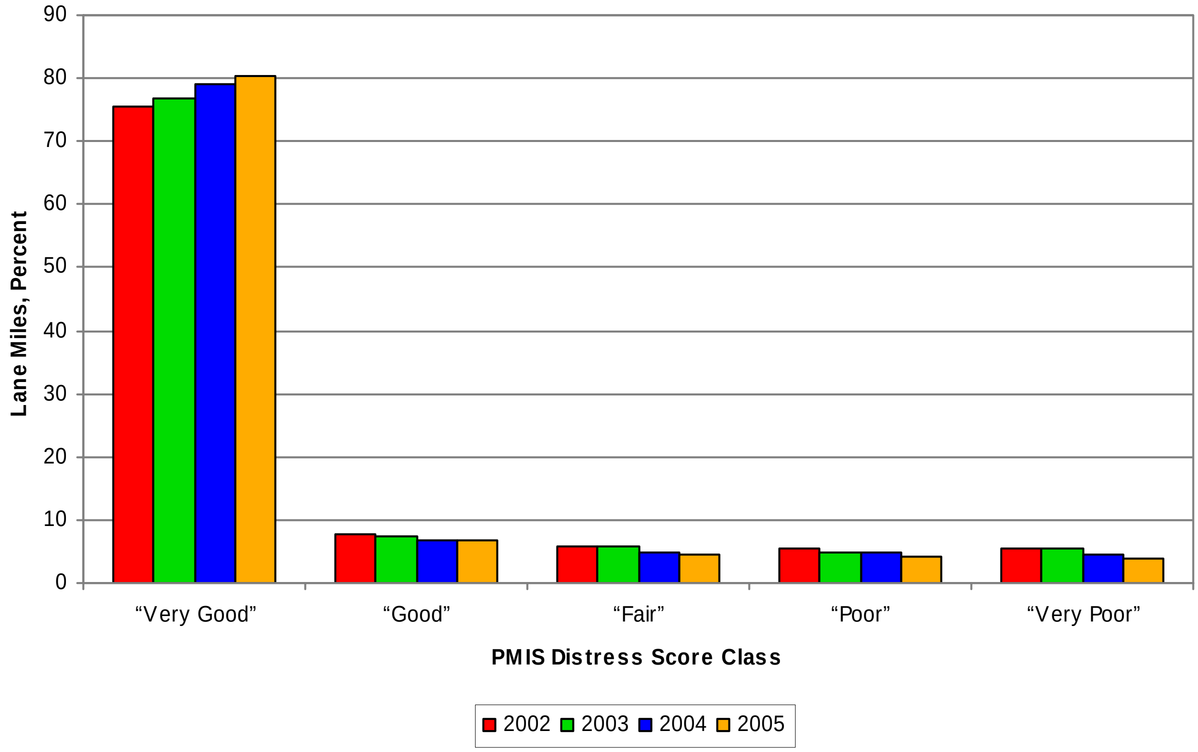


Figure 3.2 — Distress Score Classes for Flexible Pavement, FY 2002-2005.

The Distress Score Classes for Flexible Pavement shows that:

- "Very Good" mileage increased (from 79.11% in 2004 to 80.50% in 2005)
- "Good" mileage decreased (from 6.89% in 2004 to 6.66% in 2005)
- "Fair" mileage decreased (from 4.95% in 2004 to 4.65% in 2005)
- "Poor" mileage decreased (from 4.67% in 2004 to 4.19% in 2005)
- "Very Poor" mileage decreased (from 4.38% in 2004 to 4.00% in 2005).

Ride Score Classes for Flexible Pavement

Figure 3.3 shows the statewide distribution of the Ride Score classes for flexible pavements for fiscal years 2002 through 2005. In general, the average person would consider 23.60 percent of the flexible pavements in Texas to be “rough.”

25.60 percent of the flexible lane miles had “Very Good” ride quality in FY 2005.

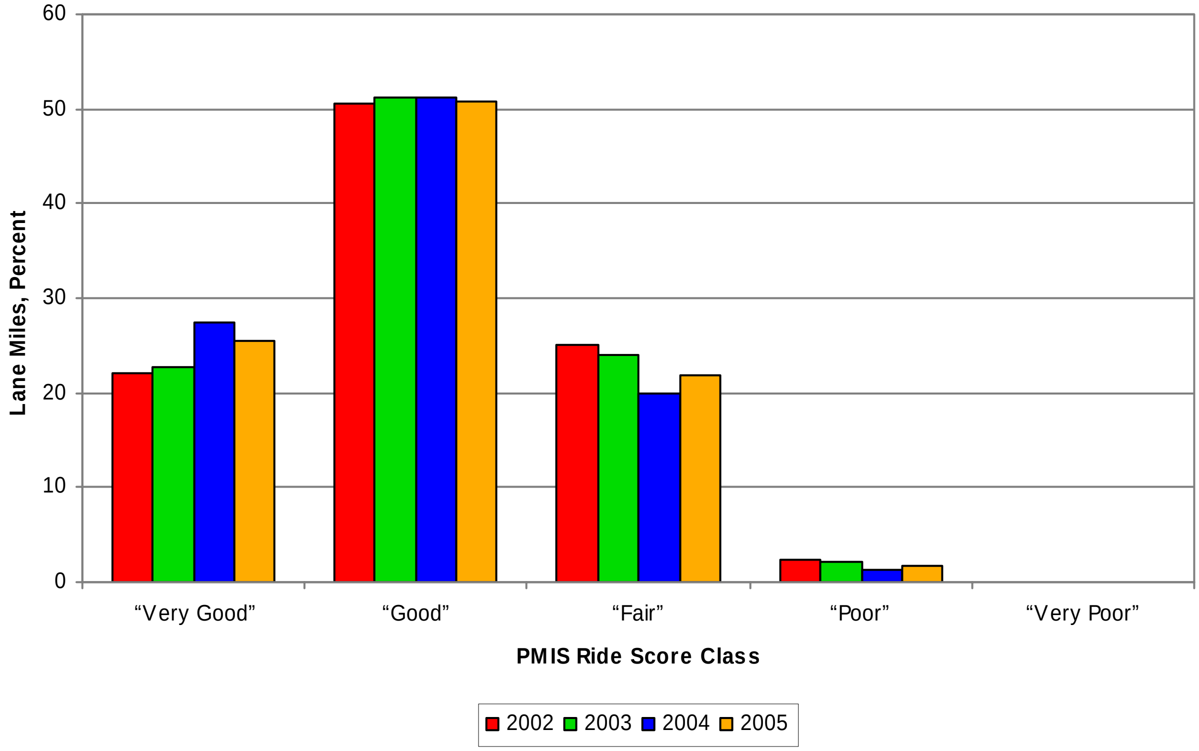


Figure 3.3 — Ride Score Classes for Flexible Pavement, FY 2002-2005.

The Ride Score Classes for Flexible Pavement shows that:

- “Very Good” mileage decreased (from 27.53% in 2004 to 25.60% in 2005)
- “Good” mileage decreased (from 51.24% in 2004 to 50.81% in 2005)
- “Fair” mileage increased (from 19.86% in 2004 to 21.91% in 2005)
- “Poor” mileage increased (from 1.32% in 2004 to 1.63% in 2005)
- “Very Poor” mileage remained the same (0.05% in 2004 to 0.05% in 2005).

IRI Score Classes for Flexible Pavement

Figure 3.4 shows the statewide distribution of the IRI Score classes for flexible pavements for fiscal years 2002 through 2005. In general, the average person would consider 65.67 percent of the flexible pavements in Texas to be “rough,” based on IRI. This is not the same as the 23.60 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.

6.62 percent of the flexible lane miles had “Very Good” IRI scores in FY 2005.

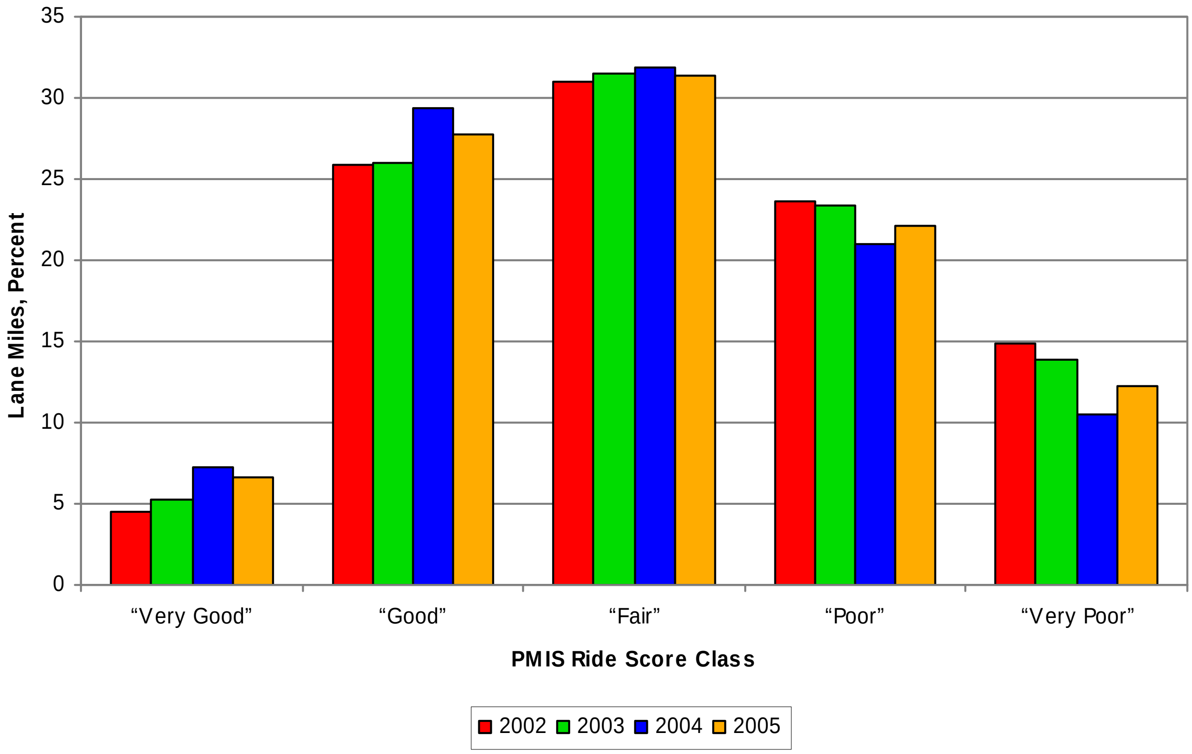


Figure 3.4 — IRI Score Classes for Flexible Pavement, FY 2002-2005.

The IRI Score Classes for Flexible Pavement shows that:

- “Very Good” mileage decreased (from 7.20% in 2004 to 6.62% in 2005)
- “Good” mileage decreased (from 29.35% in 2004 to 27.71% in 2005)
- “Fair” mileage decreased (from 31.88% in 2004 to 31.33% in 2005)
- “Poor” mileage increased (from 21.03% in 2004 to 22.10% in 2005)
- “Very Poor” mileage increased (from 10.54% in 2004 to 12.24% in 2005).

Shallow Rutting

Figure 3.5 shows the percentage of PMIS sections with Shallow Rutting for fiscal years 2002 through 2005. Shallow Rutting is a load-associated distress. It is defined as a depression in the wheelpath of ¼- to ½-inch in depth. Shallow Rutting is a result of inadequate pavement thickness or layer strength.

33.96 percent of the flexible pavement sections had Shallow Rutting in FY 2005.

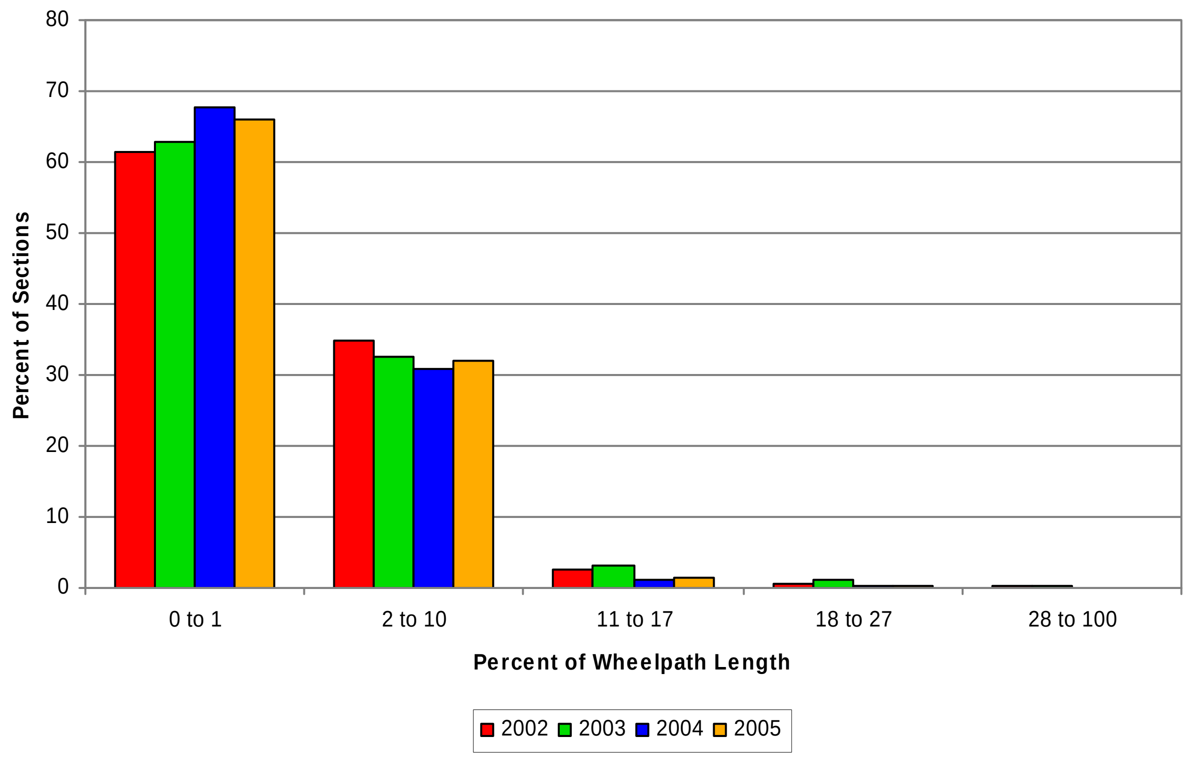


Figure 3.5 — Shallow Rutting, FY 2002-2005.

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

- "0 to 1" decreased (from 67.62% in 2004 to 66.04% in 2005)
- "2 to 10" increased (from 30.90% in 2004 to 31.93% in 2005)
- "11 to 17" increased (from 1.12% in 2004 to 1.53% in 2005)
- "18 to 27" increased (from 0.28% in 2004 to 0.41% in 2005)
- "28 to 100" remained the same (0.08% in 2004 to 0.08% in 2005).

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

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 mesurement of 10 percent would mean that the county has 20 miles of Shallow Rutting.

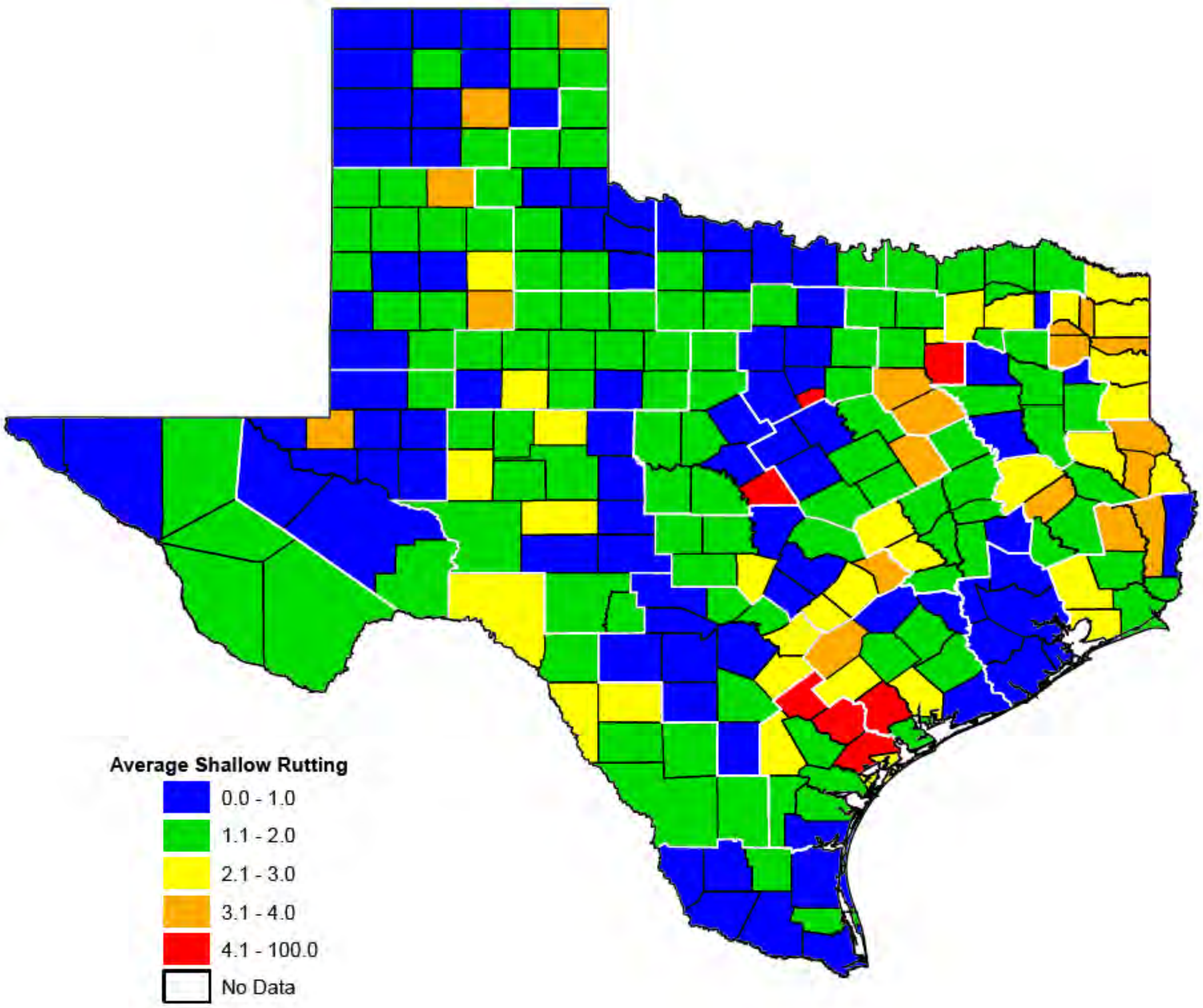
Shallow Rutting increased in FY 2005, after having decreased in FY 2004, FY 2003, and FY 2002.

Typically, Shallow Rutting is of most concern in the eastern portions of Texas, where high rainfall and moisture-sensitive subgrade can lead to rapid pavement failure. Once sub-surface materials become saturated with water, they become soft and more susceptible to damage. After a certain point, surface treatments and thin overlays do little to slow the progression of rutting and structural repair (such as medium to heavy rehabilitation) is needed.

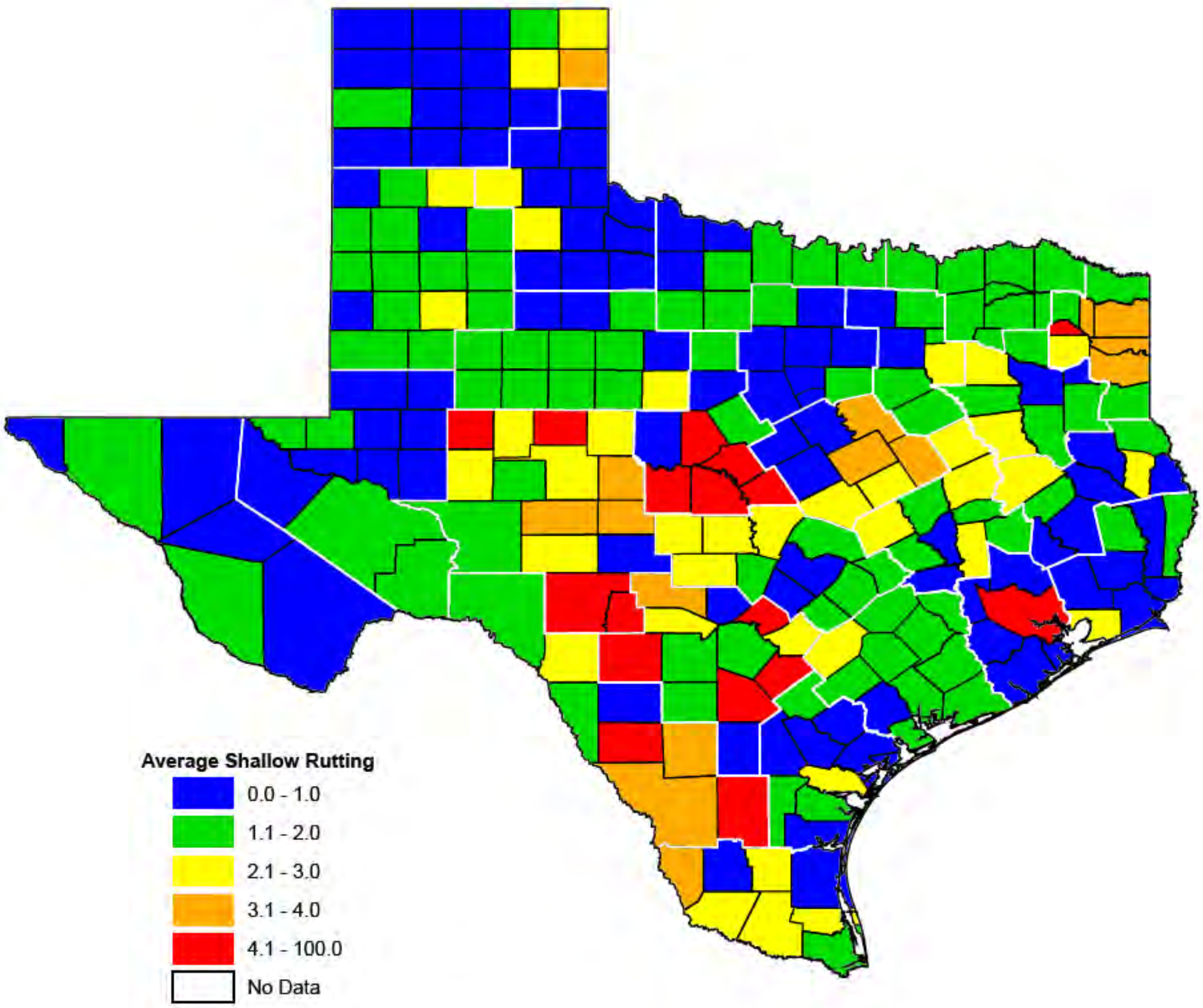
When interpreting the Shallow Rutting maps, it should be remembered that PMIS probably under-estimates the amount of Shallow Rutting actually on the road. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some Shallow Rutting on the road is not shown in these PMIS measurements, and some of the Shallow Rutting shown here may actually be Deep Rutting on the road. 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).

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

Map 3.1 — Average Shallow Rutting, FY 2004.



Map 3.2 — Average Shallow Rutting, FY 2005.



Deep Rutting

Figure 3.6 shows the percentage of PMIS sections with Deep Rutting for fiscal years 2002 through 2005. Deep Rutting is also a load-associated distress. It is defined as a depression in the wheelpath of ½- to 1-inch in depth. Deep Rutting is a result of inadequate pavement thickness or layer strength.

7.97 percent of the flexible pavement sections had Deep Rutting in FY 2005.

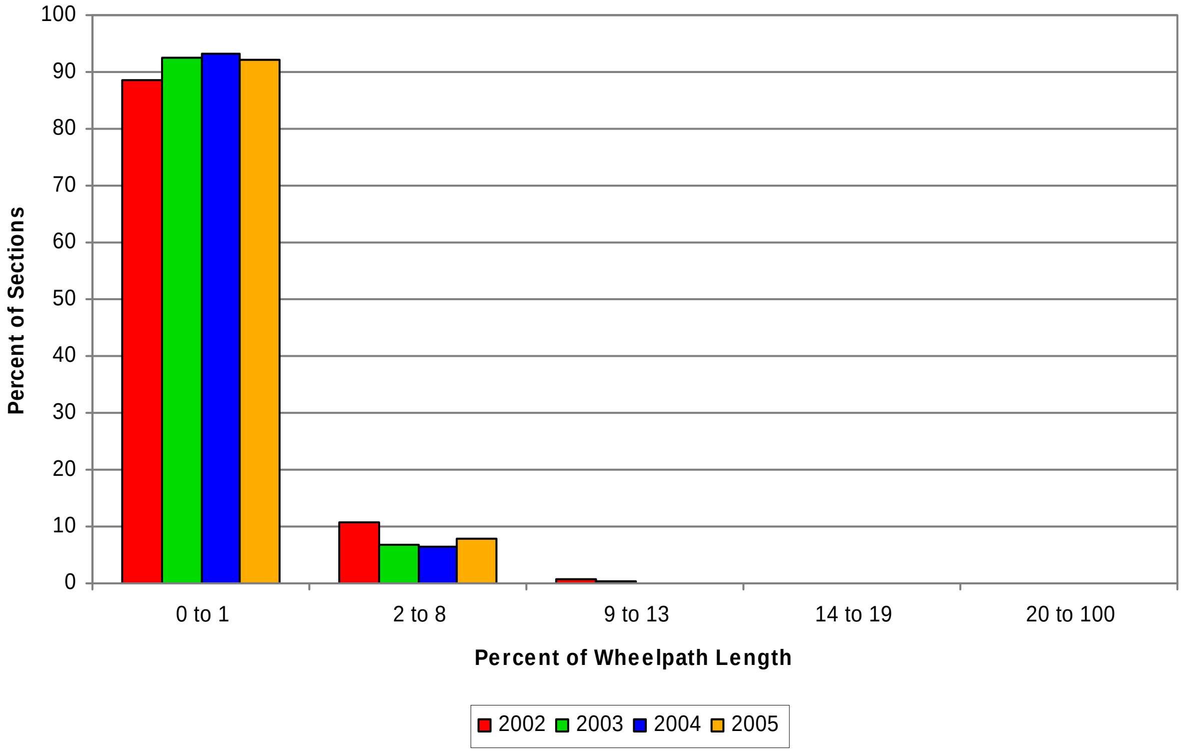


Figure 3.6 — Deep Rutting, FY 2002-2005.

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

- "0 to 1" decreased (from 93.35% in 2004 to 92.03% in 2005)
- "2 to 8" increased (from 6.44% in 2004 to 7.78% in 2005)
- "9 to 13" decreased (from 0.16% in 2004 to 0.15% in 2005)
- "14 to 19" decreased (from 0.04% in 2004 to 0.03% in 2005)
- "20 to 100" remained the same (0.01% in 2004 to 0.01% in 2005).

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

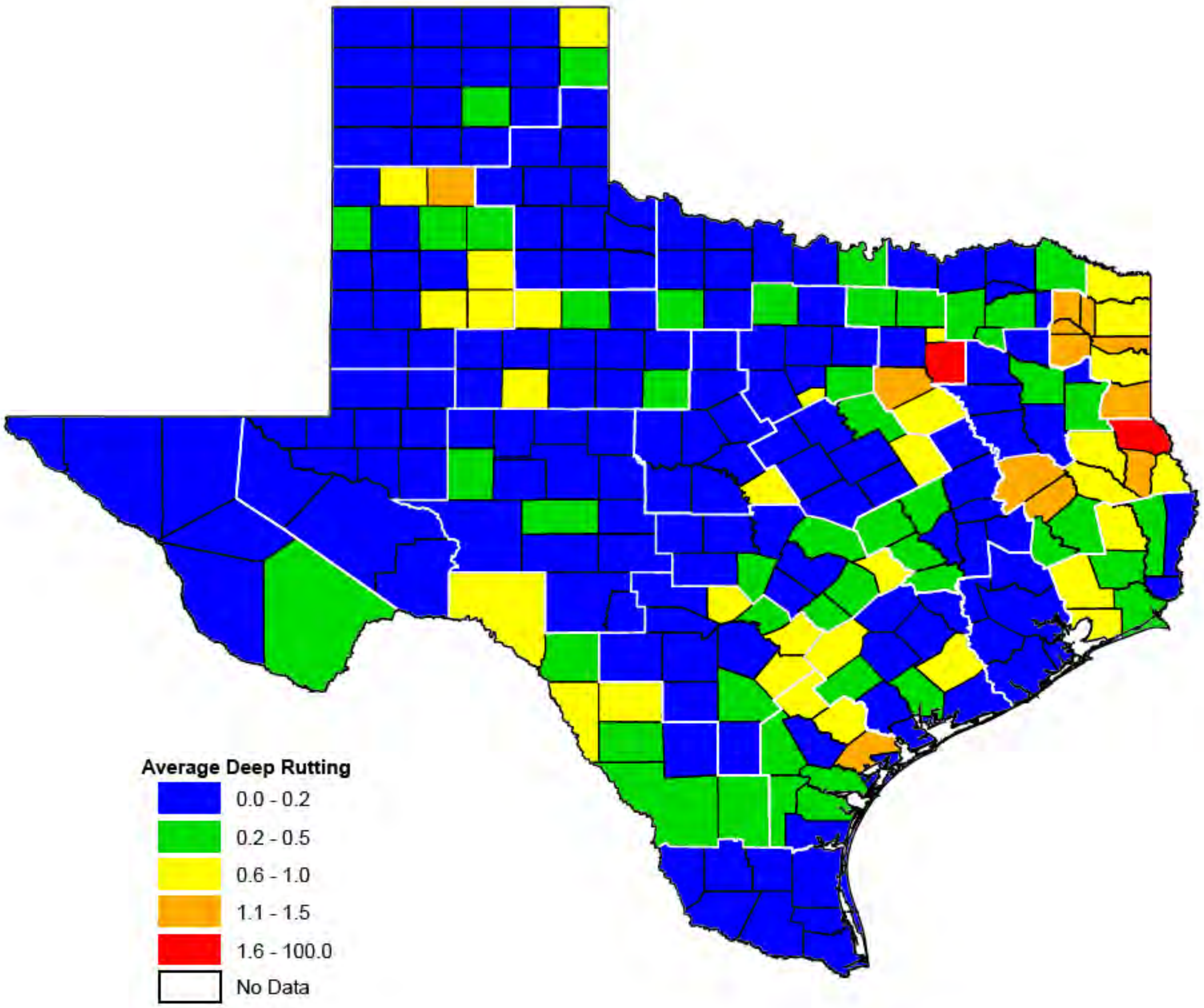
Maps 3.3 and 3.4 show the average measurement for Deep Rutting, weighted by lane miles, in each county. The average in this case is the percentage of wheelpath length with Deep Rutting. For example, if a county has 100 lane miles, it has 200 total miles of wheelpath that could have Deep Rutting; an average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

Deep Rutting increased in FY 2005, after having decreased in FY 2004 and FY 2003. It should be noted that Deep Rutting can be removed from the PMIS results by spot level-ups and in-place base repair, so areas with low levels of Deep Rutting might actually be areas of high maintenance activity. These types of treatments would also remove most, if not all, of the Shallow Rutting in PMIS.

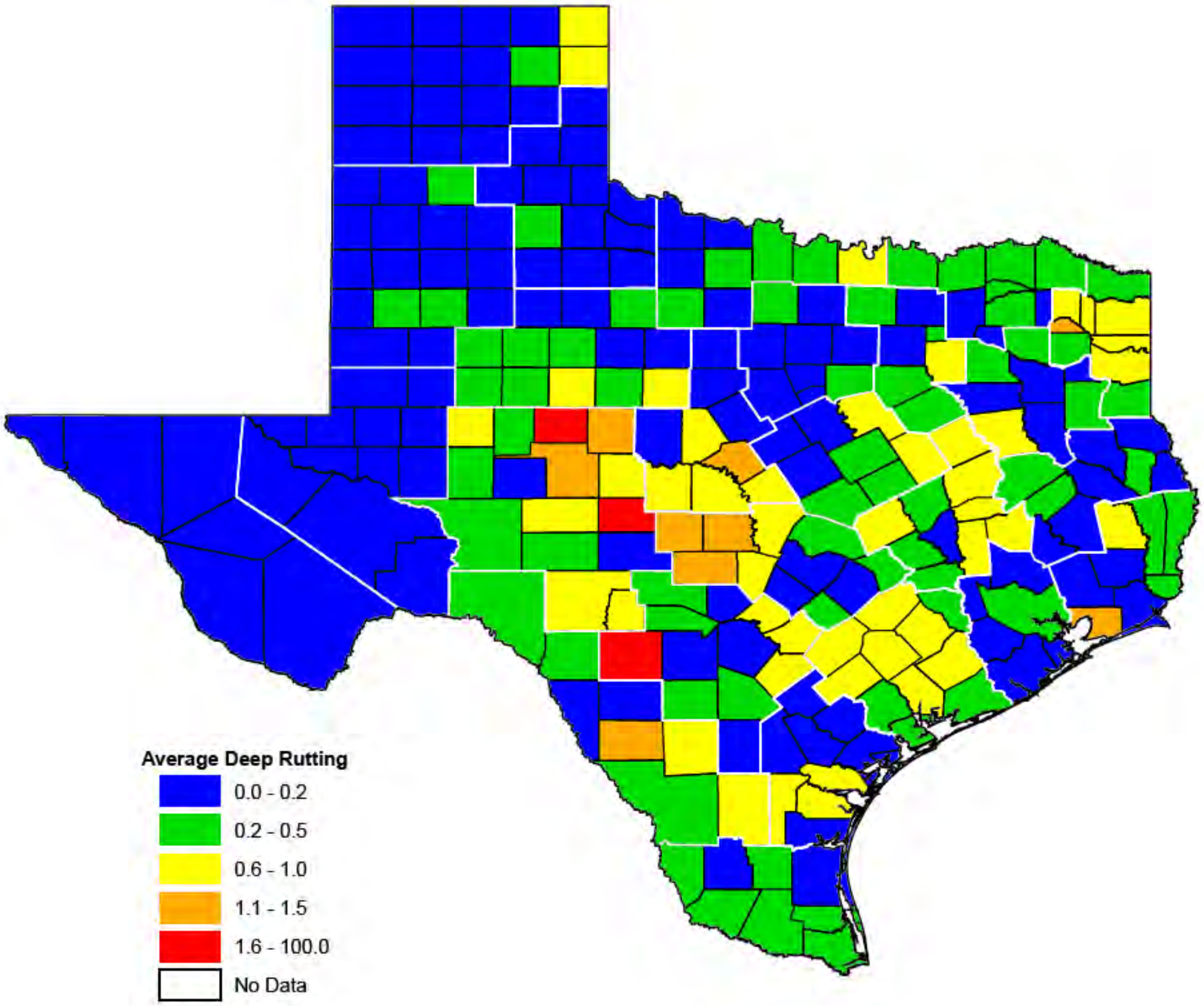
When interpreting the Deep Rutting maps, it should be remembered that PMIS probably under-estimates the amount of Deep Rutting actually on the road. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some Deep Rutting on the road is not shown in these PMIS measurements. 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).

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

Map 3.3 — Average Deep Rutting, FY 2004.



Map 3.4 — Average Deep Rutting, FY 2005.



Alligator Cracking

Figure 3.7 shows the percentage of PMIS sections with Alligator Cracking for fiscal years 2002 through 2005. Alligator Cracking is a load-associated distress. 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. Large percentages of Alligator Cracking indicate that a road surface is nearing the end of its structural life. If left untreated, Alligator Cracking soon results in more serious base problems as water seeps through the cracks, softens the base material, and washes away stabilization material. Rutting combined with Alligator Cracking increases seepage problems by ponding water into the cracked areas.

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

14.24 percent of the flexible pavement sections had Alligator Cracking in FY 2005.

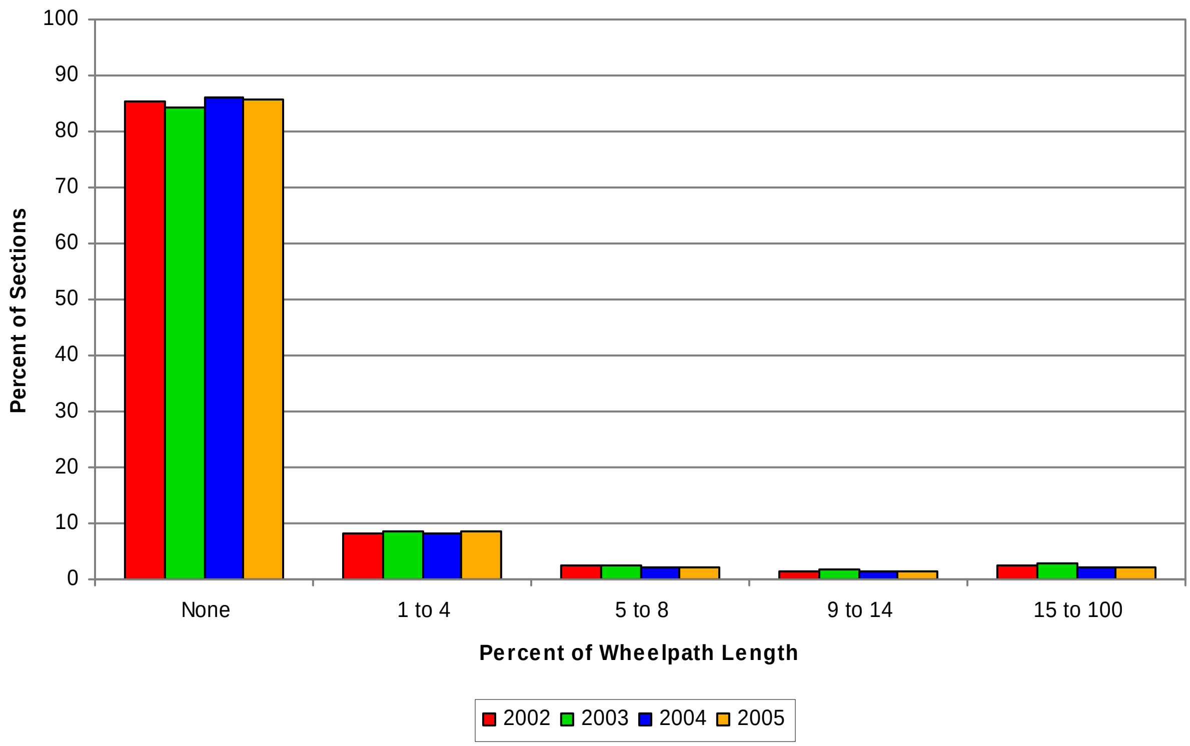


Figure 3.7 — Alligator Cracking, FY 2002-2005.

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

- "None" category decreased (from 86.00% in 2004 to 85.76% in 2005)
- "1 to 4" percent category increased (from 8.12% in 2004 to 8.51% in 2005)
- "5 to 8" percent category decreased (from 2.27% in 2004 to 2.24% in 2005)
- "9 to 14" percent category increased (from 1.36% in 2004 to 1.38% in 2005)
- "15 to 100" percent category decreased (from 2.25% in 2004 to 2.11% in 2005).

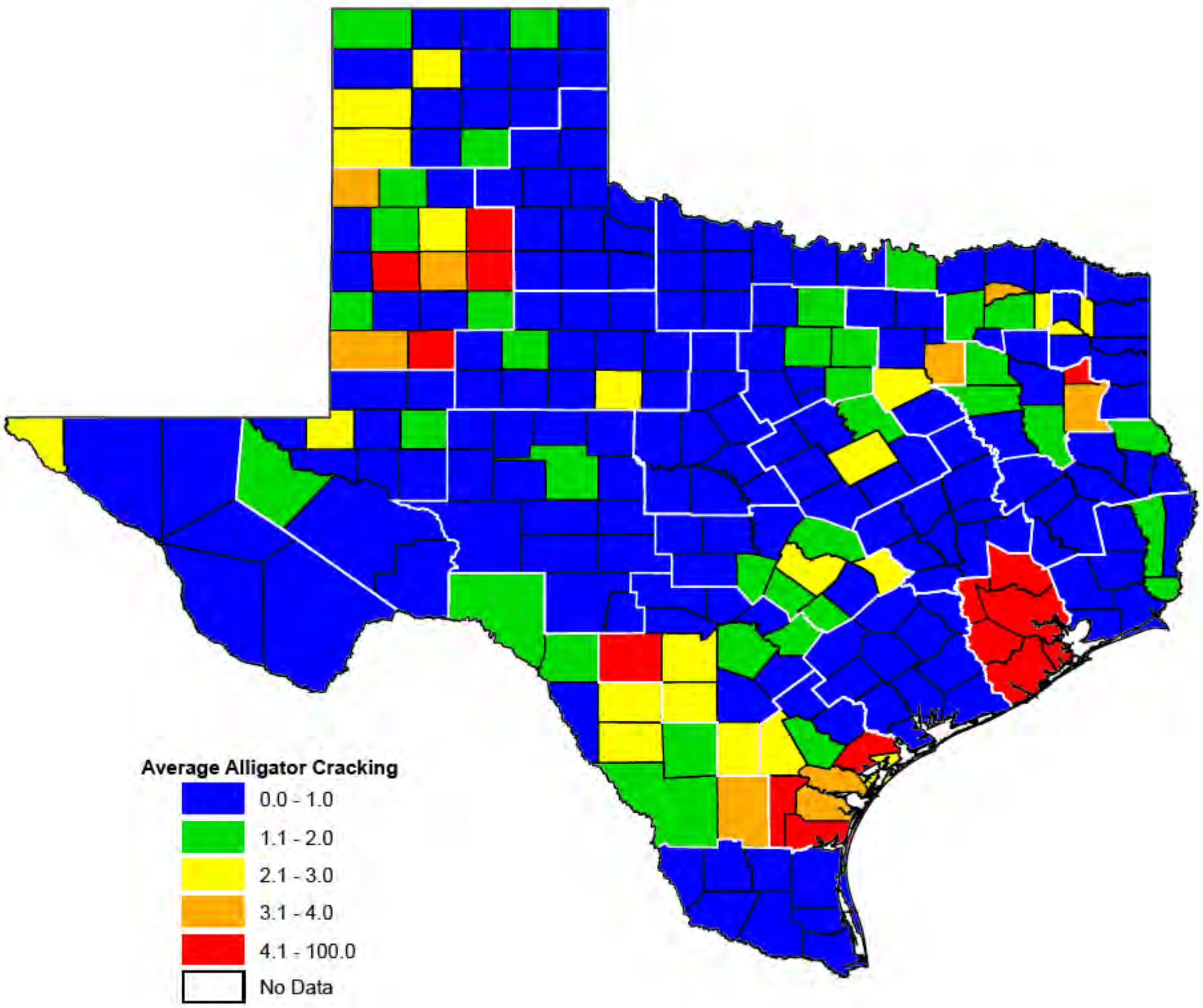
Maps 3.5 and 3.6 show the average rating for Alligator Cracking, weighted by lane miles, in each county. The average in this case is the percentage of wheelpath length with Alligator Cracking. For example, if a county has 100 lane miles, it has 200 total miles of wheelpath that could have Alligator Cracking;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

Alligator Cracking increased in FY 2005, after having decreased in FY 2004. It occurs in most parts of the state.

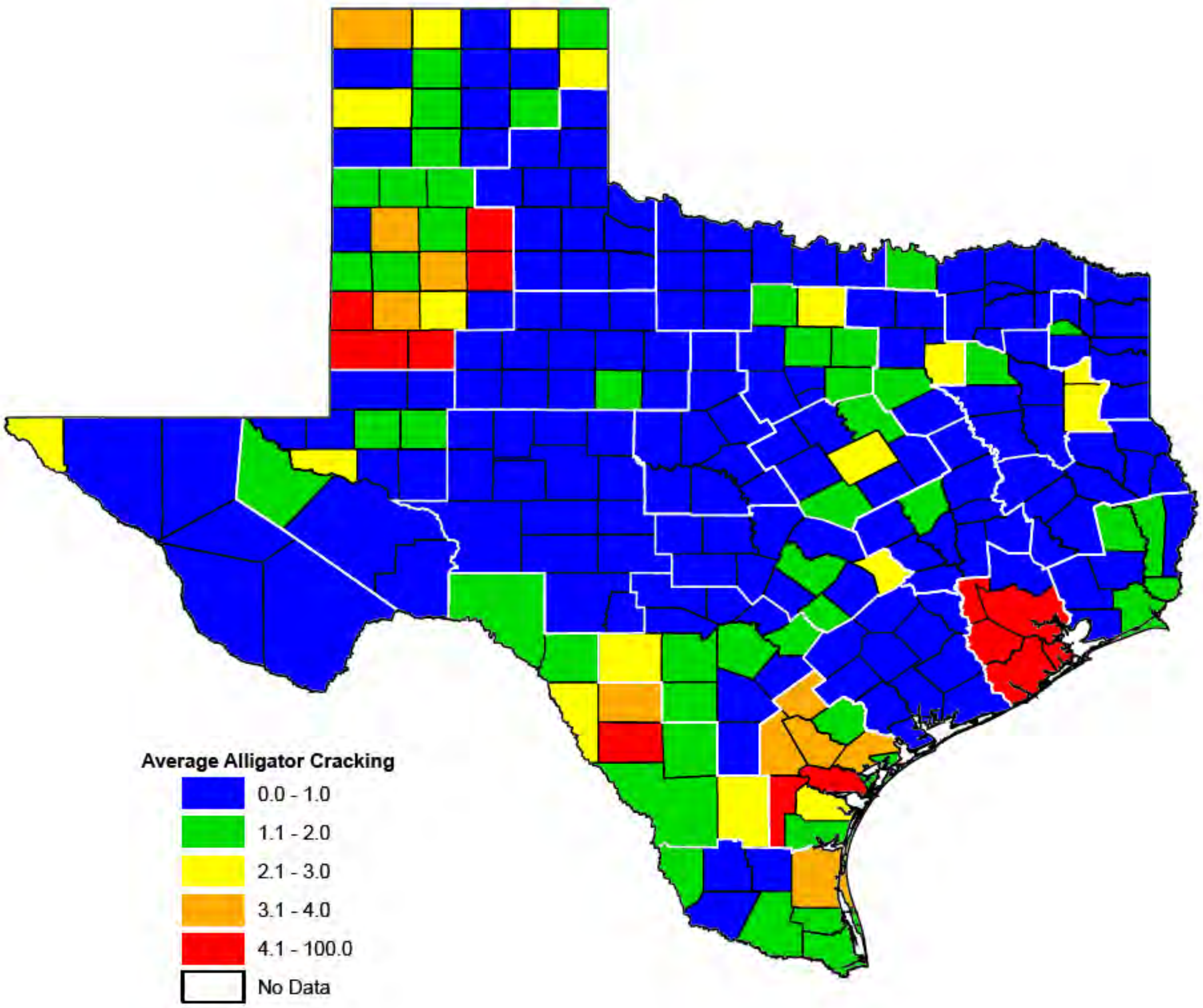
Maintenance patching and spot resurfacing can reduce Alligator Cracking and thus reduce the threat of water seeping into the base and subgrade, but these treatments can give the misleading impression that the pavement's structural strength has been restored. Areas which previously had Alligator Cracking 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")
Rating Based on Percentage of Wheelpath Length

Map 3.5 — Average Alligator Cracking, FY 2004.



Map 3.6 — Average Alligator Cracking, FY 2005.



Failures

Figure 3.8 shows the percentage of PMIS sections with Failures for fiscal years 2002 through 2005. Failures are also a load-associated distress. 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.

5.06 percent of the flexible pavement sections had Failures in FY 2005.

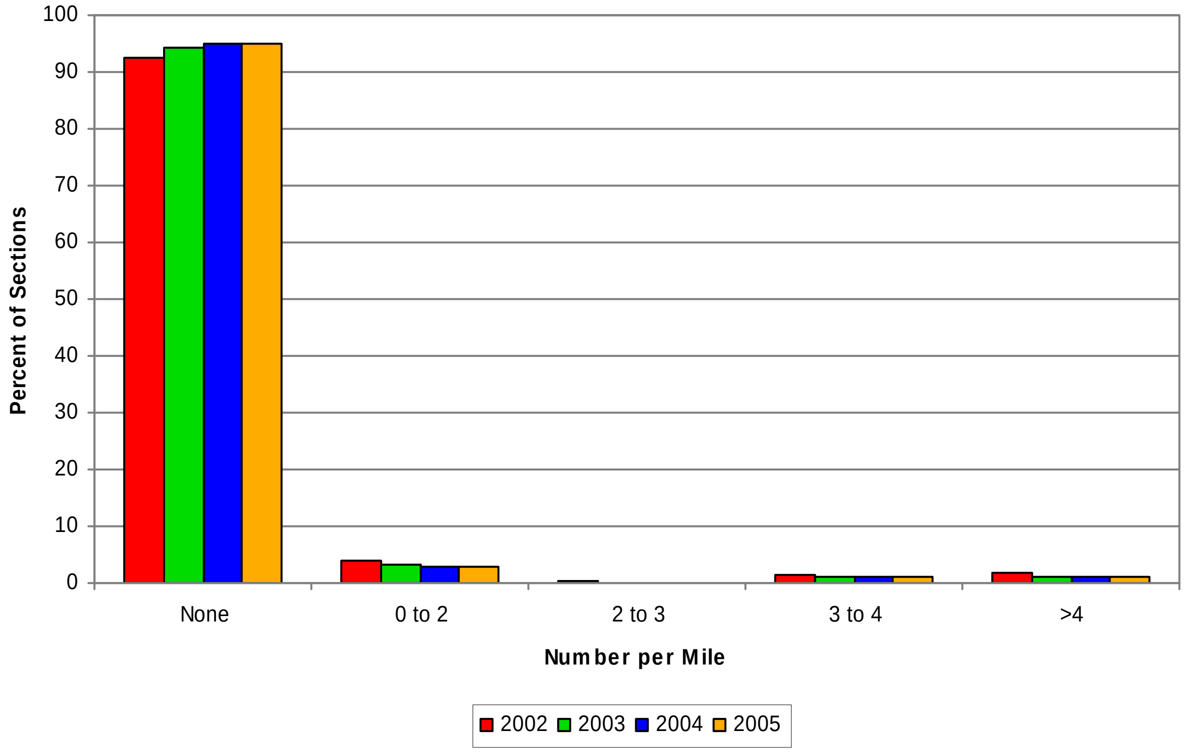


Figure 3.8 — Failures, FY 2002-2005.

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

- "None" category decreased (from 95.09% in 2004 to 94.94% in 2005)
- "0 to 2" category increased (from 2.83% in 2004 to 2.98% in 2005)
- "2 to 3" category increased (from 0.15% in 2004 to 0.16% in 2005)
- "3 to 4" category increased (from 0.91% in 2004 to 0.95% in 2005)
- ">4" category decreased (from 1.01% in 2004 to 0.97% in 2005).

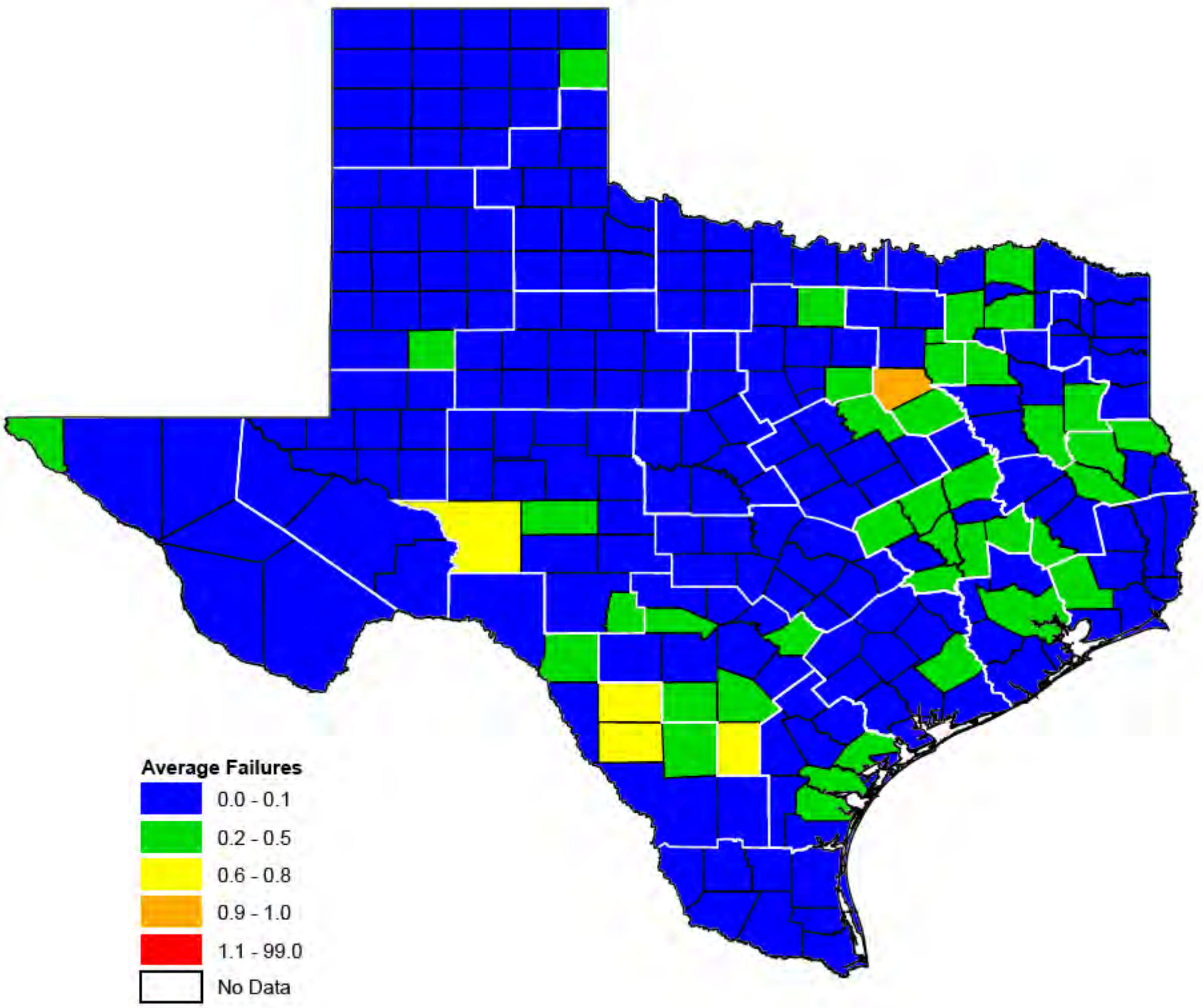
Maps 3.7 and 3.8 show the average rating for Failures, weighted by lane miles, in each county. The average in this case is the total number of Failures in a PMIS section. For example, if a county has 1000 PMIS sections, an average rating of 1 Failure per section means that the county has 1000 Failures.

Failures increased in FY 2005, after having decreased in FY 2004 and FY 2003. Failures can be eliminated through extensive routine maintenance (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.

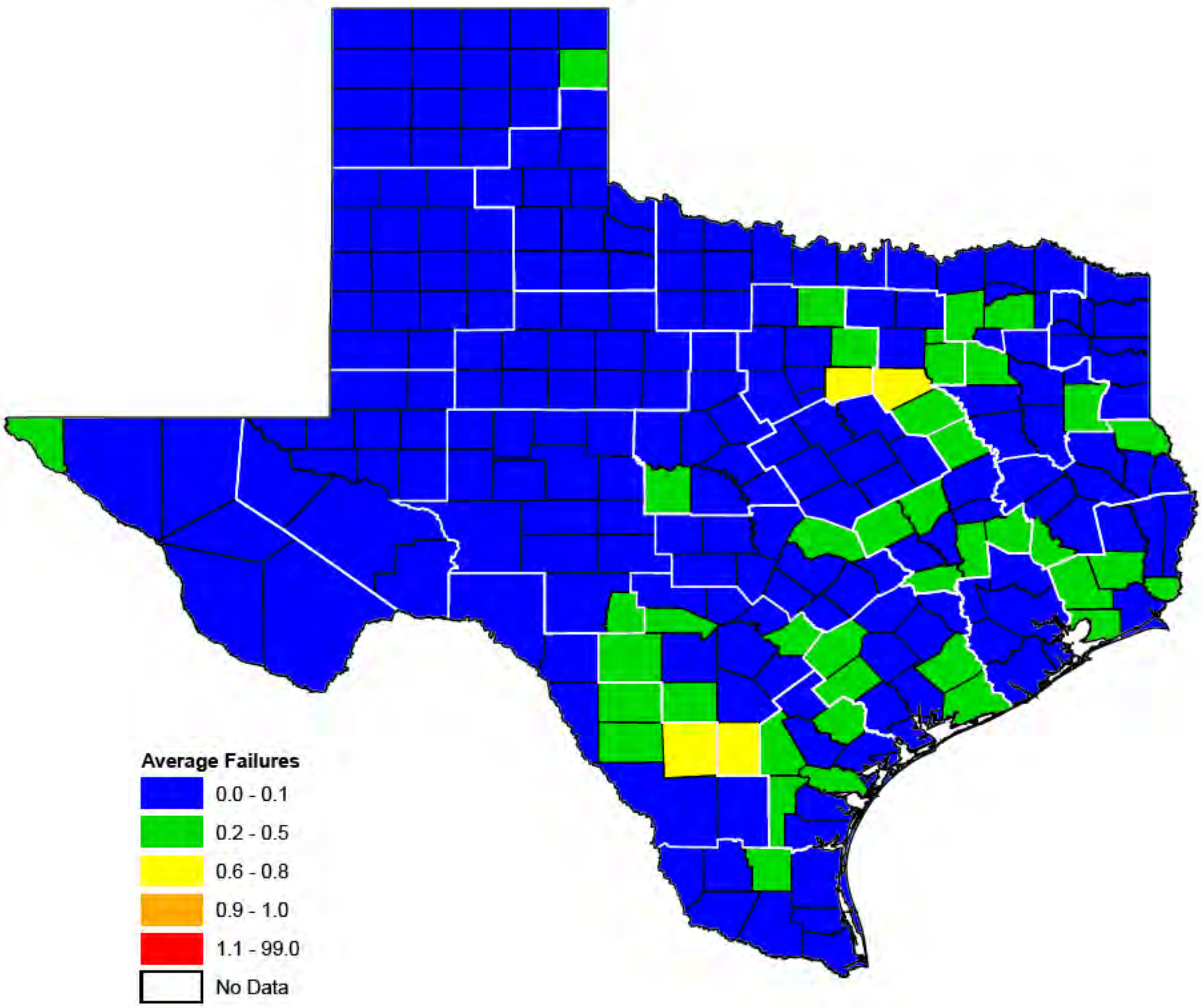
Failures are relatively uncommon in Texas because they are usually patched as soon as possible. In some cases, an area with Alligator Cracking will turn into a Failure when the cracks become wide enough to expose the base material.

Failures
Rating Based on Number of Occurrences

Map 3.7 — Average Failures, FY 2004.



Map 3.8 — Average Failures, FY 2005.



Longitudinal Cracking

Figure 3.9 shows the percentage of PMIS sections with Longitudinal Cracking for fiscal years 2002 through 2005. Longitudinal Cracking is not generally a load-associated distress type (although Deep Rutting sometimes creates a longitudinal crack in the wheelpath). The cracks run parallel to the pavement centerline (for example, reflective cracking, edge cracking, or wheelpath cracking). On thin-surfaced flexible pavements, Longitudinal edge cracking occurs because of high extremes in temperature. If left untreated, Longitudinal Cracking in the wheelpath can progress into Alligator Cracking or even Failures.

It should be noted that PMIS does not distinguish between sealed and unsealed cracks. Thus crack sealing should 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.

34.87 percent of the flexible pavement sections had Longitudinal Cracking in FY 2005.

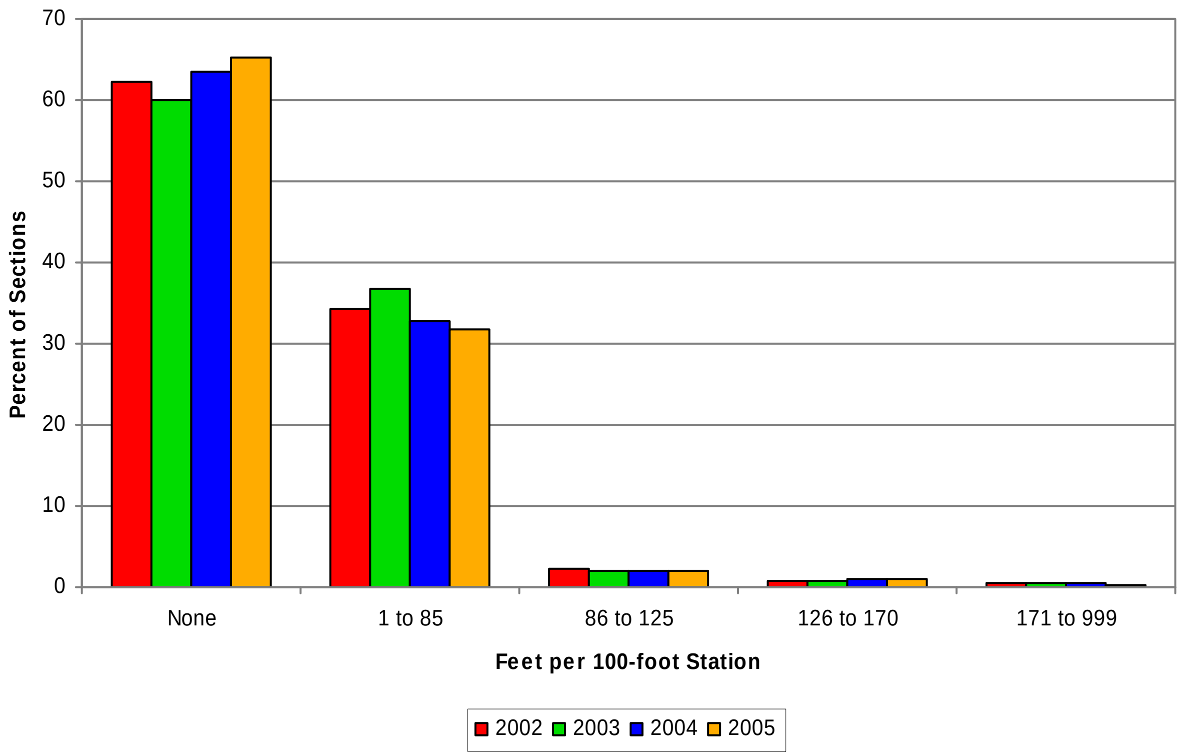


Figure 3.9 — Longitudinal Cracking, FY 2002-2005.

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

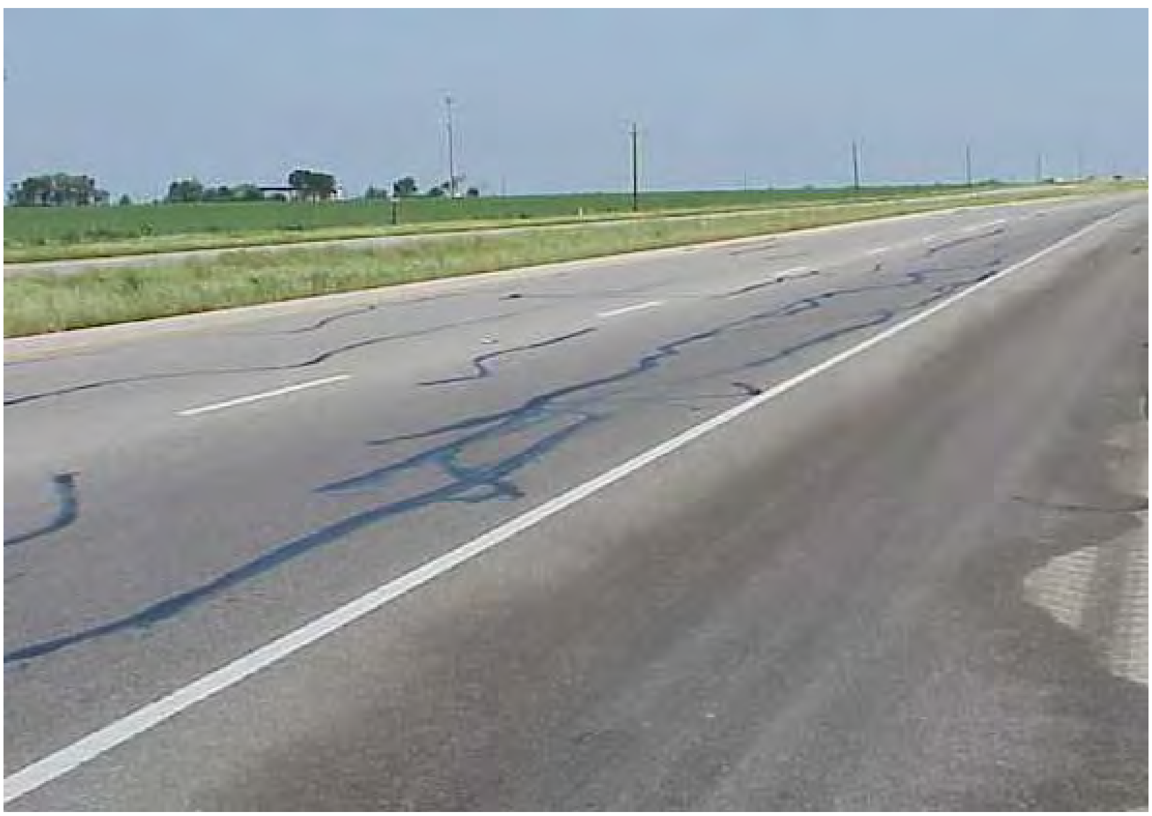
- "None" category increased (from 63.60% in 2004 to 65.13% in 2005)
- "1 to 85" feet category decreased (from 32.79% in 2004 to 31.74% in 2005)
- "86 to 125" feet category decreased (from 2.11% in 2004 to 1.89% in 2005)
- "126 to 170" feet category decreased (from 1.02% in 2004 to 0.90% in 2005)
- "171 to 999" feet category decreased (from 0.48% in 2004 to 0.34% in 2005).

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 decreased in FY 2005, as it did in FY 2004. It is widespread across the state.

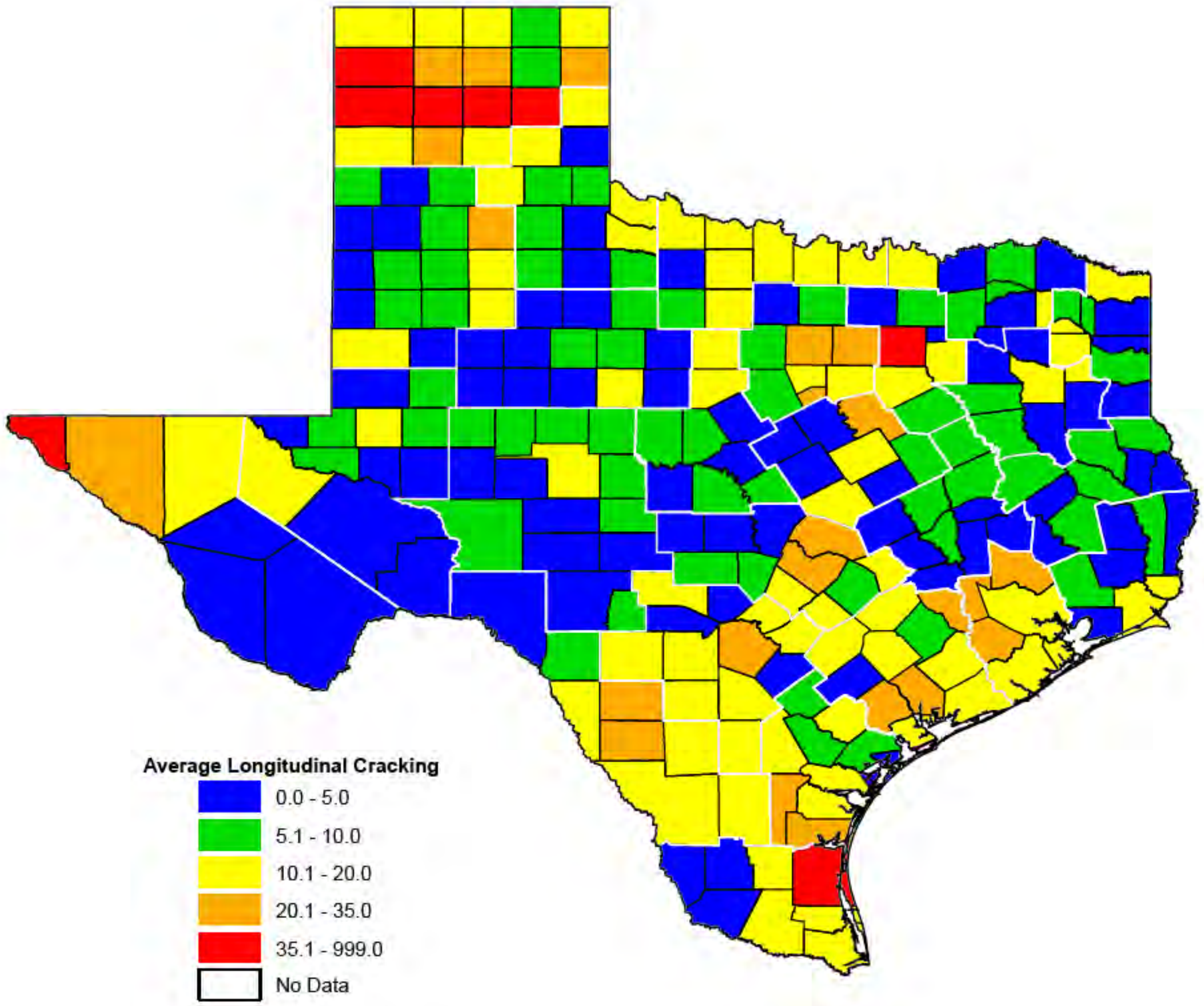
Typically, only the central and western regions of Texas can tolerate Longitudinal Cracking without progression to more serious distresses. This is because of the high-grade limestone materials locally available for the pavement structure, and because of the relatively warm and dry climate. Local paving 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.

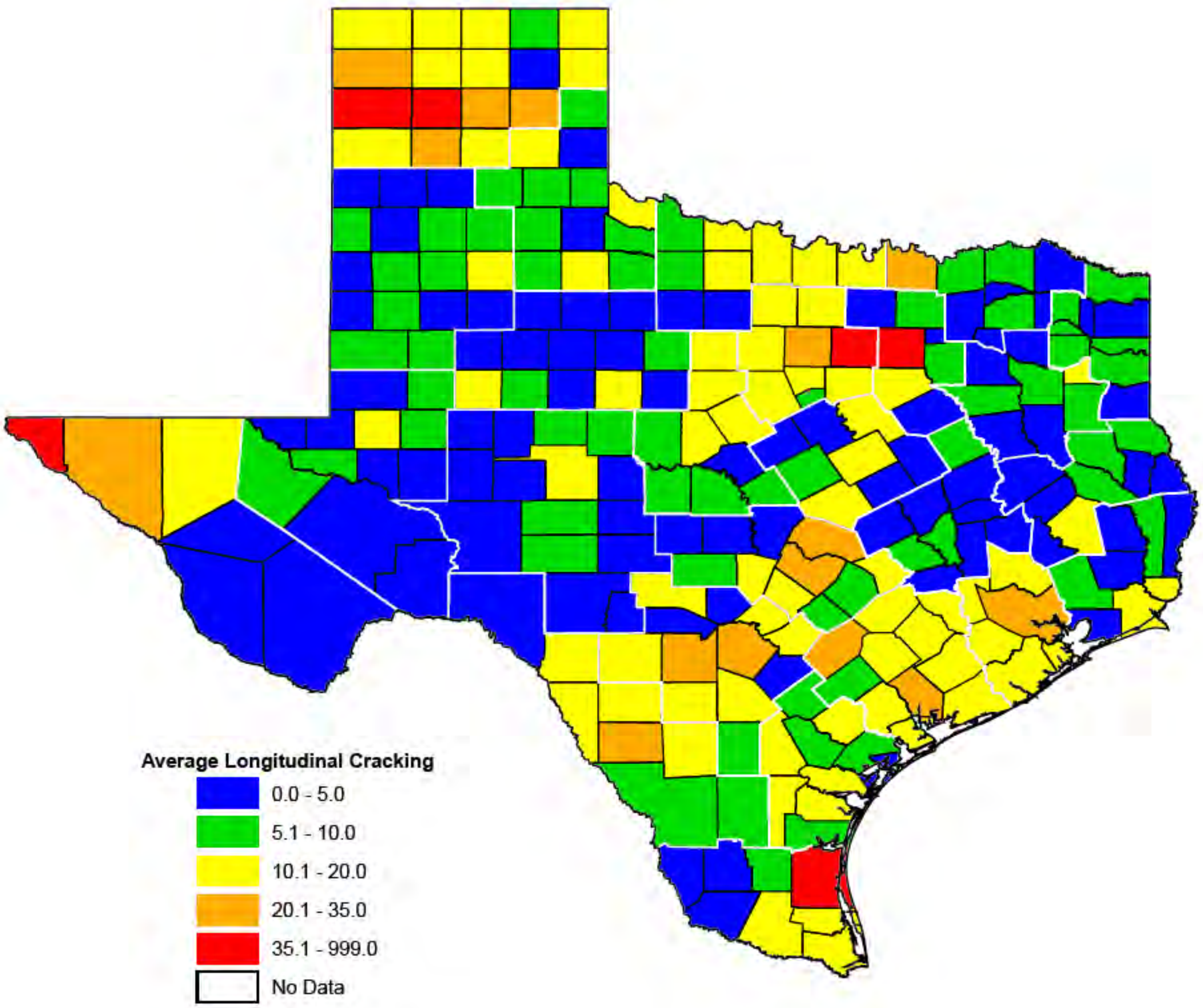


Longitudinal Cracking
Rating Based on Length (in feet) per 100-foot Station

Map 3.9 — Average Longitudinal Cracking, FY 2004.



Map 3.10 — Average Longitudinal Cracking, FY 2005.



Transverse Cracking

Figure 3.10 shows the percentage of PMIS sections with Transverse Cracking for fiscal years 2002 through 2005. Transverse Cracking is not a load-associated distress type – it is related more to material and climate. 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 should 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.

11.69 percent of the flexible pavement sections had Transverse Cracking in FY 2005.

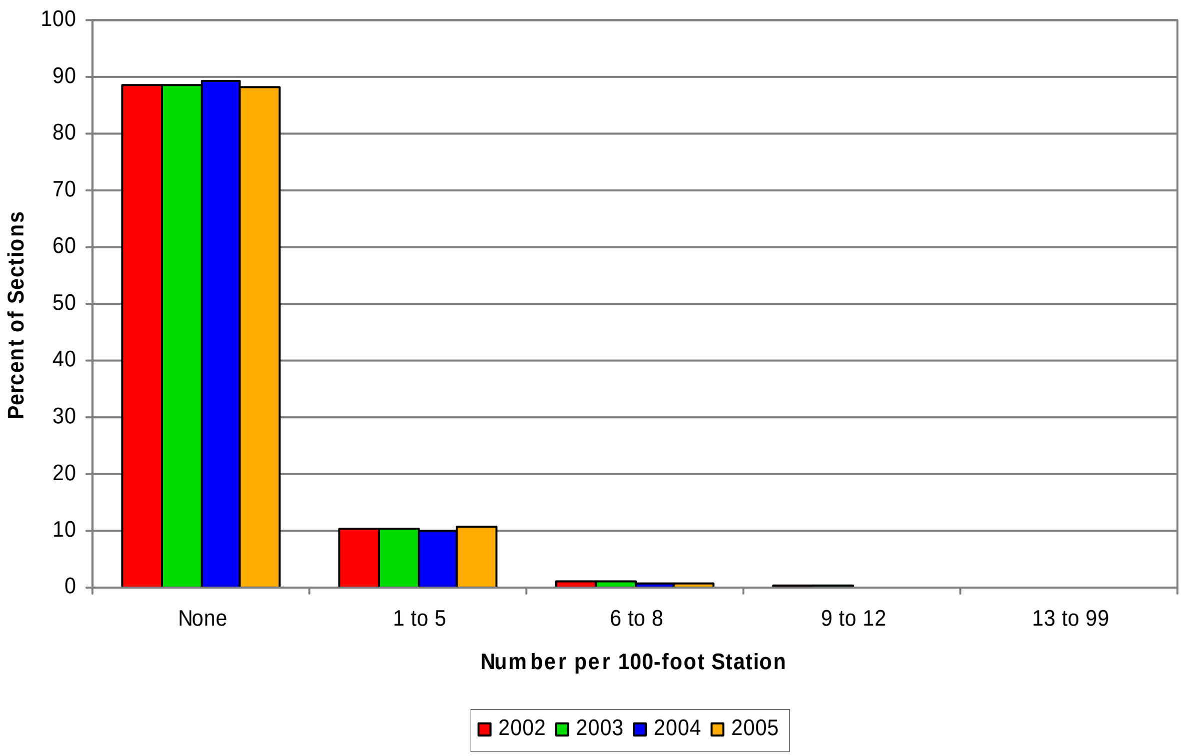


Figure 3.10— Transverse Cracking, FY 2002-2005.

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

- "None" decreased (from 89.36% in 2004 to 88.31% in 2005)
- "1 to 5" increased (from 9.85% in 2004 to 10.66% in 2005)
- "6 to 8" increased (from 0.62% in 2004 to 0.78% in 2005)
- "9 to 12" increased (from 0.11% in 2004 to 0.18% in 2005)
- "13 to 99" increased (from 0.07% in 2004 to 0.08% in 2005).

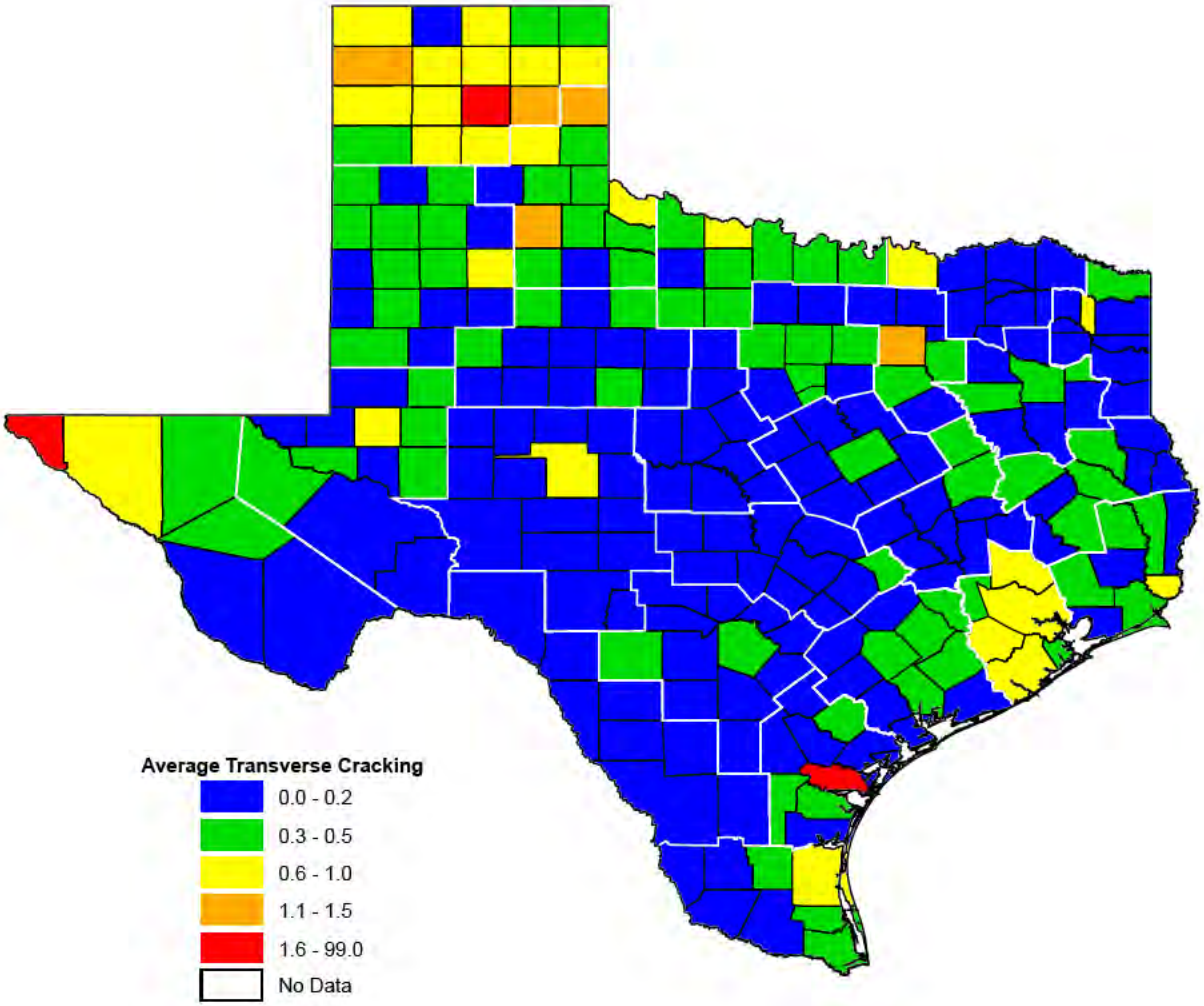
Maps 3.11 and 3.12 show the average rating for Transverse Cracking, weighted by lane miles, in each county. The average in this case is the number of Transverse Cracks per 100-foot station. For example, if a county has 100 lane miles, it has 528,000 feet of travel lanes, and 5280 100-foot stations that 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 increased in FY 2005 after having decreased in FY 2004. It is mainly found in the north and southeast parts of the state.

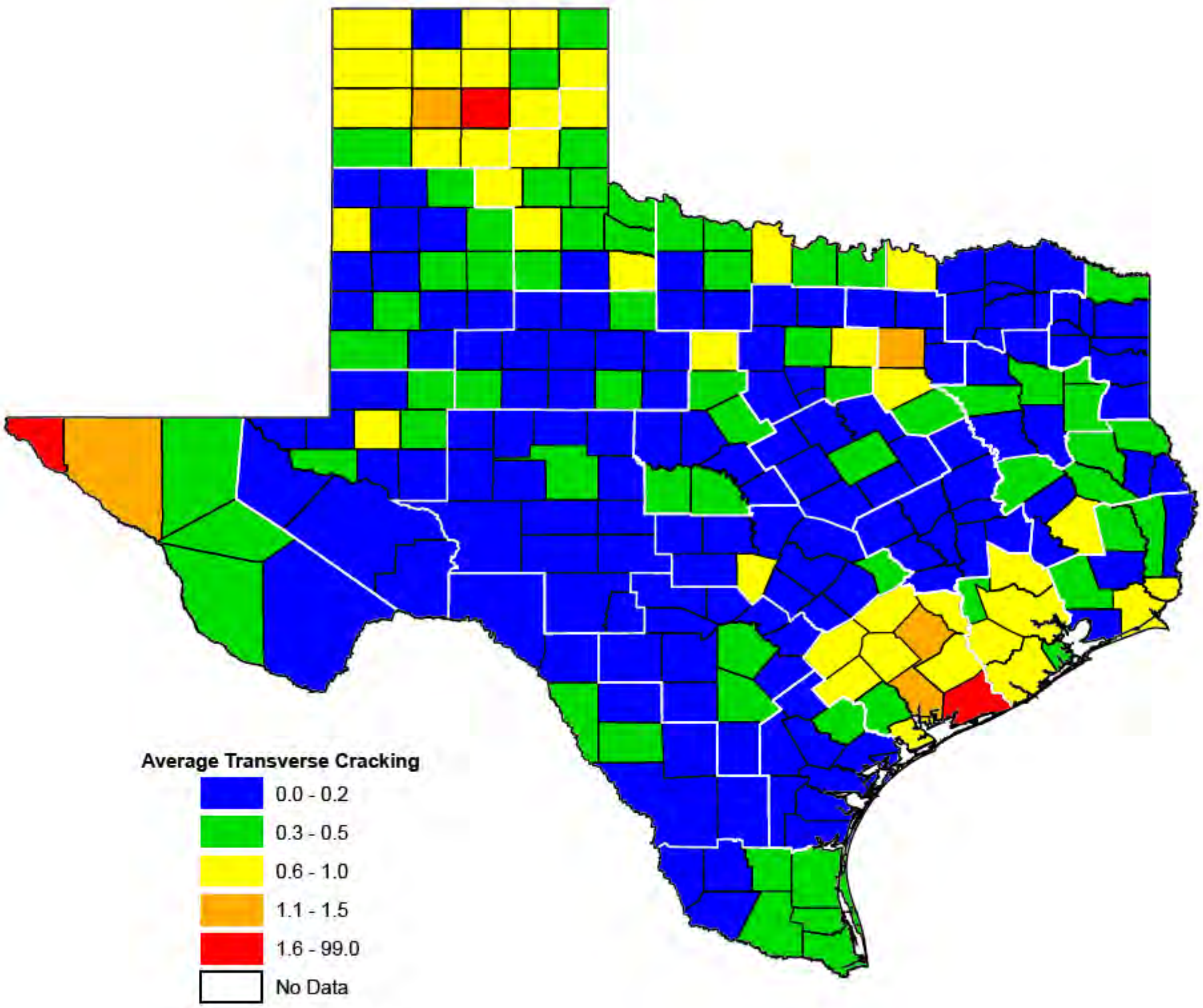
In north Texas, Transverse Cracking is aggravated by the extreme changes in temperature. In southeast Texas, Transverse Cracking is generally caused by the use of cement-treated bases. Transverse Cracks that are wide and deep – which often occurs with cement-treated base – cause serious ride quality 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


Average Transverse Cracking
0.0 - 0.2
0.3 - 0.5
0.6 - 1.0
1.1 - 1.5
1.6 - 99.0
No Data

Map 3.12 — Average Transverse Cracking, FY 2005.



Block Cracking

Figure 3.11 shows the percentage of PMIS sections with Block Cracking for fiscal years 2002 through 2005. Block Cracking is not a load-associated distress. It is usually caused by shrinkage of the flexible pavement surface or by overly-stabilized base material. In itself, Block Cracking is not a cause for concern except that it is a crack in the road that can let water into sub-surface layers. In low rainfall areas, such as West Texas, more Block Cracking can be tolerated than in the higher rainfall areas to the east.

0.63 percent of the flexible pavement sections had Block Cracking in FY 2005.

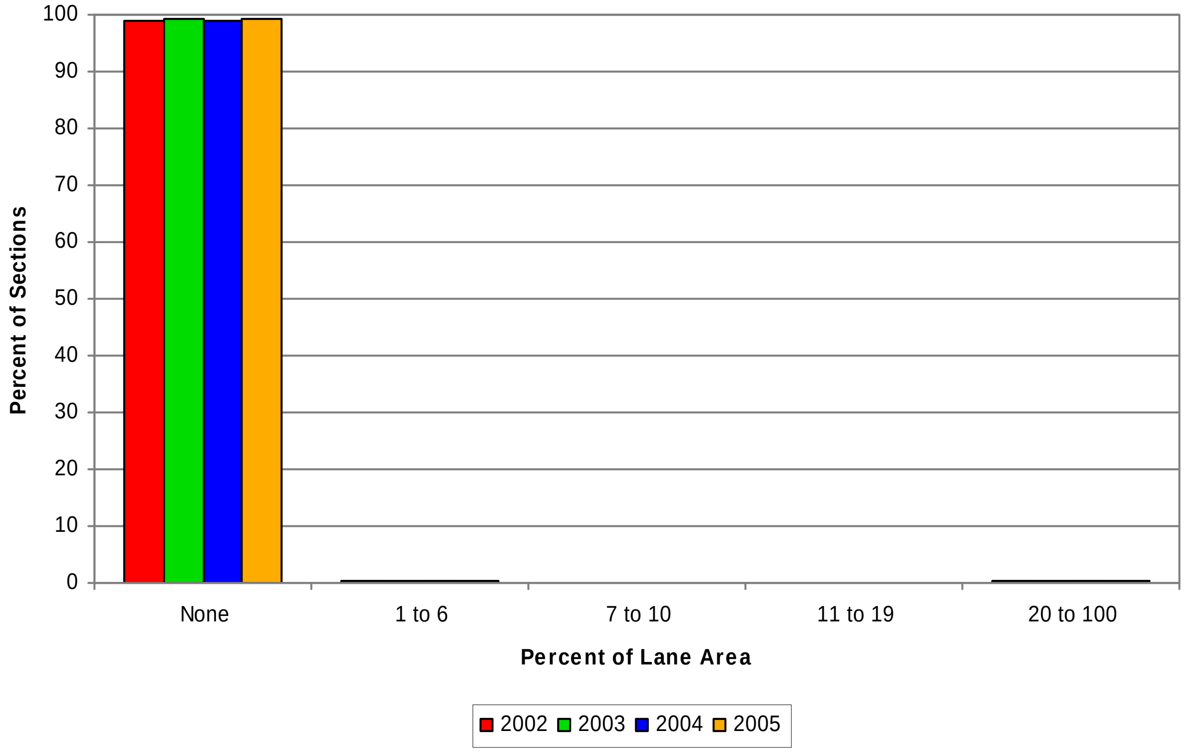


Figure 3.11— Block Cracking, FY 2002-2005.

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

- "None" category increased (from 98.95% in 2004 to 99.37% in 2005)
- "1 to 6" percent category decreased (from 0.43% in 2004 to 0.25% in 2005)
- "7 to 10" percent category decreased (from 0.11% in 2004 to 0.08% in 2005)
- "11 to 19" percent category decreased (from 0.16% in 2004 to 0.09% in 2005)
- "20 to 100" percent category decreased (from 0.35% in 2004 to 0.22% in 2005).

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.

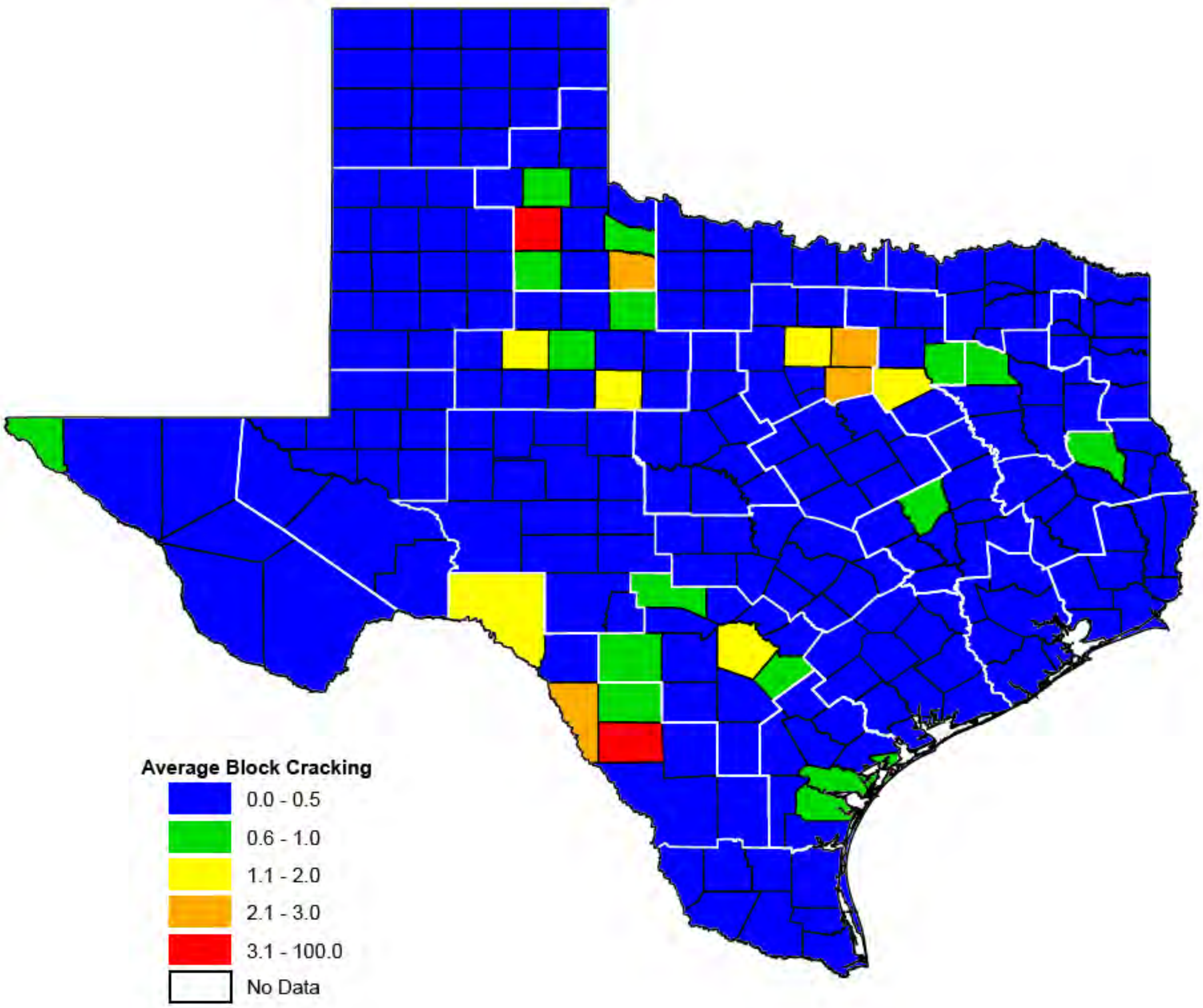
Block Cracking decreased in FY 2005 after having increased in FY 2004. It is found only in isolated areas. It is easy to confuse Block Cracking with Longitudinal and Transverse Cracking, so it is possible that PMIS under-estimates the amount of Block Cracking on Texas pavements.

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.

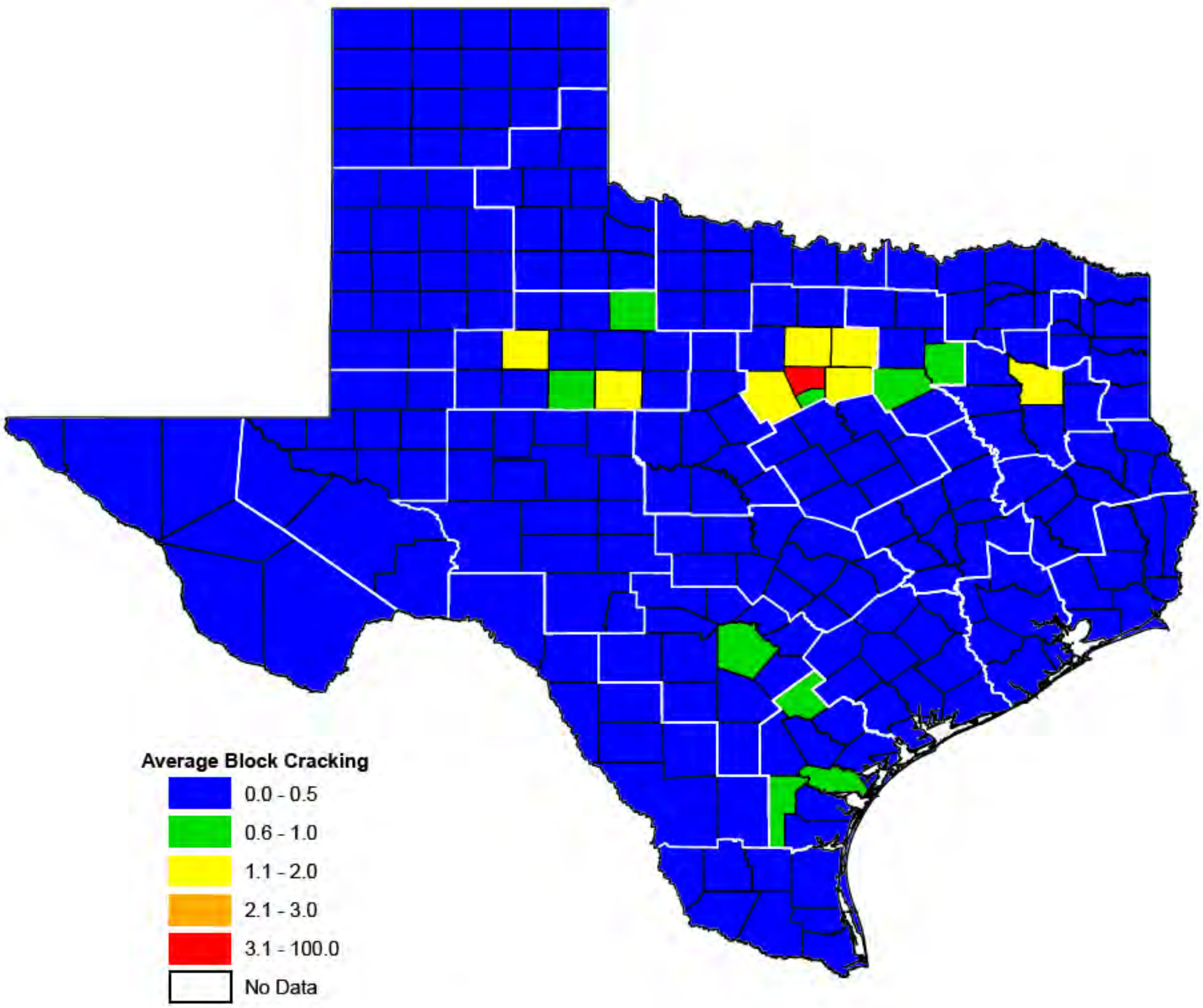
It should be noted that sealed Block Cracks are still rated in PMIS. This causes a problem in some areas because the PMIS ratings give the impression that there is more cracking than there really is. If the sealed cracks remain sealed, then water cannot seep in to erode the pavement structure. But if 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 2004.



Map 3.14 — Average Block Cracking, FY 2005.



Patching

Figure 3.12 shows the percentage of PMIS sections with Patching for fiscal years 2002 through 2005. Patches are repairs made to pavement distress. It indicates prior maintenance activity, and thus is used as a general measure of maintenance cost, which is then used as a general measure of pavement age (maintenance cost tends to increase as a pavement ages). Pavements with large amounts of Patching are considered to be in marginal condition at best, even though the quality of the individual patches may be quite high.

Patching is not a load-associated distress, but it can be caused by repair of load-associated distress types such as Shallow Rutting, Deep Rutting, Failures, or Alligator Cracking. Patching can also be used to repair non-load associated cracking.

14.79 percent of the flexible pavement sections had Patching in FY 2005.

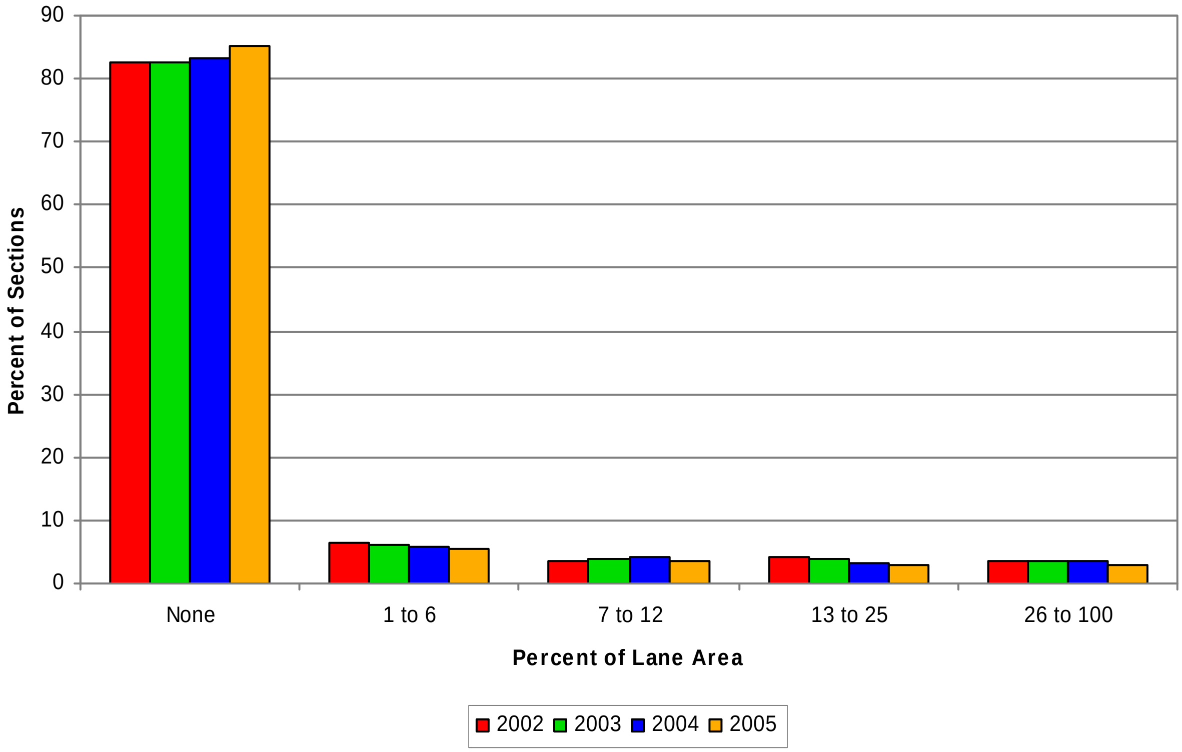


Figure 3.12— Patching, FY 2002-2005.

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

- "None" category increased (from 83.19% in 2004 to 85.21% in 2005)
- "1 to 6" percent category decreased (from 5.88% in 2004 to 5.40% in 2005)
- "7 to 12" percent category decreased (from 4.08% in 2004 to 3.43% in 2005)
- "13 to 25" percent category decreased (from 3.32% in 2004 to 2.96% in 2005)
- "26 to 100" percent category decreased (from 3.54% in 2004 to 3.00% in 2005).

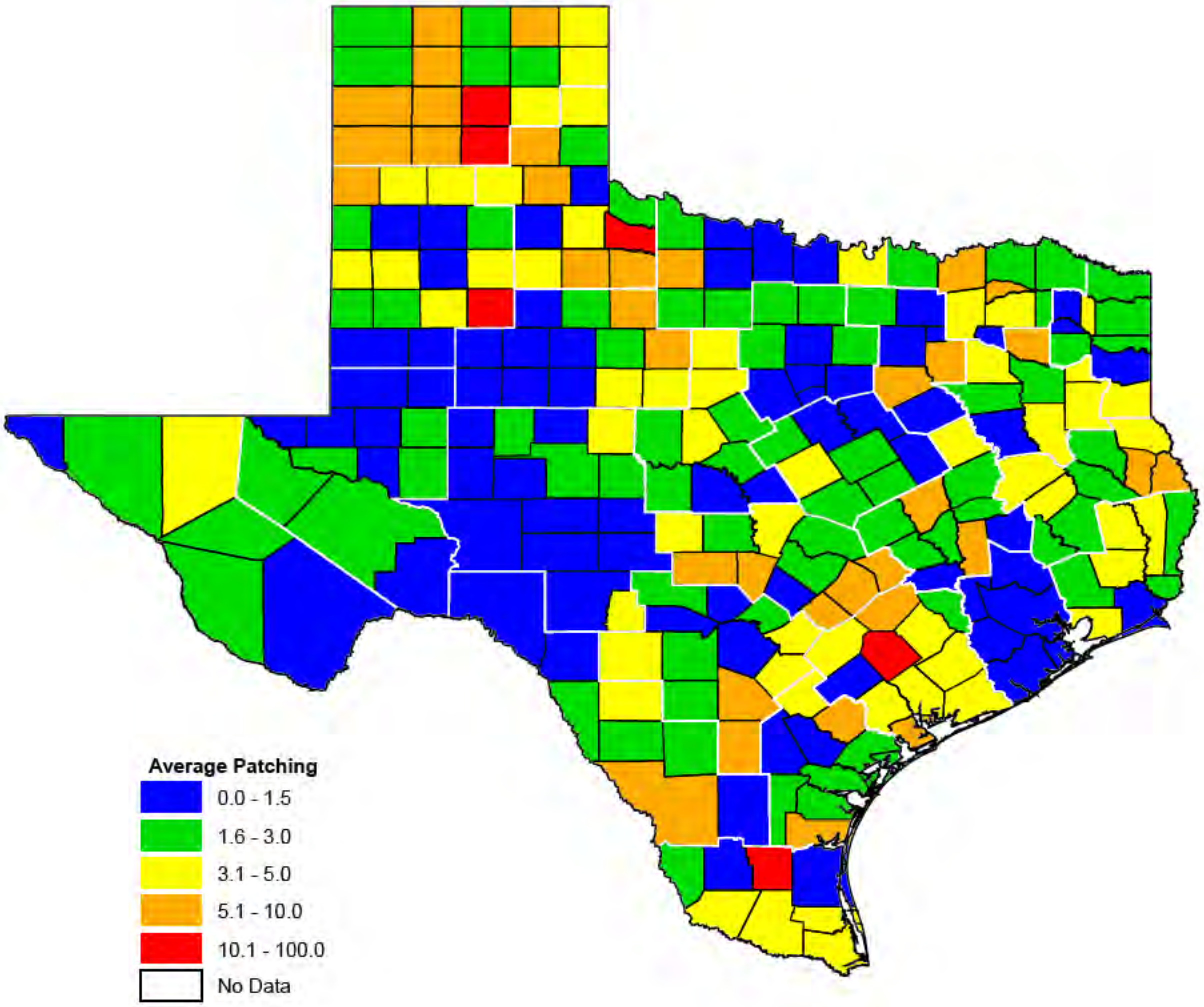
Maps 3.15 and 3.16 show the average rating for Patching, weighted by lane miles, in each county. The average in this case is the percentage of lane area covered by Patching. For example, if a county has 100 lane miles, it has 100 total miles of lane area that could have Patching; an average rating of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

Patching decreased in FY 2005 as it did in FY 2004 and FY 2003. It is widespread throughout the state.

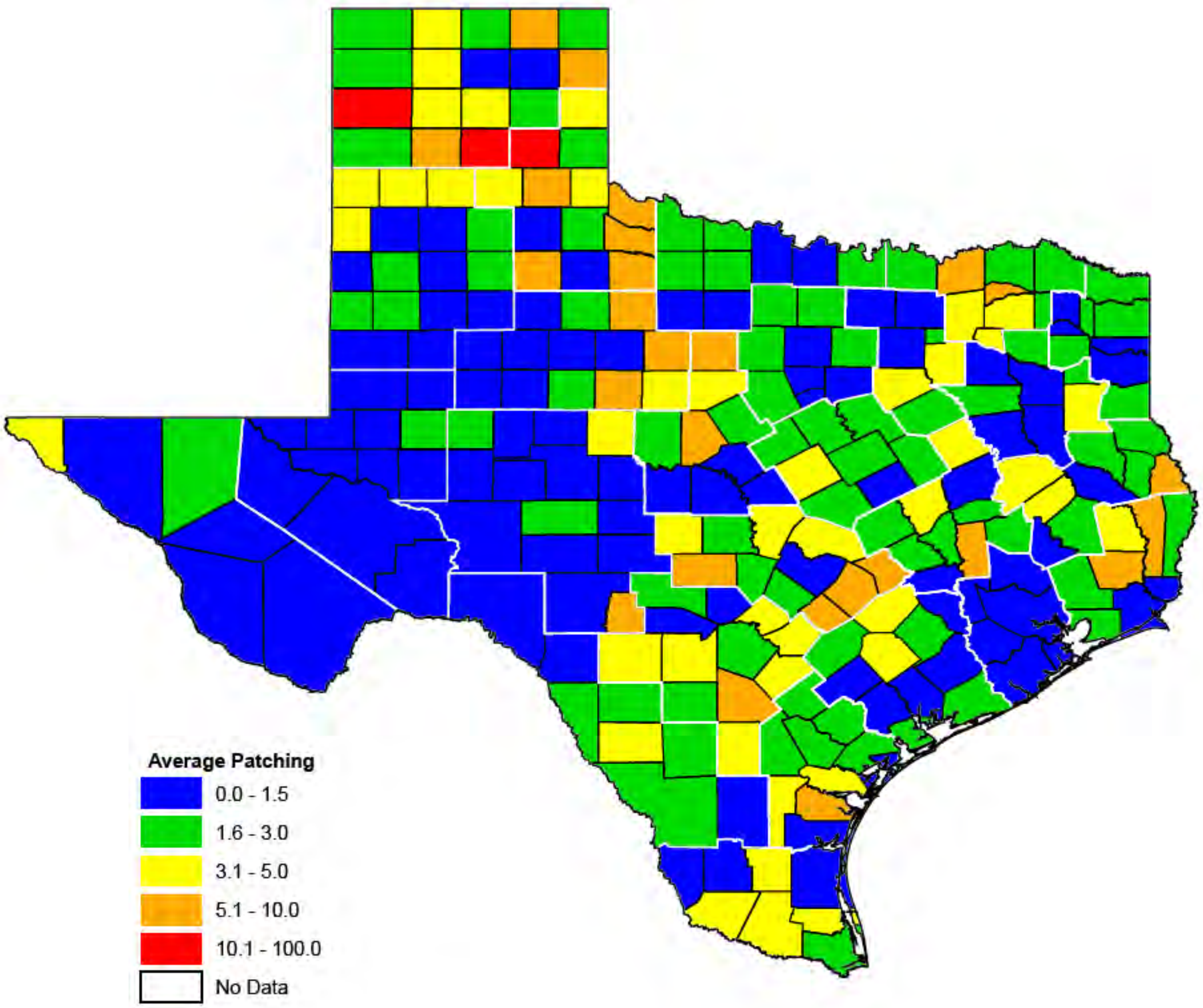
It should be noted that local maintenance practices can drastically affect the amount of Patching in PMIS. Flexible pavement material used to fill in ruts will be rated as Patching. Strip-type surface treatments and microsurfacing to improve surface texture will also be rated as Patching, even though 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 structural distress.

Patching
Rating Based on Percentage of Lane Area

Map 3.15 — Average Patching, FY 2004.



Map 3.16 — Average Patching, FY 2005.



TxDOT's FY 2005 budget is $6,765.2 billion — of which $2,464.3 billion is scheduled for construction and $2,613.7 billion is scheduled for maintenance.

Discussion

In FY 2005, ACP condition and distress improved, but ride quality got worse. ACP had the best overall condition and distress of the three major pavement types in FY 2005, as it has since FY 2002. The FY 2005 decline in ACP ride quality followed three years of improvement.

Five of the eight ACP distress types — Shallow Rutting, Deep Rutting, Failures, Alligator Cracking, and Transverse Cracking — increased in FY 2005. This trend would appear to contradict the observed improvement in overall ACP distress. Most of the increases in ACP distress were small and had little impact on the overall PMIS Distress Score. The small increases in five of the ACP distress types were offset by a large decrease in the amount of Patching, which can have a large impact on PMIS Distress Scores.

TxDOT has resurfaced about one quarter of all pavements in Texas during the last two years as part of the effort to meet the Texas Transportation Commission's pavement condition goal of 90 percent "good" or better condition by FY 2012. This increased resurfacing has reduced surface cracking and patching, but has not always improved statewide ride quality, especially on ACP mileage. Use of coarse-texture seal coats for resurfacing can show up as increased "rutting" and "roughness" on some mileage because the test equipment picks up the spaces between the larger stones as "rutting" or "roughness." Fine-texture hot-mix overlays usually provide more accurate rutting and ride quality measurements.

The most commonly-observed flexible pavement distress types in FY 2005 were Longitudinal Cracking, Shallow Rutting, Patching, Alligator Cracking, and Transverse Cracking. This list has been the same since FY 2003.

As in previous years, the flexible pavement condition, distress, and ride quality trends were the same as the statewide trends. This is because flexible pavement makes up almost all (92.51 percent) of the TxDOT-maintained mileage, but this percentage is slowly dropping as more rigid pavement (especially CRCP) is being built.

It should be noted that PMIS distress results 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. On-site structural testing using Falling Weight Deflectometer (FWD), Ground Penetrating Radar (GPR), Seismic Pavement Analyzer (SPA), Dynamic Cone Penetrometer (DCP), or pavement coring can help to pinpoint structural problems.

Summary

In FY 2005, ACP condition and distress improved, but ride quality got worse. ACP had the best overall condition and distress of the three major pavement types in FY 2005, as it has since FY 2002. The FY 2005 decline in ACP ride quality followed three years of improvement. Shallow Rutting, Deep Rutting, Failures, Alligator Cracking, and Transverse Cracking all increased, but a large reduction in Patching offset those increases and caused overall ACP distress to improve in FY 2005.

From 1928-1930, 1,100 miles of gravel roads received asphalt treatments. A single treatment ranged from 12-16 cents a square yard and double bituminous treatments from 17-21 cents a square yard.

Chapter 4 Condition of Rigid Pavements — CRCP

This chapter describes the condition of Continuously Reinforced Concrete Pavements (CRCP) in Texas. They make up approximately 5.19 percent of the TxDOT-maintained lane mileage but carry 22.05 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.

Causes of CRCP Distress Types

The CRCP distress types in PMIS are caused by a combination of age and traffic loading. Minute cracks form in CRCP during the first hours of curing. Temperature and humidity during these initial hours play a major factor in how well the CRCP will perform over its life. Even with the minute curing cracks, the concrete stays together through aggregate interlock and reinforcing steel. As the concrete ages, cracks widen because of climatic changes. Crack widening or spalling can become bad enough to affect ride quality, or can lead to Punchouts, which must be patched with asphalt or concrete.

The average spacing of transverse cracks is an important indicator of the concrete's structural integrity. As the transverse crack spacing gets smaller, Punchouts are likely to occur and increase the need for structural rehabilitation. These trends are primarily true for older CRCP in Texas, which typically was built 8-12 inches thick. Thicker CRCP slabs — such as those being built today — seem to be able to tolerate smaller transverse crack spacing without developing Spalled Cracks or Punchouts.

Bats' use of bridges as roosts first came to TxDOT's attention in 1980 when a colony of Mexican Free-tail bats moved into the crevices beneath the newly-renovated Congress Avenue bridge in downtown Austin, Texas. Now, more than 1.5 million Mexican Free-tail bats live under the bridge. On a typical summer night, the Congress Avenue bats eat over 20,000 pounds of insects.

CRCP Distress Examples

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

Spalled Cracks
(Number of Occurrences)

Punchouts
(Number of Occurrences)

Asphalt Patches
(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 2002 through 2005.

71.28 percent of the CRCP lane miles were in "Very Good" condition in FY 2005.

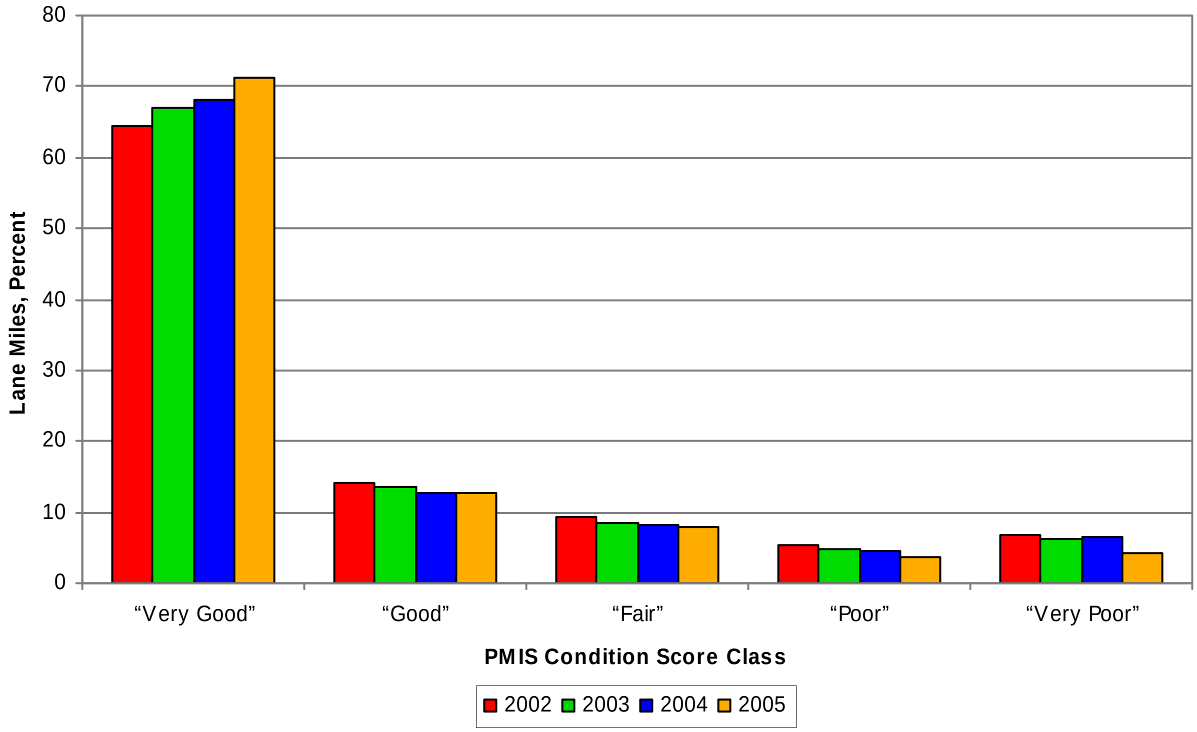


Figure 4.1 — Condition Score Classes for CRCP, FY 2002-2005.

The Condition Score Classes for CRCP show that:

- "Very Good" mileage increased (from 68.19% in 2004 to 71.28% in 2005)
- "Good" mileage increased (from 12.69% in 2004 to 12.77% in 2005)
- "Fair" mileage decreased (from 8.23% in 2004 to 7.90% in 2005)
- "Poor" mileage decreased (from 4.39% in 2004 to 3.77% in 2005)
- "Very Poor" mileage decreased (from 6.50% in 2004 to 4.27% in 2005).

Distress Score Classes for CRCP

Figure 4.2 shows the statewide distribution of Distress Score classes for CRCP pavements for fiscal years 2002 through 2005.

83.53 percent of CRCP lane miles were "Very Good" in terms of pavement distress in FY 2005.

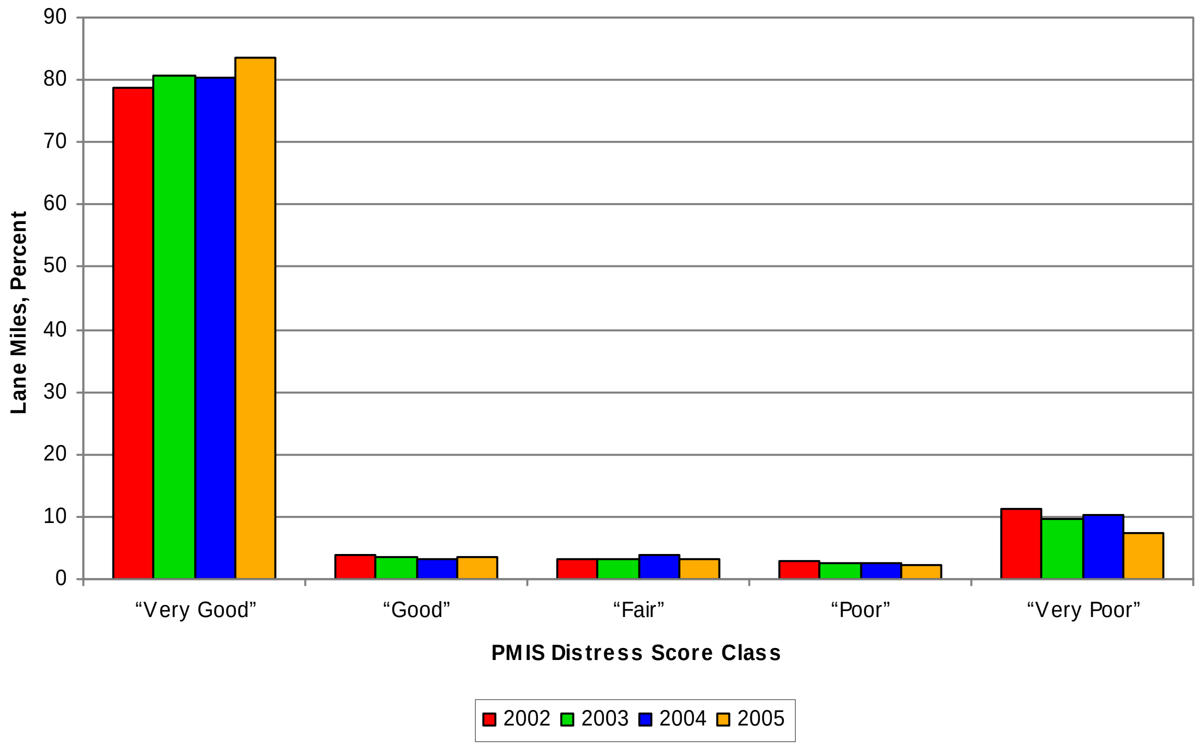


Figure 4.2 — Distress Score Classes for CRCP, FY 2002-2005.

The Distress Score Classes for CRCP show that:

- "Very Good" mileage increased (from 80.22% in 2004 to 83.53% in 2005)
- "Good" mileage increased (from 3.19% in 2004 to 3.63% in 2005)
- "Fair" mileage decreased (from 3.72% in 2004 to 3.11% in 2005)
- "Poor" mileage decreased (from 2.45% in 2004 to 2.40% in 2005)
- "Very Poor" mileage decreased (from 10.42% in 2004 to 7.33% in 2005).

Ride Score Classes for CRCP

Figure 4.3 shows the statewide distribution of Ride Score classes for CRCP pavements for fiscal years 2002 through 2005. In general, the average person would consider 16.29 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.

19.27 percent of the CRCP lane miles had "Very Good" ride quality in FY 2005.

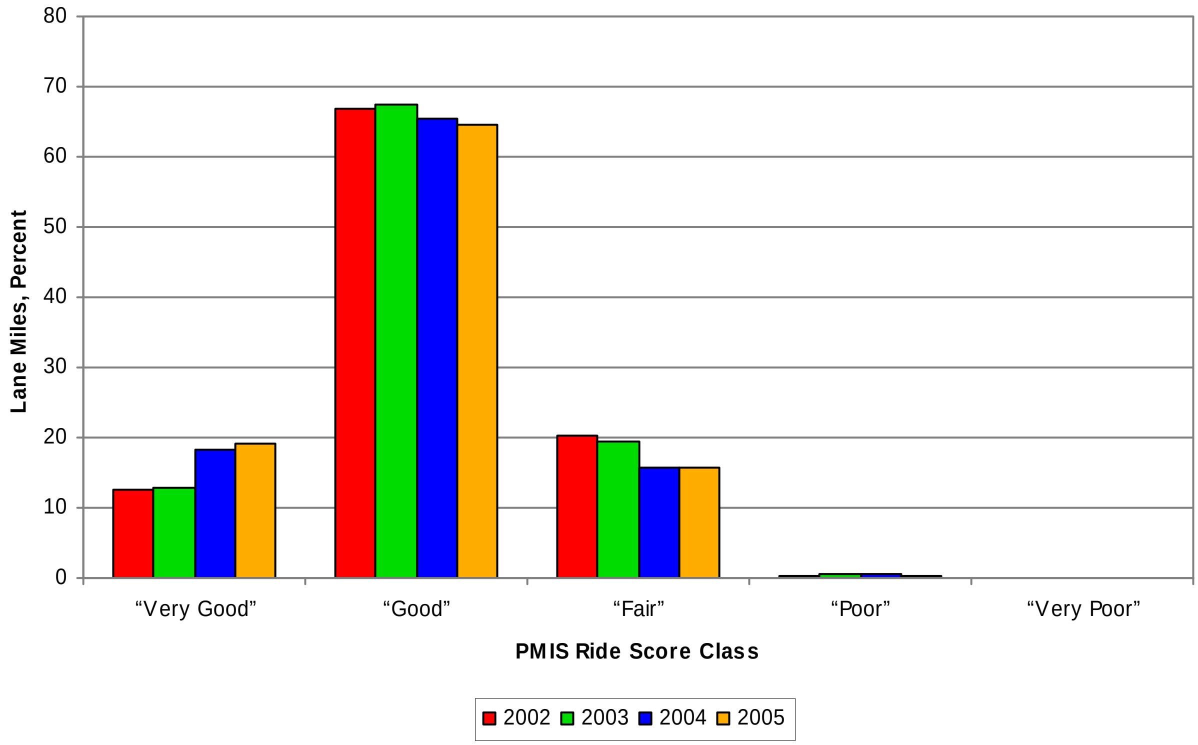


Figure 4.3 — Ride Score Classes for CRCP, FY 2002-2005.

The Ride Score Classes for CRCP show that:

- "Very Good" mileage increased (from 18.16% in 2004 to 19.27% in 2005)
- "Good" mileage decreased (from 65.51% in 2004 to 64.44% in 2005)
- "Fair" mileage increased (from 15.75% in 2004 to 15.85% in 2005)
- "Poor" mileage decreased (from 0.55% in 2004 to 0.42% in 2005)
- "Very Poor" mileage decreased (from 0.03% in 2004 to 0.02% in 2005).

IRI Score Classes for CRCP

Figure 4.4 shows the statewide distribution of IRI Score classes for CRCP pavements for fiscal years 2002 through 2005. In general, the average person would consider 70.26 percent of the continuously-reinforced concrete pavements to be "rough," based on IRI. This is not the same as the 16.29 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.

1.77 percent of the CRCP lane miles had "Very Good" IRI scores in FY 2005.

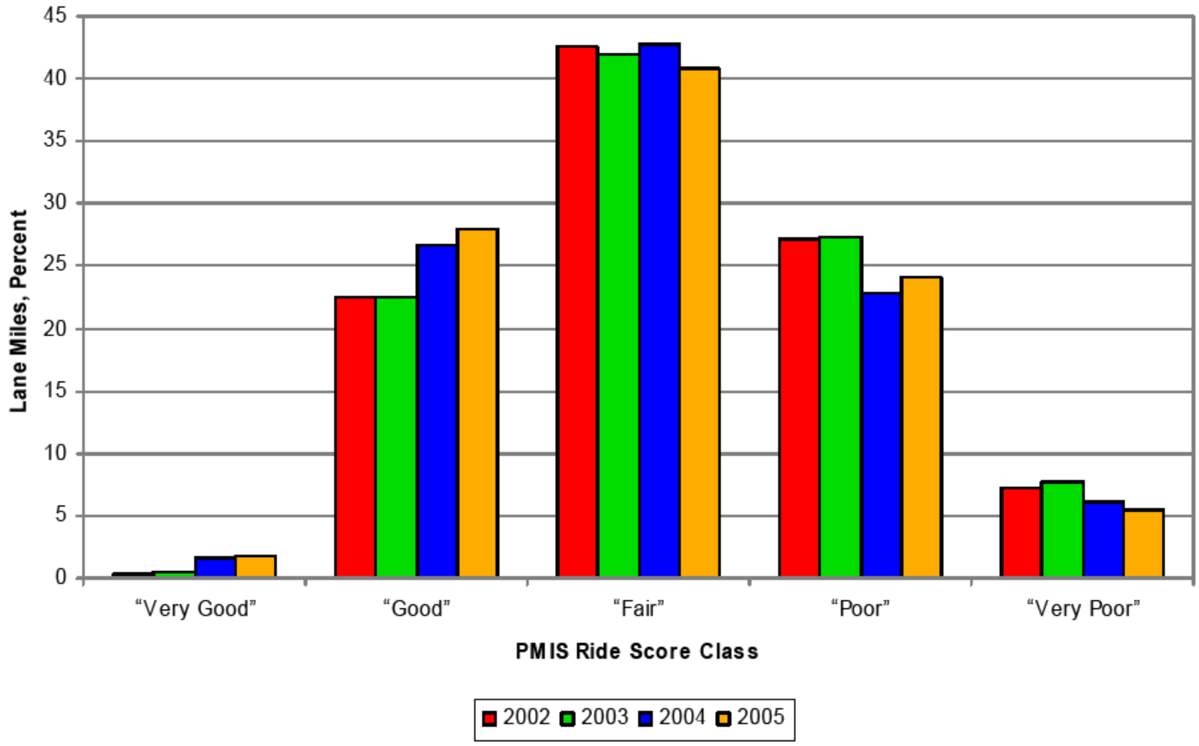


Figure 4.4 — IRI Score Classes for CRCP, FY 2002-2005.

The IRI Score Classes for CRCP show that:

- "Very Good" mileage increased (from 1.64% in 2004 to 1.77% in 2005)
- "Good" mileage increased (from 26.64% in 2004 to 27.98% in 2005)
- "Fair" mileage decreased (from 42.68% in 2004 to 40.75% in 2005)
- "Poor" mileage increased (from 22.86% in 2004 to 24.11% in 2005)
- "Very Poor" mileage decreased (from 6.18% in 2004 to 5.40% in 2005).

Spalled Cracks

Figure 4.5 shows the percentage of PMIS sections with Spalled Cracks for fiscal years 2002 through 2005.

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.

22.20 percent of the CRCP sections had Spalled Cracks in FY 2005.

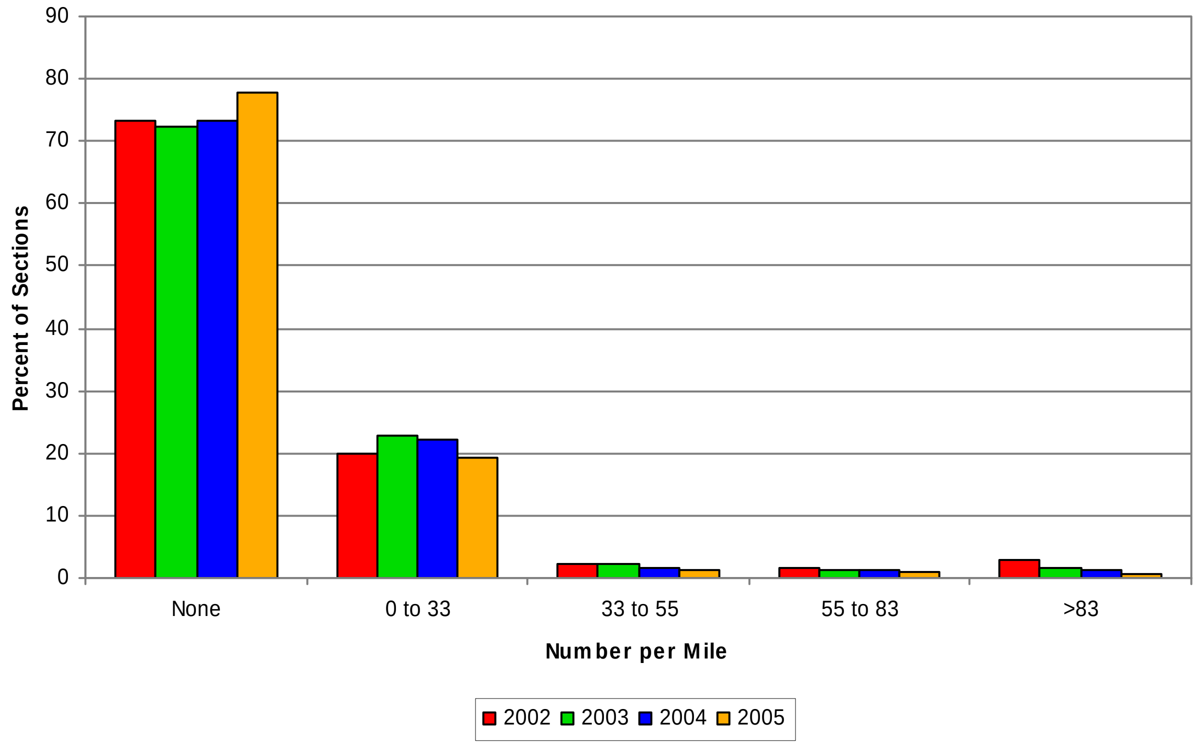


Figure 4.5 — Spalled Cracks, FY 2002-2005.

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

- "None" category increased (from 73.39% in 2004 to 77.80% in 2005)
- "0 to 33" category decreased (from 22.20% in 2004 to 19.19% in 2005)
- "33 to 55" category decreased (from 1.75% in 2004 to 1.32% in 2005)
- "55 to 83" category decreased (from 1.42% in 2004 to 0.91% in 2005)
- ">83" category decreased (from 1.24% in 2004 to 0.79% in 2005).

Punchouts

Figure 4.6 shows the percentage of PMIS sections with Punchouts for fiscal years 2002 through 2005.

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.

9.67 percent of the CRCP sections had Punchouts in FY 2005.

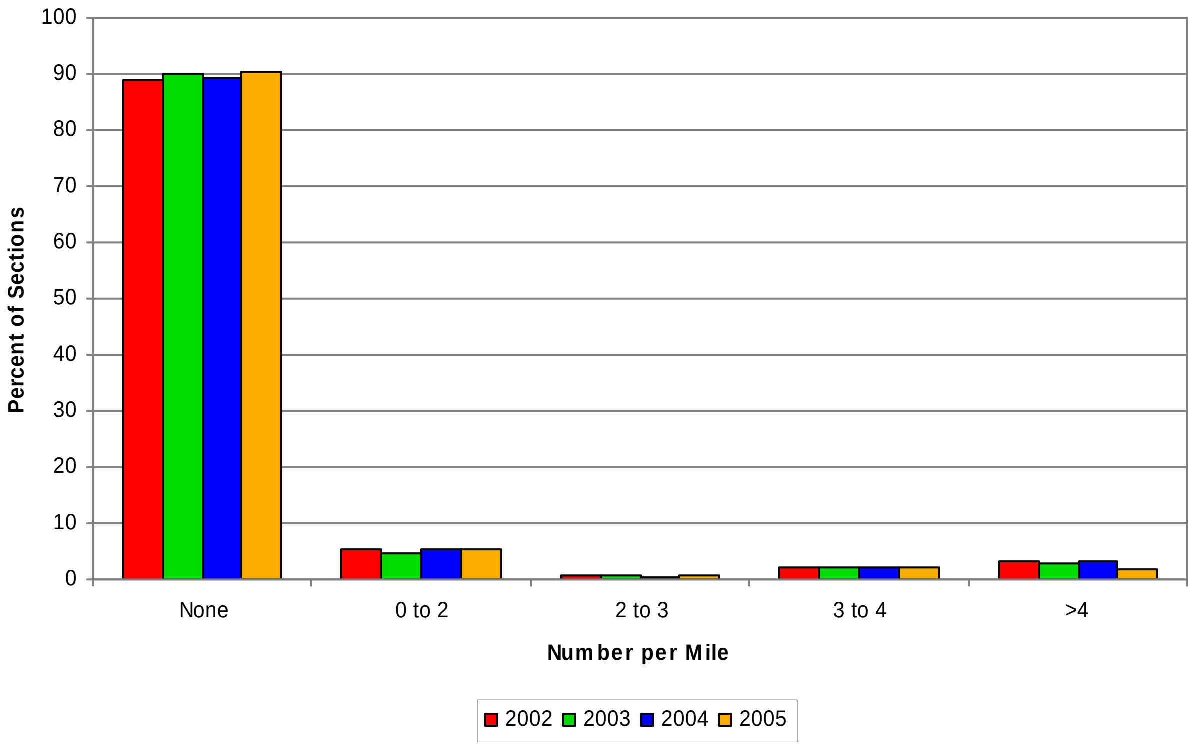


Figure 4.6 — Punchouts, FY 2002-2005.

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

- "None" category increased (from 89.23% in 2004 to 90.33% in 2005)
- "0 to 2" category increased (from 5.18% in 2004 to 5.22% in 2005)
- "2 to 3" category increased (from 0.39% in 2004 to 0.70% in 2005)
- "3 to 4" category decreased (from 2.14% in 2004 to 1.98% in 2005)
- ">4" category decreased (from 3.05% in 2004 to 1.77% in 2005).

Asphalt Patches

Figure 4.7 shows the percentage of PMIS sections with Asphalt Patches for fiscal years 2002 through 2005.

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.

0.94 percent of the CRCP sections had Asphalt Patches in FY 2005.

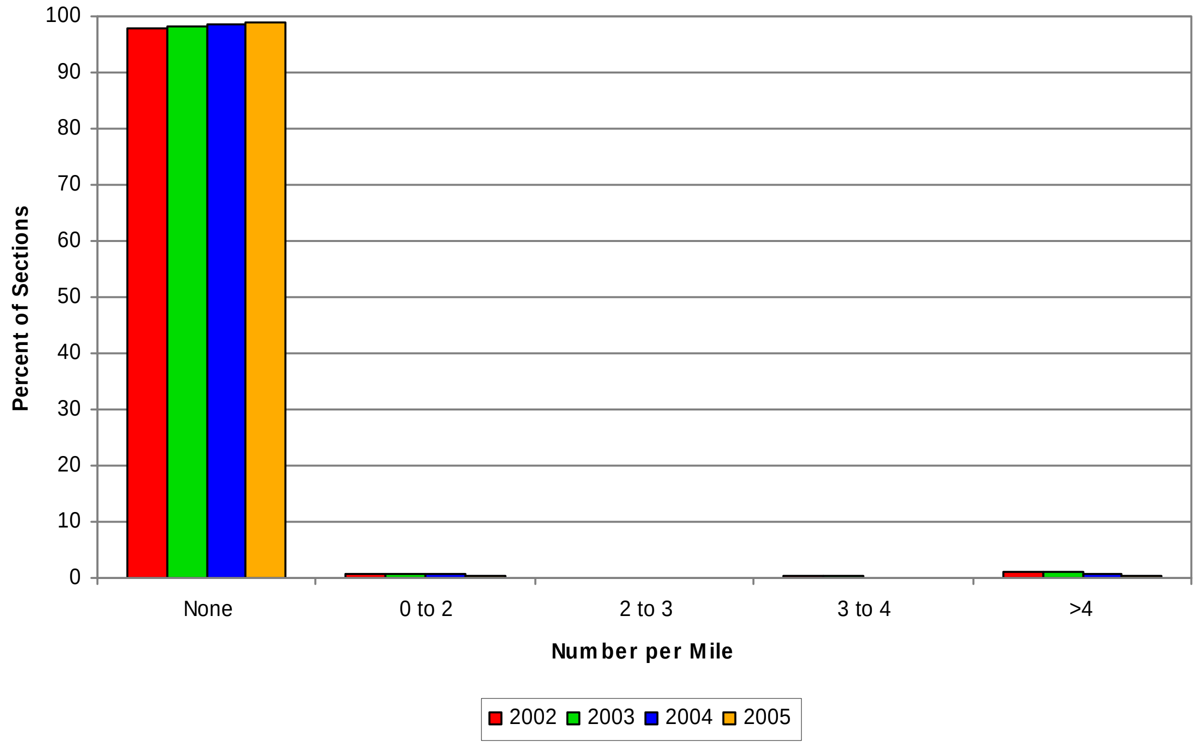


Figure 4.7 — Asphalt Patches, FY 2002-2005.

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

- "None" category increased (from 98.69% in 2004 to 99.06% in 2005)
- "0 to 2" category decreased (from 0.55% in 2004 to 0.29% in 2005)
- "2 to 3" category decreased (from 0.06% in 2004 to 0.05% in 2005)
- "3 to 4" category increased (from 0.11% in 2004 to 0.17% in 2005)
- ">4" category decreased (from 0.58% in 2004 to 0.44% in 2005).

Concrete Patches

Figure 4.8 shows the percentage of PMIS sections with Concrete Patches for fiscal years 2002 through 2005.

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.

16.46 percent of the CRCP sections had Concrete Patches in FY 2005.

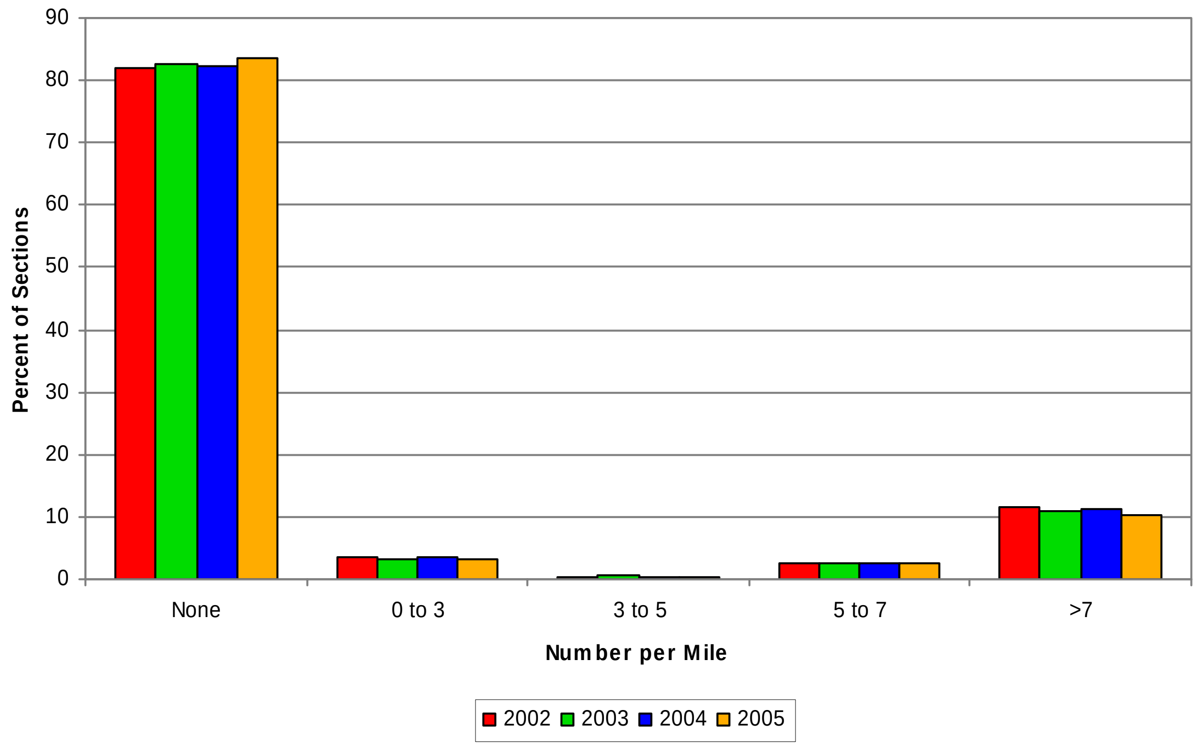


Figure 4.8 — Concrete Patches, FY 2002-2005.

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

- "None" category increased (from 82.40% in 2004 to 83.54% in 2005)
- "0 to 3" category decreased (from 3.43% in 2004 to 3.25% in 2005)
- "3 to 5" category increased (from 0.43% in 2004 to 0.45% in 2005)
- "5 to 7" category increased (from 2.52% in 2004 to 2.54% in 2005)
- ">7" category decreased (from 11.22% in 2004 to 10.21% in 2005).

Average Crack Spacing

Figure 4.9 shows the distribution of Average Crack Spacing on PMIS sections for fiscal years 2002 through 2005.

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.

2.30 percent of PMIS sections had an Average Crack Spacing less than three feet in FY 2005.

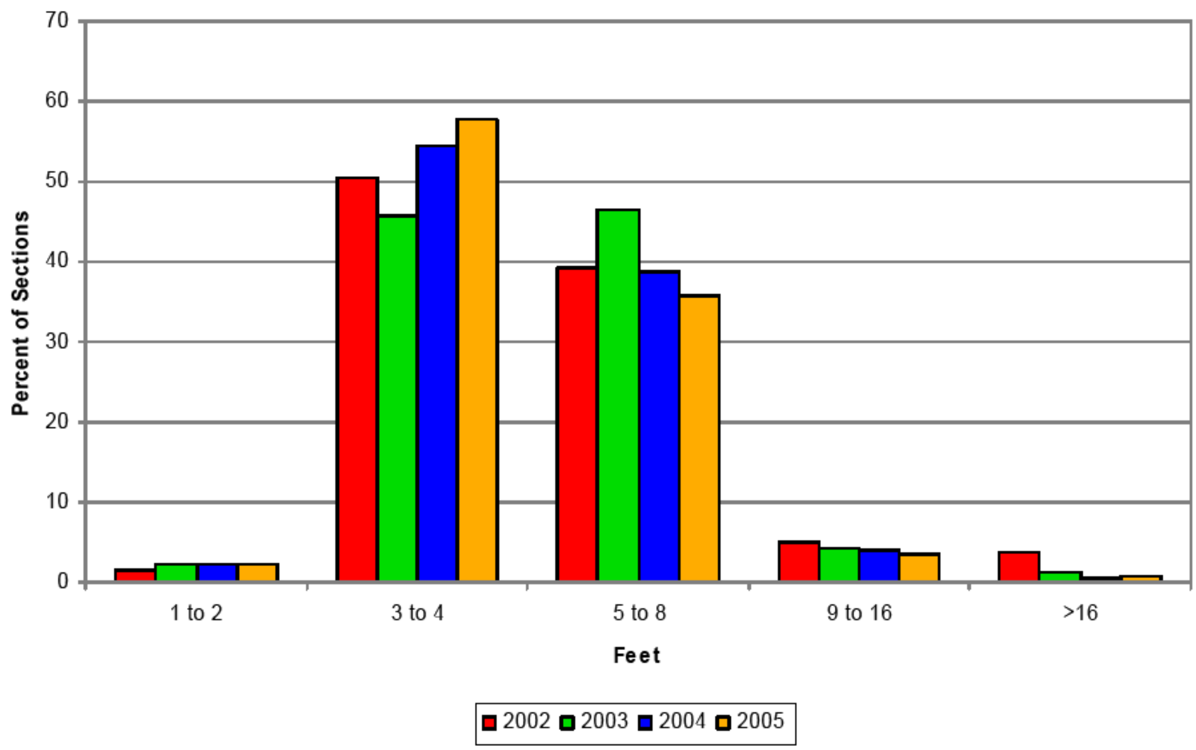


Figure 4.9 — Average Crack Spacing, FY 2002-2005.

The Average Crack Spacing for CRCP show that the:

- "1 to 2" feet increased (from 2.17% in 2004 to 2.30% in 2005)
- "3 to 4" feet increased (from 54.55% in 2004 to 57.68% in 2005)
- "5 to 8" feet decreased (from 38.71% in 2004 to 35.72% in 2005)
- "9 to 16" feet decreased (from 4.12% in 2004 to 3.50% in 2005)
- ">16" feet increased (from 0.44% in 2004 to 0.80% in 2005).

Discussion

CRCP condition, distress, and ride quality improved to the highest level in four years in FY 2005. CRCP was the only pavement type to show improved ride quality in FY 2005 — in fact, it now has the best overall ride quality of the major pavement types in Texas.

The FY 2005 CRCP ride quality improvement followed a larger improvement in FY 2004. The percentage of lane miles with "Very Good" ride quality increased to 19.27 percent in FY 2005, up from 18.16 percent in FY 2004, 12.79 percent in FY 2003, and 12.68 percent in FY 2002.

CRCP distress also improved in FY 2005, with all distress types decreasing. Spalled Cracks showed the largest improvement, decreasing from 26.61 percent of PMIS sections in FY 2004 to 22.20 percent of PMIS sections in FY 2005.

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 that gap has been closing in recent years.

Summary

CRCP condition, distress, and ride quality improved to the highest level in four years in FY 2005. CRCP was the only pavement type to show improved ride quality in FY 2005 — in fact, it now has the best overall ride quality of the major pavement types in Texas. All CRCP distress types decreased in FY 2005, with Spalled Cracks showing the largest decrease.

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

Chapter 5 Condition of Rigid Pavements — JCP

This chapter describes the condition of Jointed Concrete Pavements (JCP) in Texas. They make up approximately 2.30 percent of the TxDOT-maintained lane mileage but carry 5.49 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

The JCP distress types in PMIS are caused by a combination of age and traffic loading. Minute cracks form in JCP during the first hours of curing. As the concrete ages, the cracks widen due to the effects of climate, but these are controlled by placement of the construction joints. The joints give room for the pavement to expand and contract, but they also provide a way for water to seep into the underlying layers and cause structural damage. If the joints are not maintained periodically, damage can affect ride quality and eventually reduce the structural condition of the pavement.

From 1929-1930, the department built 1,773 miles of new highways and improved 629 miles of existing roads.

JCP Distress Examples

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

Failed Joints and Cracks (Number of Occurrences)

JCP Failures (Number of Occurrences)

Shattered Slabs (Number of Slabs)

Slabs with Longitudinal Cracks (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 2002 through 2005.

42.70 percent of the JCP lane miles were in "Very Good" condition in FY 2005.

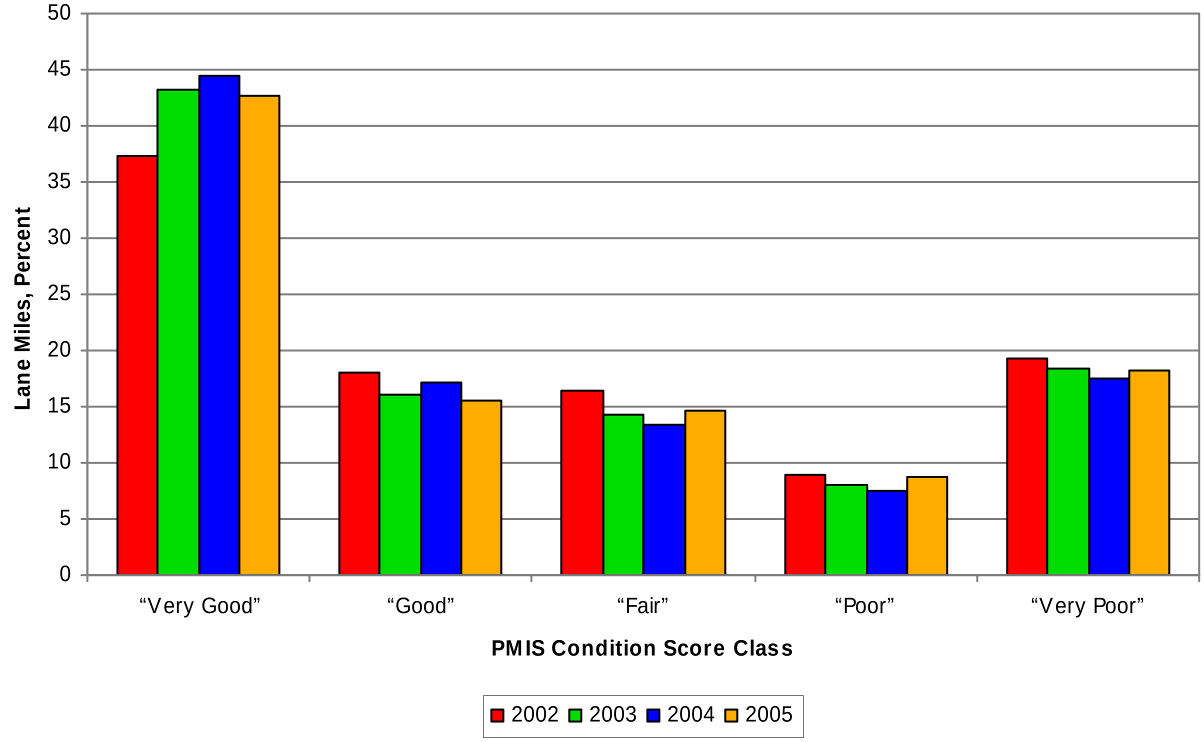


Figure 5.1 — Condition Score Classes for JCP, FY 2002-2005.

The Condition Score Classes for JCP show that:

- "Very Good" mileage decreased (from 44.47% in 2004 to 42.70% in 2005)
- "Good" mileage decreased (from 17.08% in 2004 to 15.62% in 2005)
- "Fair" mileage increased (from 13.44% in 2004 to 14.69% in 2005)
- "Poor" mileage increased (from 7.50% in 2004 to 8.70% in 2005)
- "Very Poor" mileage increased (from 17.50% in 2004 to 18.29% in 2005).

Distress Score Classes for JCP

Figure 5.2 shows the statewide distribution of Distress Score classes for JCP pavements for fiscal years 2002 through 2005.

73.16 percent of JCP lane miles were "Very Good" in terms of pavement distress in FY 2005.

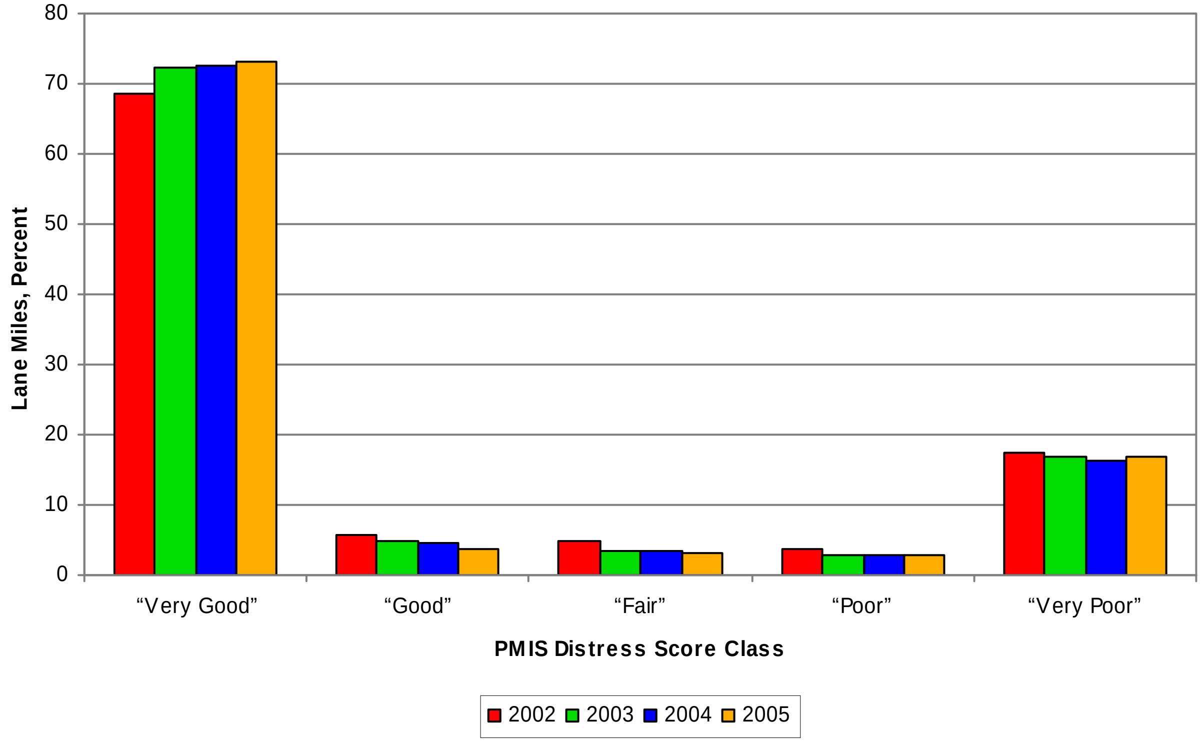


Figure 5.2 — Distress Score Classes for JCP, FY 2002-2005.

The Distress Score Classes for JCP show that:

- "Very Good" mileage increased (from 72.67% in 2004 to 73.16% in 2005)
- "Good" mileage decreased (from 4.67% in 2004 to 3.79% in 2005)
- "Fair" mileage decreased (from 3.46% in 2004 to 3.25% in 2005)
- "Poor" mileage increased (from 2.85% in 2004 to 2.88% in 2005)
- "Very Poor" mileage increased (from 16.35% in 2004 to 16.91% in 2005).

Ride Score Classes for JCP

Figure 5.3 shows the statewide distribution of Ride Score classes for JCP pavements for fiscal years 2002 through 2005. In general, the average person would consider 50.44 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.

6.18 percent of the JCP lane miles had "Very Good" ride quality in FY 2005.

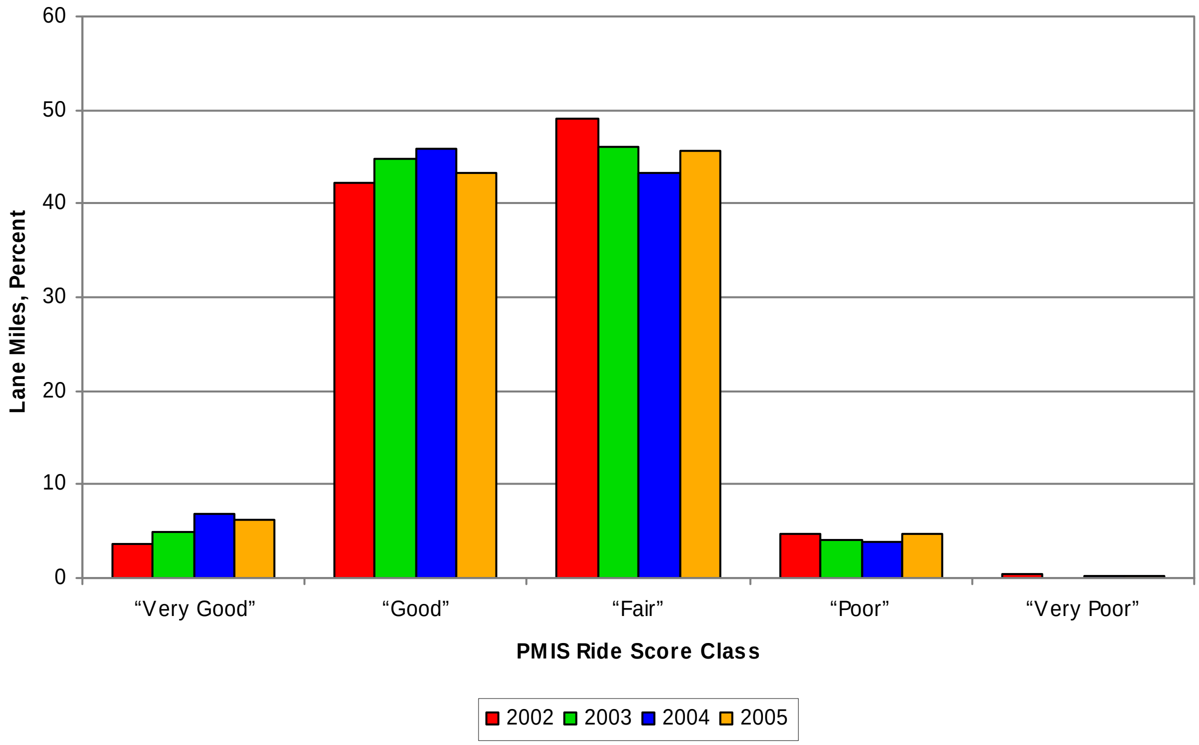


Figure 5.3 — Ride Score Classes for JCP, FY 2002-2005.

The Ride Score Classes for JCP show that:

- "Very Good" mileage decreased (from 6.85% in 2004 to 6.18% in 2005)
- "Good" mileage decreased (from 45.84% in 2004 to 43.39% in 2005)
- "Fair" mileage increased (from 43.36% in 2004 to 45.69% in 2005)
- "Poor" mileage increased (from 3.79% in 2004 to 4.62% in 2005)
- "Very Poor" mileage decreased (from 0.17% in 2004 to 0.13% in 2005).

IRI Score Classes for JCP

Figure 5.4 shows the statewide distribution of IRI Score classes for JCP pavements for fiscal years 2002 through 2005. In general, the average person would consider 88.13 percent of the jointed concrete pavements to be "rough," based on IRI. This is not the same as the 50.44 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.

0.25 percent of the JCP lane miles had "Very Good" IRI scores in FY 2005.

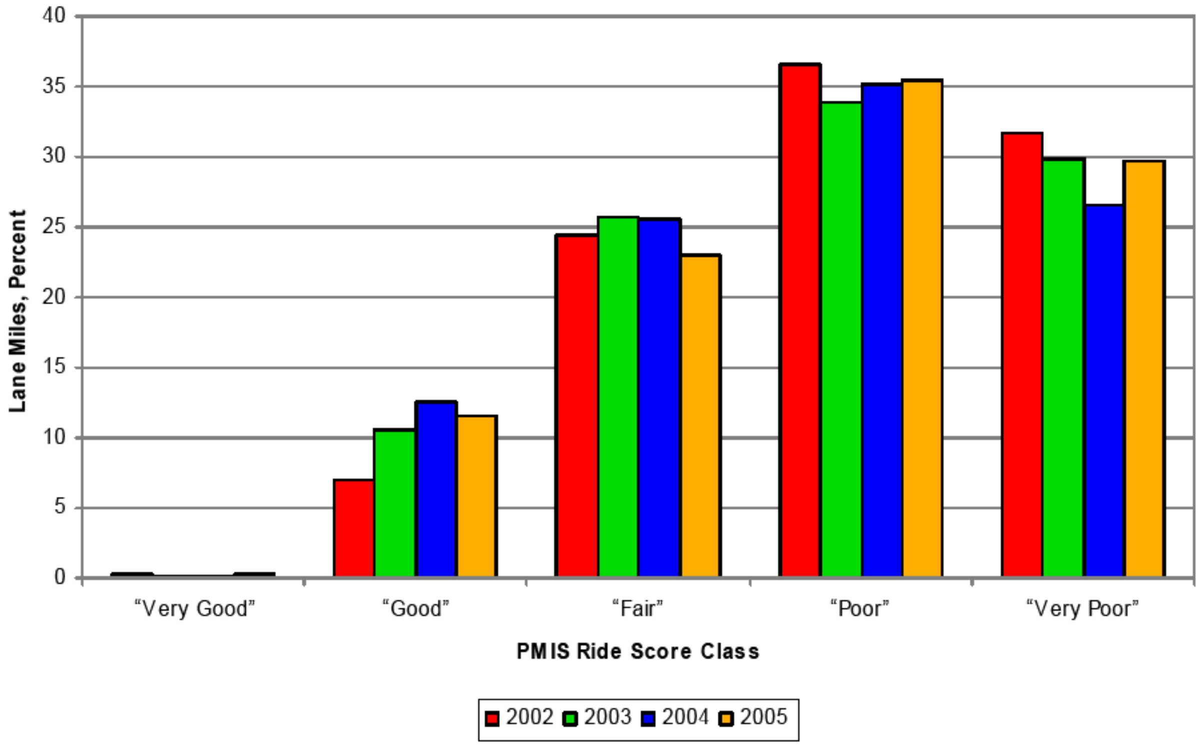


Figure 5.4 — IRI Score Classes for JCP, FY 2002-2005.

The IRI Score Classes for JCP show that:

- "Very Good" mileage increased (from 0.17% in 2004 to 0.25% in 2005)
- "Good" mileage decreased (from 12.55% in 2004 to 11.62% in 2005)
- "Fair" mileage decreased (from 25.63% in 2004 to 23.03% in 2005)
- "Poor" mileage increased (from 35.14% in 2004 to 35.43% in 2005)
- "Very Poor" mileage increased (from 26.51% in 2004 to 29.67% in 2005).

Failed Joints and Cracks

Figure 5.5 shows the percentage of PMIS sections with Failed Joints and Cracks for fiscal years 2002 through 2005.

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.

44.76 percent of the JCP sections had Failed Joints and Cracks in FY 2005.

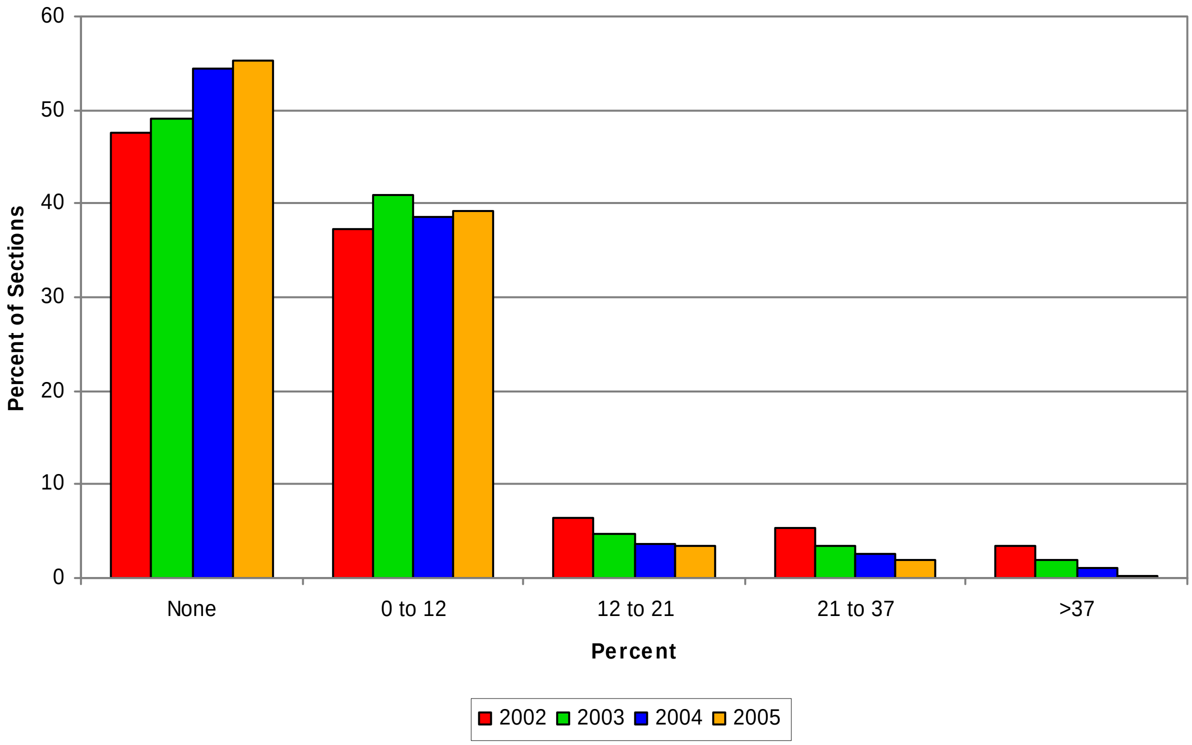


Figure 5.5 — Failed Joints and Cracks, FY 2002-2005.

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

- "None" category increased (from 54.37% in 2004 to 55.24% in 2005)
- "0 to 12" percent category increased (from 38.47% in 2004 to 39.12% in 2005)
- "12 to 21" percent category decreased (from 3.54% in 2004 to 3.51% in 2005)
- "21 to 37" percent category decreased (from 2.50% in 2004 to 1.87% in 2005)
- ">37" percent category decreased (from 1.11% in 2004 to 0.26% in 2005).

JCP Failures

Figure 5.6 shows the percentage of PMIS sections with JCP Failures for fiscal years 2002 through 2005.

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).

36.10 percent of the JCP sections had JCP Failures in FY 2005.

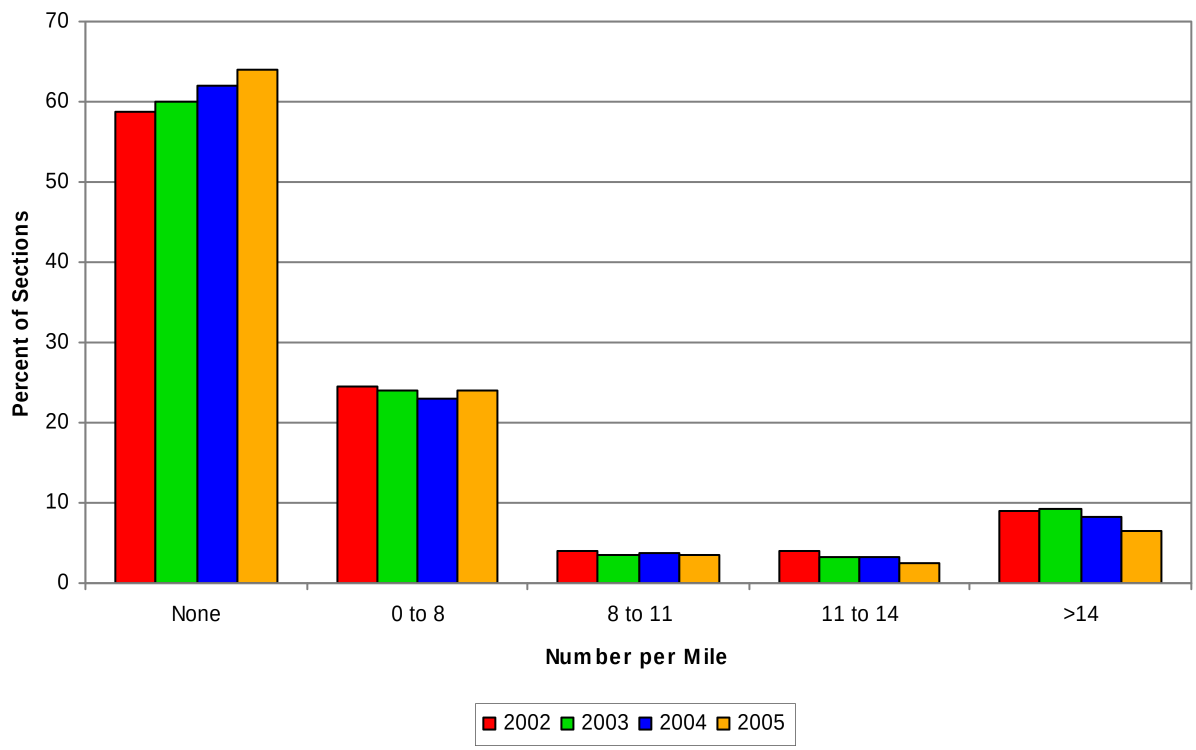


Figure 5.6 — JCP Failures, FY 2002-2005.

The Number of Failures per Mile for JCP show that:

- "None" category increased (from 61.96% in 2004 to 63.90% in 2005)
- "0 to 8" percent category increased (from 23.09% in 2004 to 23.89% in 2005)
- "8 to 11" percent category decreased (from 3.66% in 2004 to 3.43% in 2005)
- "11 to 14" percent category decreased (from 3.14% in 2004 to 2.39% in 2005)
- ">14" percent category decreased (from 8.15% in 2004 to 6.38% in 2005).

Shattered Slabs

Figure 5.7 shows the percentage of PMIS sections with Shattered Slabs for fiscal years 2002 through 2005.

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

0.52 percent of the JCP sections had Shattered Slabs in FY 2005.

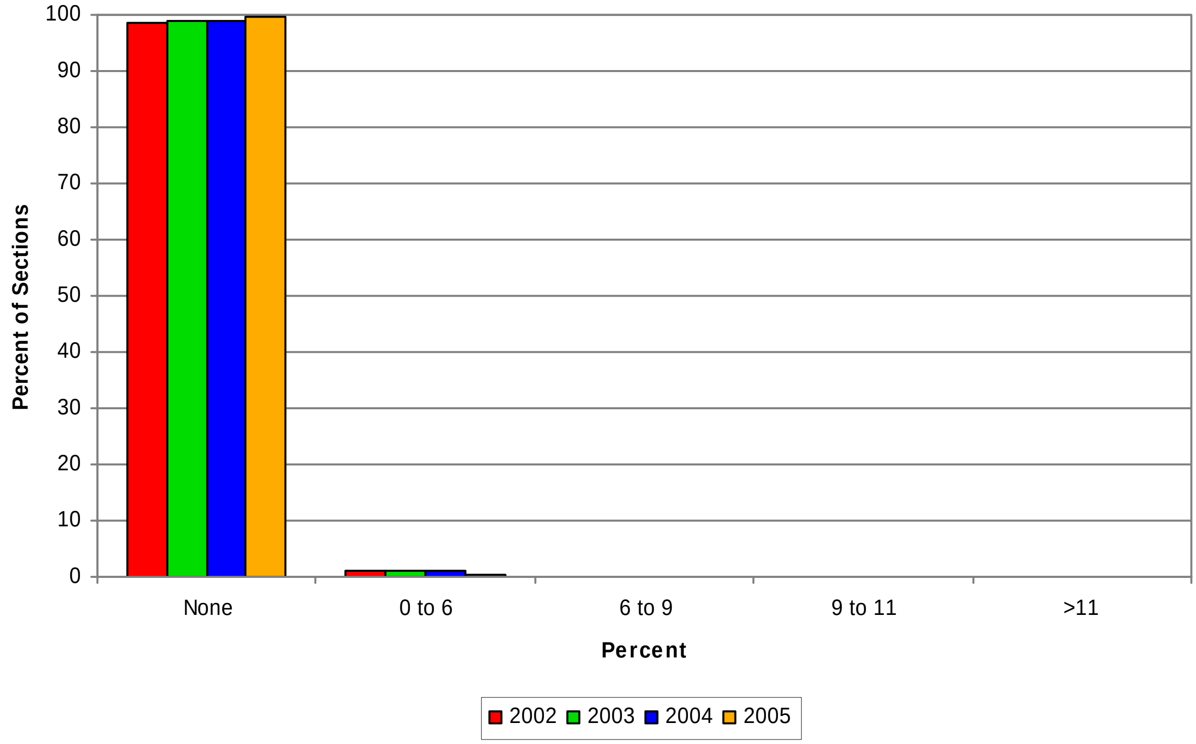


Figure 5.7 — Shattered Slabs, FY 2002-2005.

The Percent of Shattered Slabs for JCP show that:

- "None" category increased (from 98.77% in 2004 to 99.48% in 2005)
- "0 to 6" percent category decreased (from 1.23% in 2004 to 0.49% in 2005)
- "6 to 9" percent category remained the same (0.00% in 2004 to 0.00% in 2005)
- "9 to 11" percent category remained the same (0.00% in 2004 to 0.00% in 2005)
- ">11" percent category increased (from 0.00% in 2004 to 0.04% in 2005).

Slabs With Longitudinal Cracks

Figure 5.8 shows the percentage of PMIS sections having Slabs with Longitudinal Cracks for fiscal years 2002 through 2005.

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.

11.16 percent of the JCP sections had Slabs with Longitudinal Cracks in FY 2005.

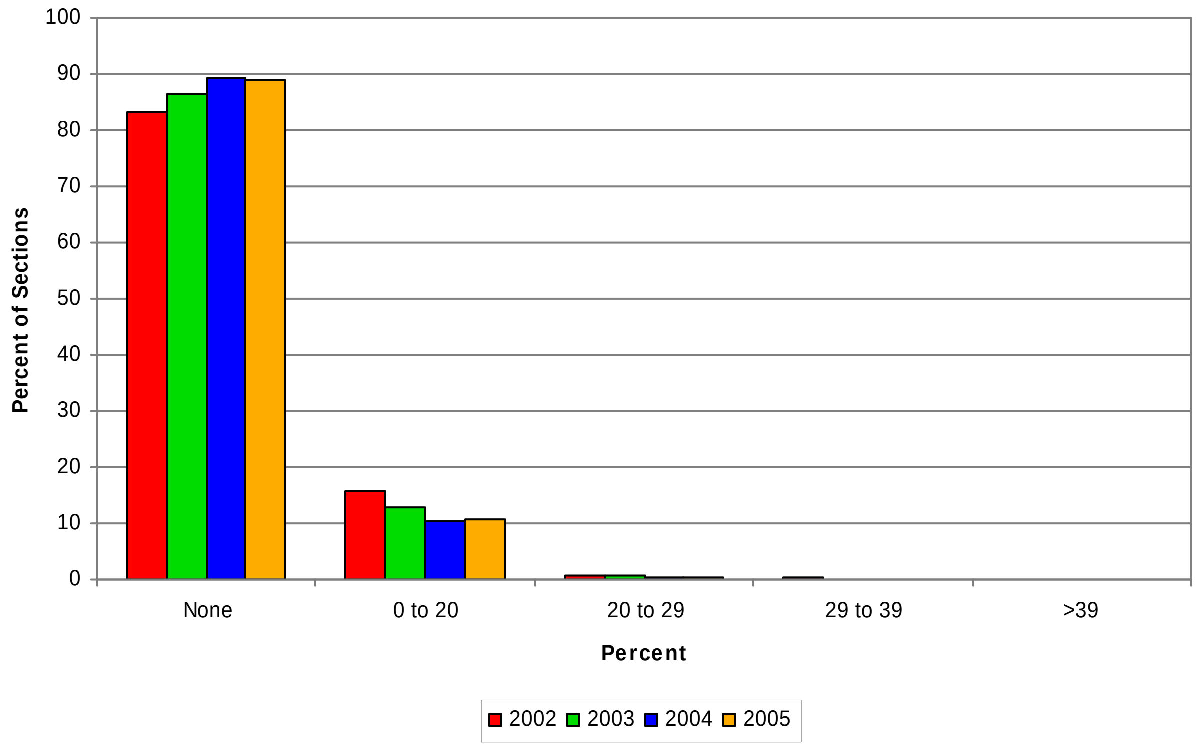


Figure 5.8 — Slabs with Longitudinal Cracks, FY 2002-2005.

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

- "None" category decreased (from 89.11% in 2004 to 88.84% in 2005)
- "0 to 20" percent category increased (from 10.29% in 2004 to 10.60% in 2005)
- "20 to 29" percent category remained the same (0.52% in 2004 to 0.52% in 2005)
- "29 to 39" percent category remained the same (0.04% in 2004 to 0.04% in 2005)
- ">39" percent category decreased (from 0.04% in 2004 to 0.00% in 2005).

Concrete Patches

Figure 5.9 shows the percentage of PMIS sections with Concrete Patches for fiscal years 2002 through 2005.

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).

30.35 percent of the JCP sections had Concrete Patches in FY 2005.

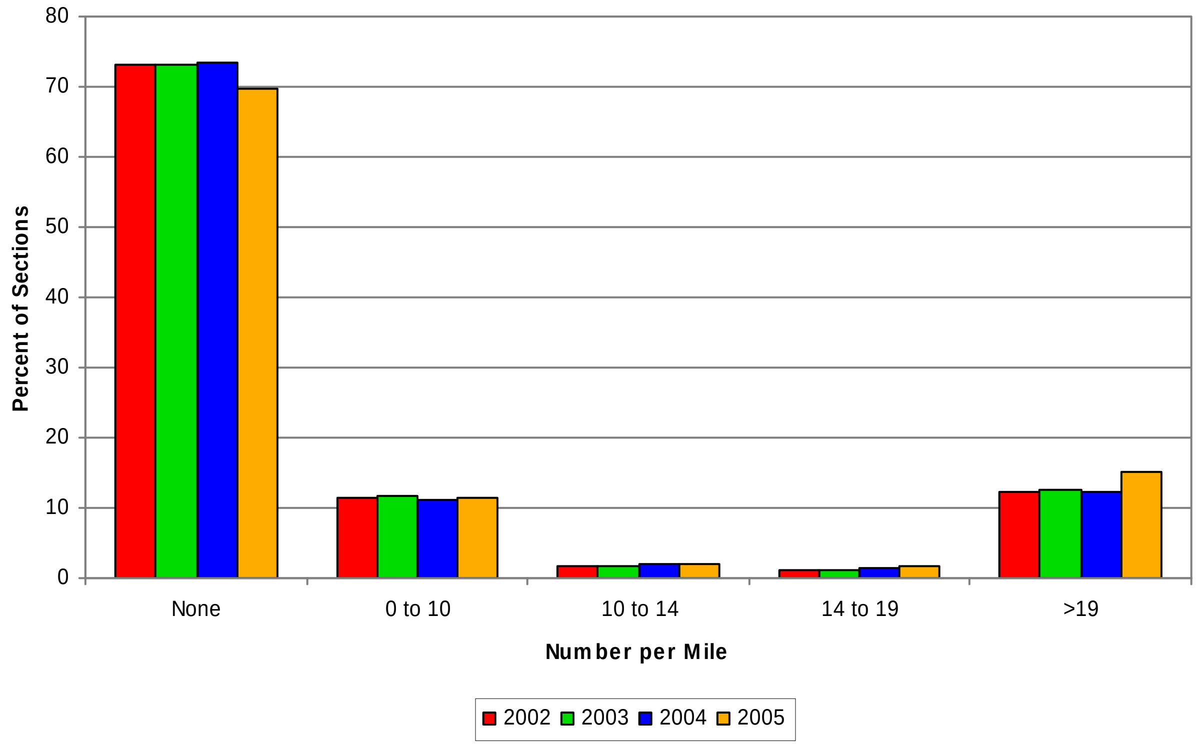


Figure 5.9 — Concrete Patches, FY 2002-2005.

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

- "None" category decreased (from 73.49% in 2004 to 69.65% in 2005)
- "0 to 10" category increased (from 11.01% in 2004 to 11.50% in 2005)
- "10 to 14" category increased (from 1.95% in 2004 to 2.09% in 2005)
- "14 to 19" category increased (from 1.31% in 2004 to 1.75% in 2005)
- ">19" category increased (from 12.24% in 2004 to 15.01% in 2005).

Discussion

JCP condition, distress, and ride quality got worse in FY 2005, after having improved in FY 2003 and FY 2004. JCP was the only pavement type to have worse condition and distress in FY 2005.

JCP ride quality continues to be a statewide problem. The percentage of JCP lane miles with "Very Good" ride quality is still only 6.18 percent in FY 2005, and the average person would consider 50.44 percent of the JCP mileage "rough" in FY 2005. By comparison, the FY 2005 values for CRCP were 19.27 percent "Very Good" and 16.29 percent "rough," and the values for ACP were 25.60 percent "Very Good" and 23.60 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.

Three of the five JCP distress types — Failed Joints and Cracks, Failures, and Shattered Slabs — decreased in FY 2005. However, Slabs with Longitudinal Cracks and Concrete Patches increased, and they were enough to lower the overall PMIS Distress Score for JCP in FY 2005.

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, roughest ride quality, and 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, distress, and ride quality got worse in FY 2005, after having improved in FY 2003 and FY 2004. JCP was the only pavement type to have worse condition and distress in FY 2005. Three of the five JCP distress types — Failed Joints and Cracks, Failures, and Shattered Slabs — decreased in FY 2005. However, Slabs with Longitudinal Cracks and Concrete Patches increased, and they were enough to lower the overall PMIS Distress Score for JCP in FY 2005.

As of March 31, 1929, Texas had more Federal-aid mileage completed – 6,092.4 miles – than any other state. The states with the next highest mileages were: Minnesota, North Dakota, Nebraska, and South Dakota.

Source: United States Department of Agriculture
Bureau of Public Roads
Current Status of Federal Aid Road Construction
(as of March 31, 1929)

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.

The famous Route 66 was renamed Interstate 40 in July 1984. Route 66 signs started disappearing from Texas highways in 1985, when citizens heard they would be removed. The signs were sent to Austin for public auction. An original Route 66 sign in good condition can sell for about $1,200.

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% shallow & 0% deep	1-50% shallow & 0% deep	51-100% shallow & 0% deep OR 0-50% shallow & 1-25% deep	51-100% shallow & 1-25% deep OR 26-100% deep
	Medium (501-10,000)	0% shallow & 0% deep	1-50% shallow & 0% deep	51-100% shallow & 0% deep OR 0-50% shallow & 1-25% deep	51-100% shallow & 1-25% deep OR 26-100% deep
	High (over 10,000)	0% shallow & 0% deep	1-25% shallow 0% deep	26-50% shallow & 0% deep	51-100% shallow & 0% deep OR 1-100% 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 2002 through 2005.

41.75 percent of the flexible lane miles was "Desirable" in terms of Rutting in FY 2005.

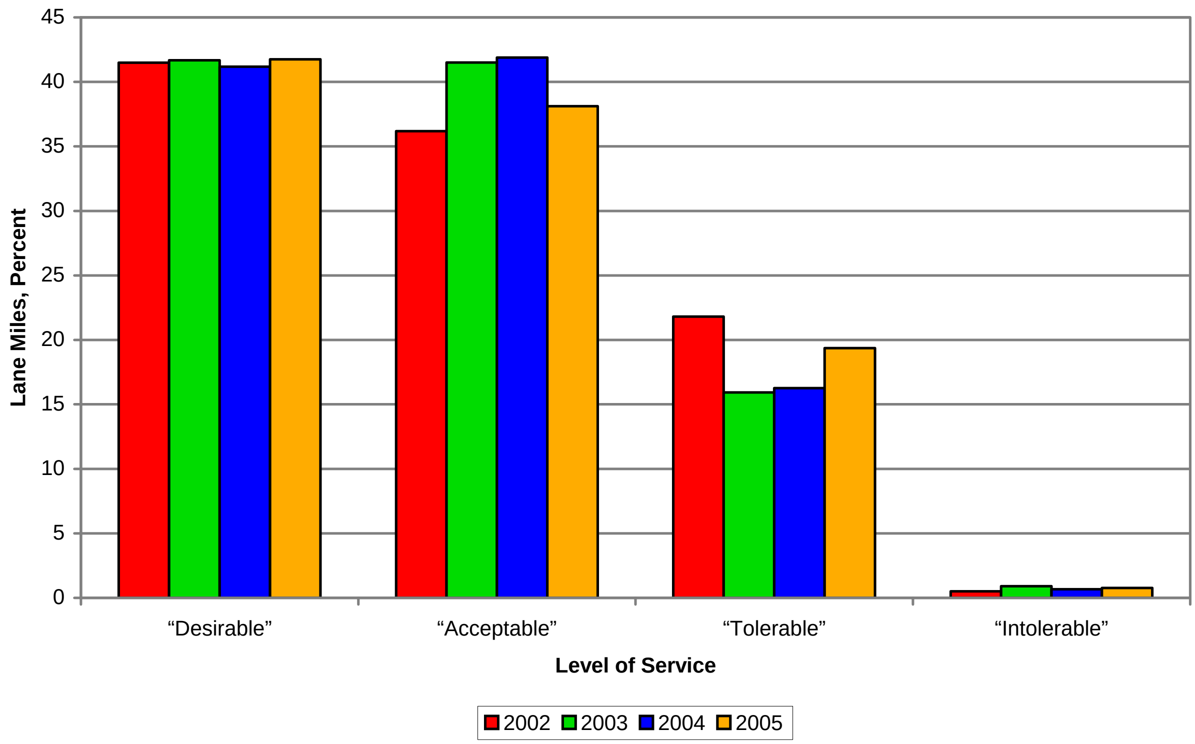


Figure 6.1 — Rutting Level of Service, FY 2002-2005.

The Rutting Level of Service shows that:

- "Desirable" mileage increased (from 41.18% in 2004 to 41.75% in 2005)
- "Acceptable" mileage decreased (from 41.89% in 2004 to 38.11% in 2005)
- "Tolerable" mileage increased (from 16.26% in 2004 to 19.37% in 2005)
- "Intolerable" mileage increased (from 0.67% in 2004 to 0.77% in 2005).

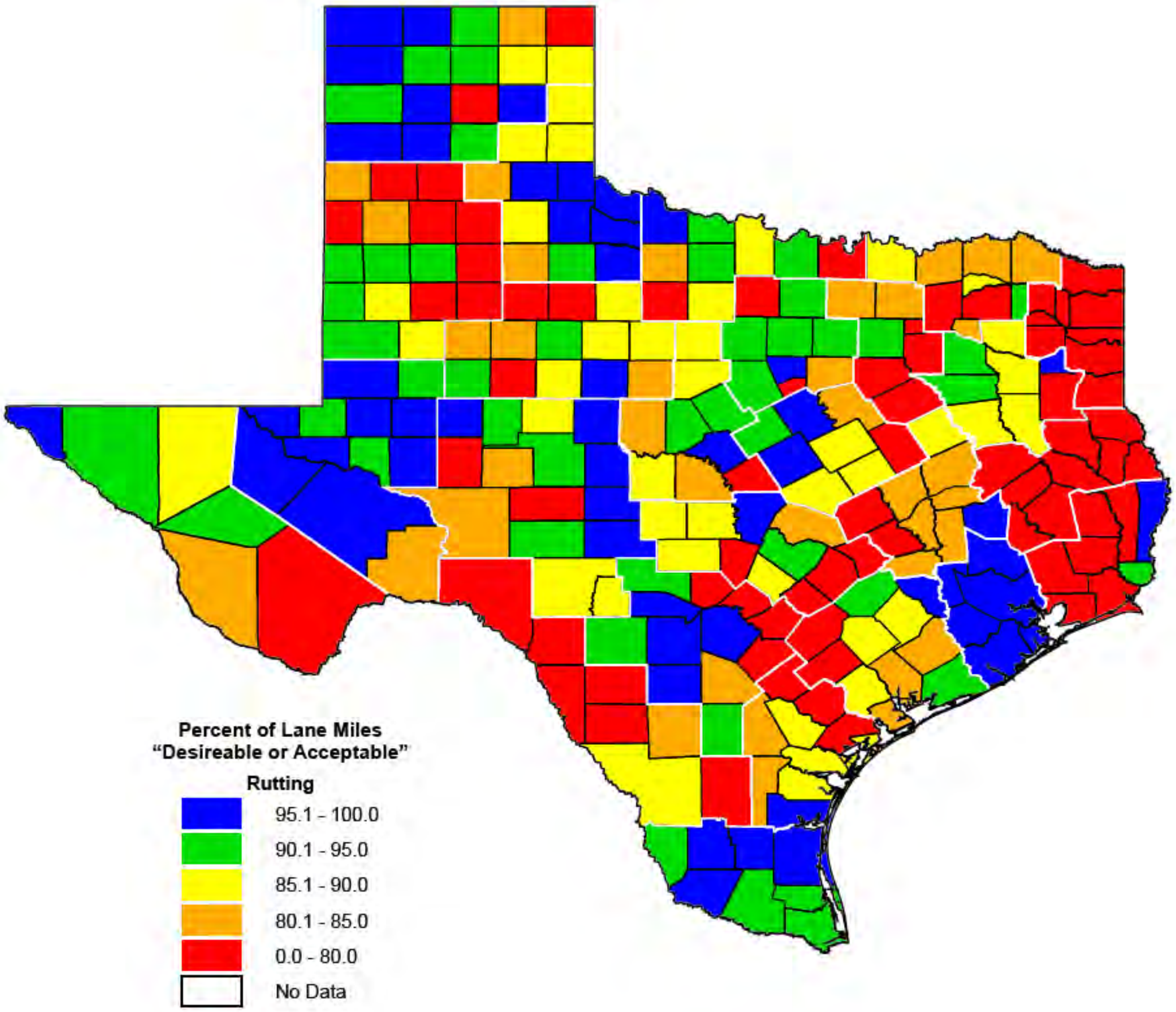
TxDOT experience with the automated rut-measuring equipment ("Rutbar") suggests that these PMIS results are a minimum estimate of the amount of rutting that actually exists in the field. Because the sensors on the Rutbar are fixed in positions less than the full width of the lane, some pavement rutting that exists in the field 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 2004 and 2005. 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.

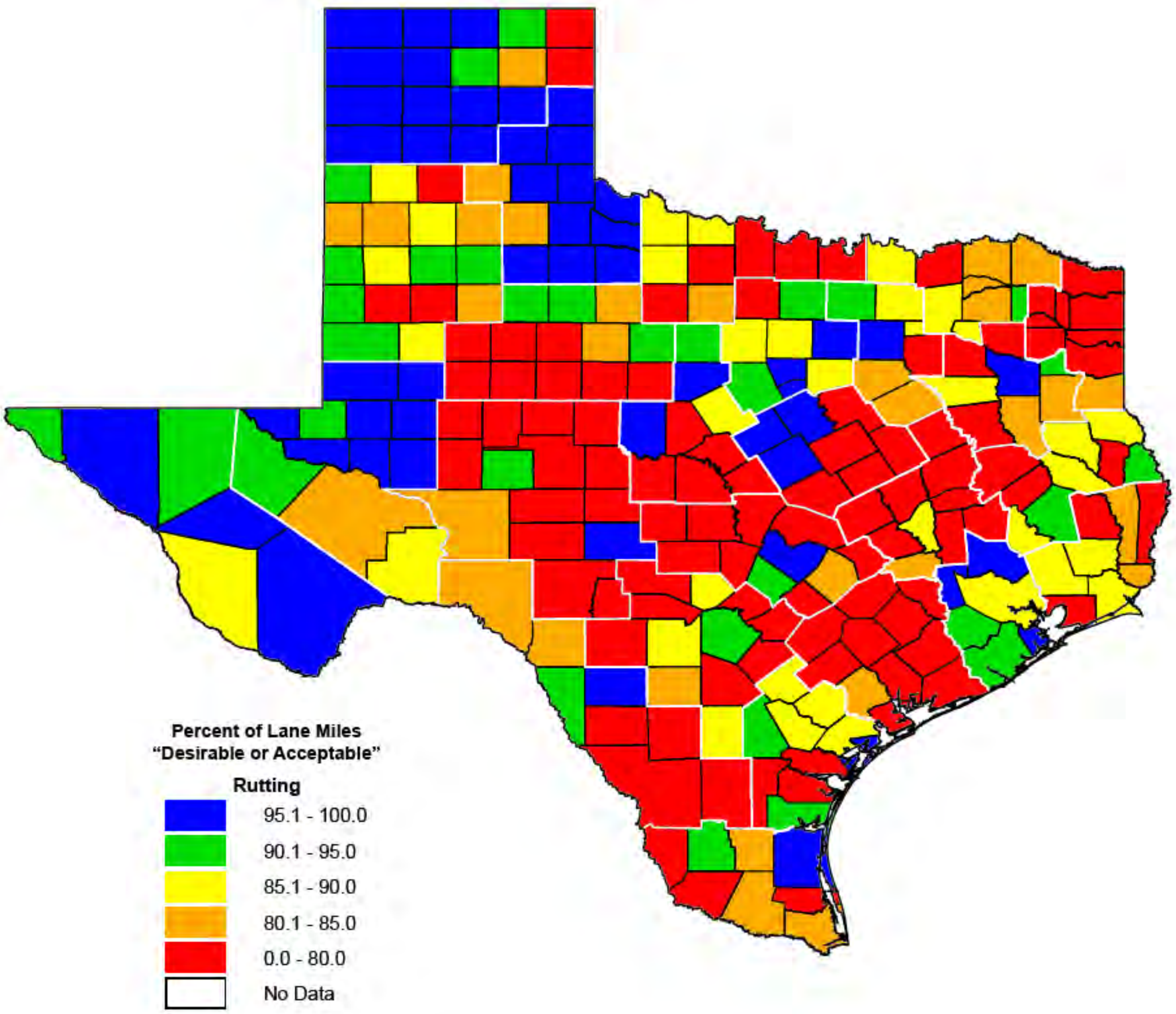
The maintenance level of service for Rutting worsened noticeably in FY 2005, mainly because of the increase in "Tolerable" Rutting. This trend is consistent with the observed increase in Shallow Rutting and Deep Rutting described in Chapter 3.

Rutting Level of Service

Map 6.1 — Rutting Level of Service, FY 2004.



Map 6.2 — Rutting Level of Service, FY 2005.



Alligator Cracking Level of Service

Figure 6.2 shows the statewide distribution for Alligator Cracking level of service for fiscal years 2002 through 2005.

84.99 percent of flexible lane miles was “Desirable” in terms of Alligator Cracking in FY 2005.

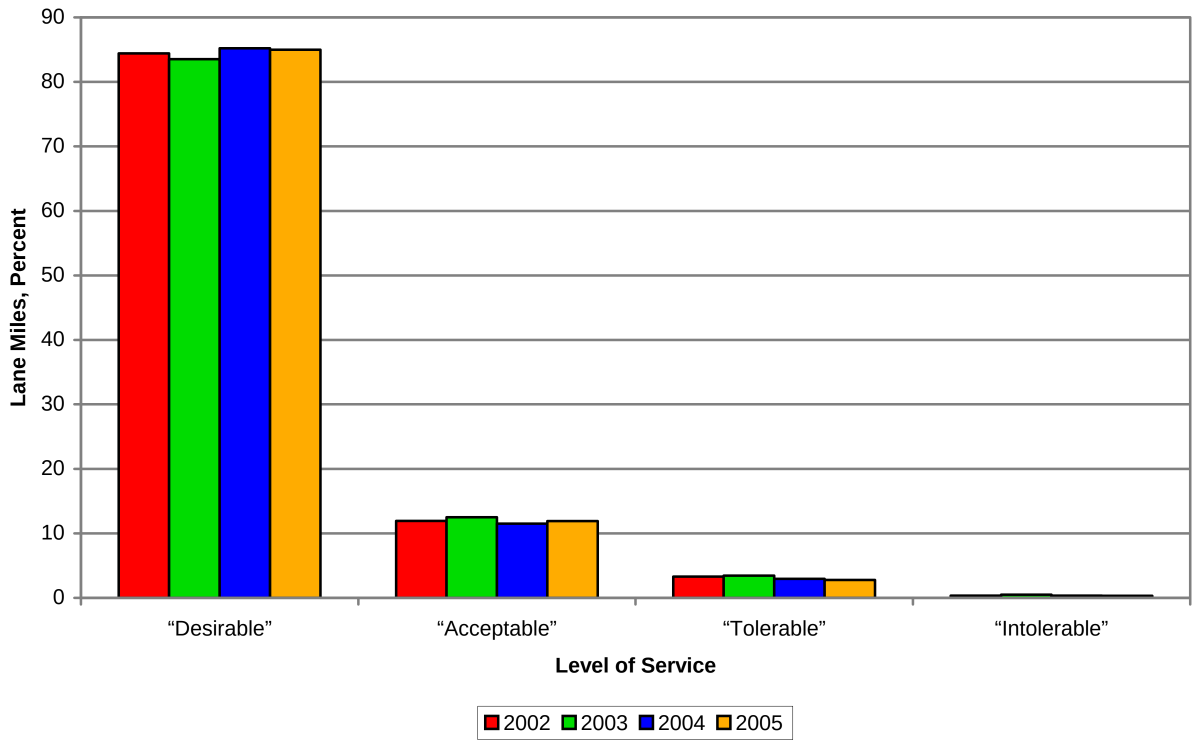


Figure 6.2 — Alligator Cracking Level of Service, FY 2002-2005.

The Alligator Cracking Level of Service shows that:

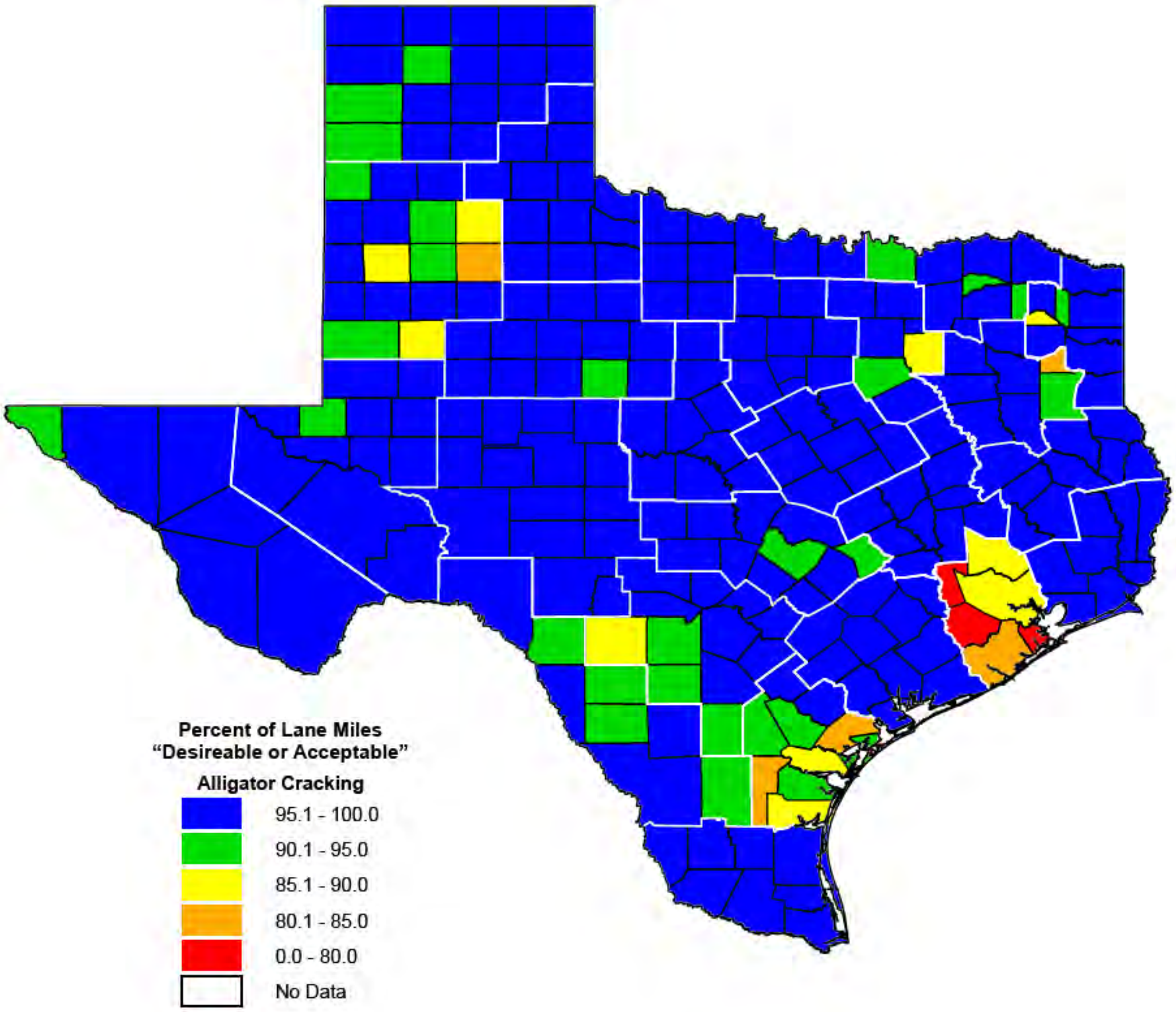
- “Desirable” mileage decreased (from 85.21% in 2004 to 84.99% in 2005)
- “Acceptable” mileage increased (from 11.51% in 2004 to 11.91% in 2005)
- “Tolerable” mileage decreased (from 2.95% in 2004 to 2.78% in 2005)
- “Intolerable” mileage decreased (from 0.34% in 2004 to 0.33% in 2005).

Maps 6.3 and 6.4 on the following pages show Alligator Cracking level of service in each county for fiscal years 2004 and 2005. 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.

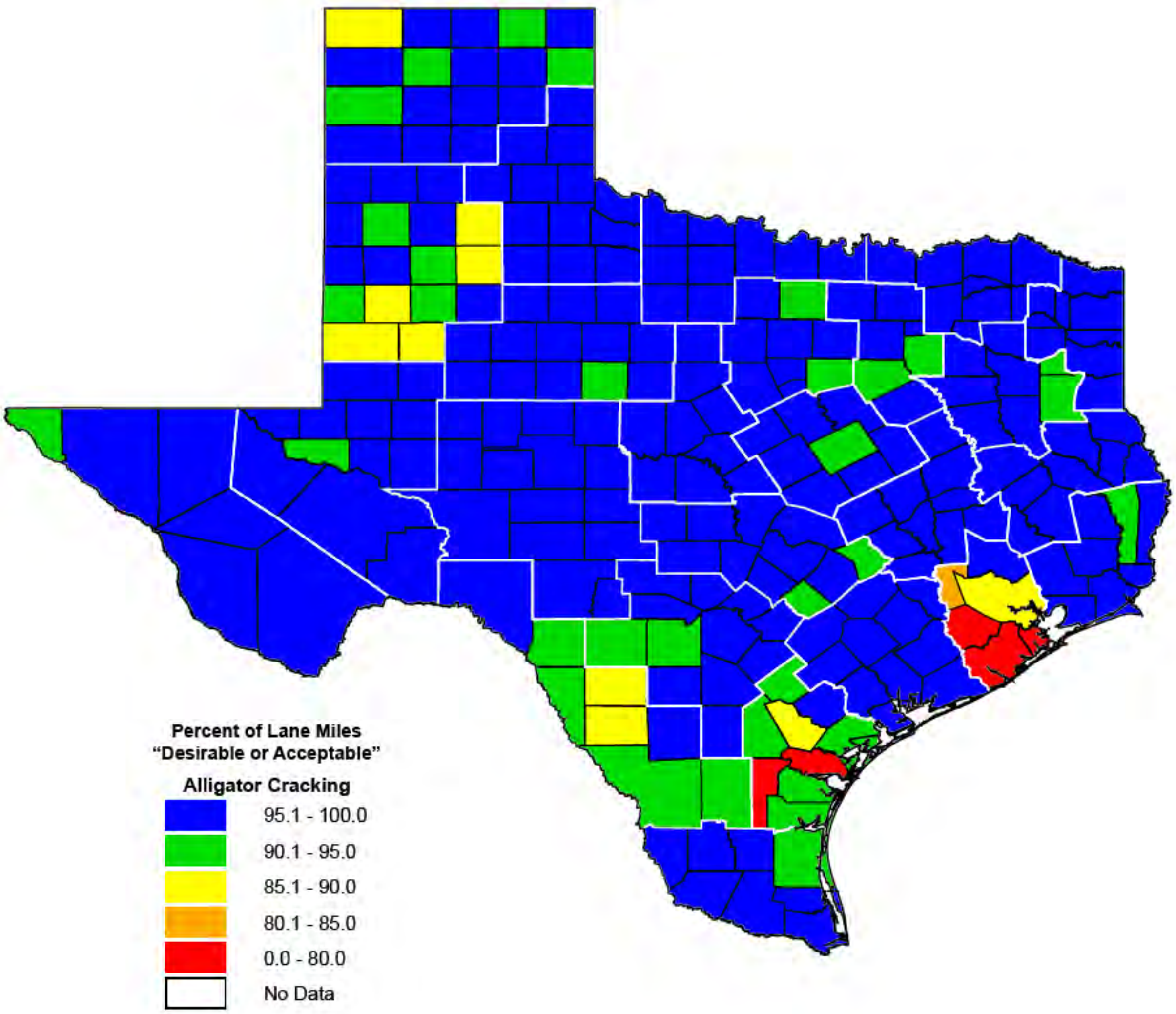
The maintenance level of service for Alligator Cracking improved very slightly in FY 2005. This contradicts the observed increase in Alligator Cracking described in Chapter 3, which only describes the increase in PMIS sections with Alligator Cracking. However, an increase in the percentage of PMIS sections with Alligator Cracking would show up as an increase in the percentages of “Acceptable,” “Tolerable, or “Intolerable” mileage, which is exactly what happened – those percentages went up and the percentage of “Desirable” mileage (with no Alligator Cracking) went down in FY 2005.

Alligator Cracking Level of Service

Map 6.3 — Alligator Cracking Level of Service, FY 2004.



Map 6.4 — Alligator Cracking Level of Service, FY 2005.



Ride Quality Level of Service

Figure 6.3 shows the statewide distribution for Ride Quality level of service for fiscal years 2002 through 2005.

78.04 percent of the flexible lane miles was "Desirable" in terms of Ride Quality in FY 2005.

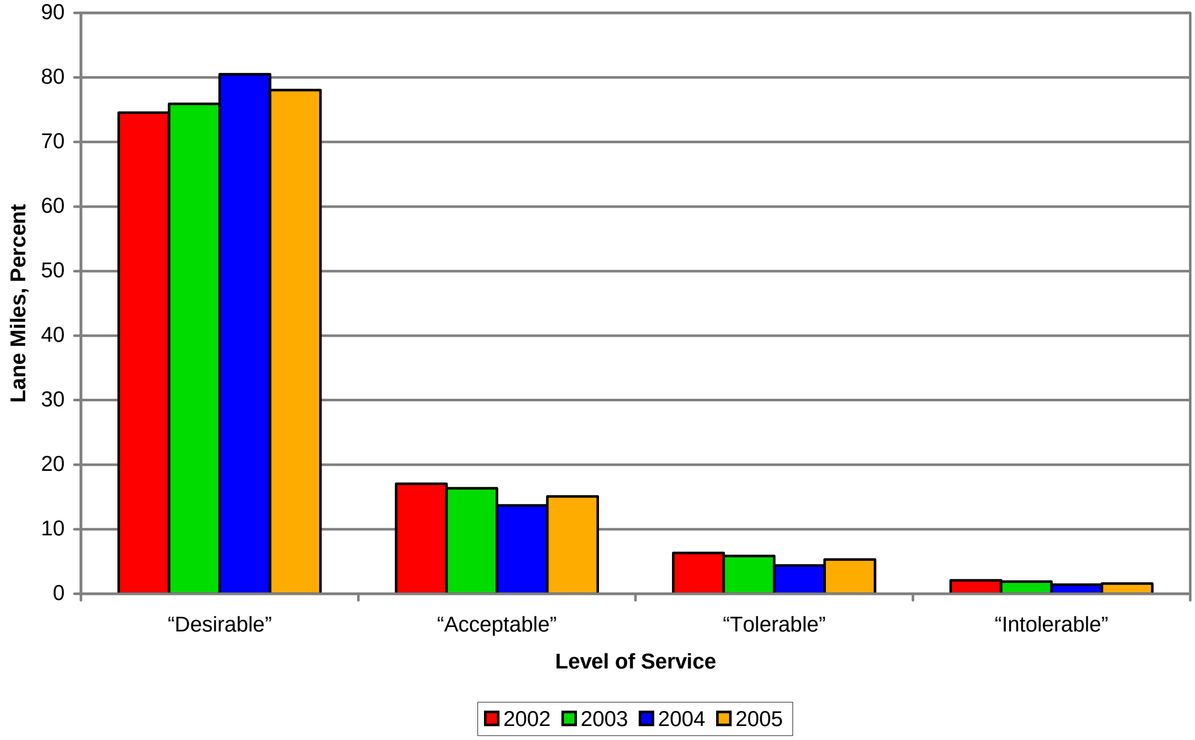


Figure 6.3 — Ride Quality Level of Service, FY 2002-2005.

The Ride Quality Level of Service shows that:

- "Desirable" mileage decreased (from 80.49% in 2004 to 78.04% in 2005)
- "Acceptable" mileage increased (from 13.70% in 2004 to 15.08% in 2005)
- "Tolerable" mileage increased (from 4.39% in 2004 to 5.30% in 2005)
- "Intolerable" mileage increased (from 1.42% in 2004 to 1.58% in 2005).

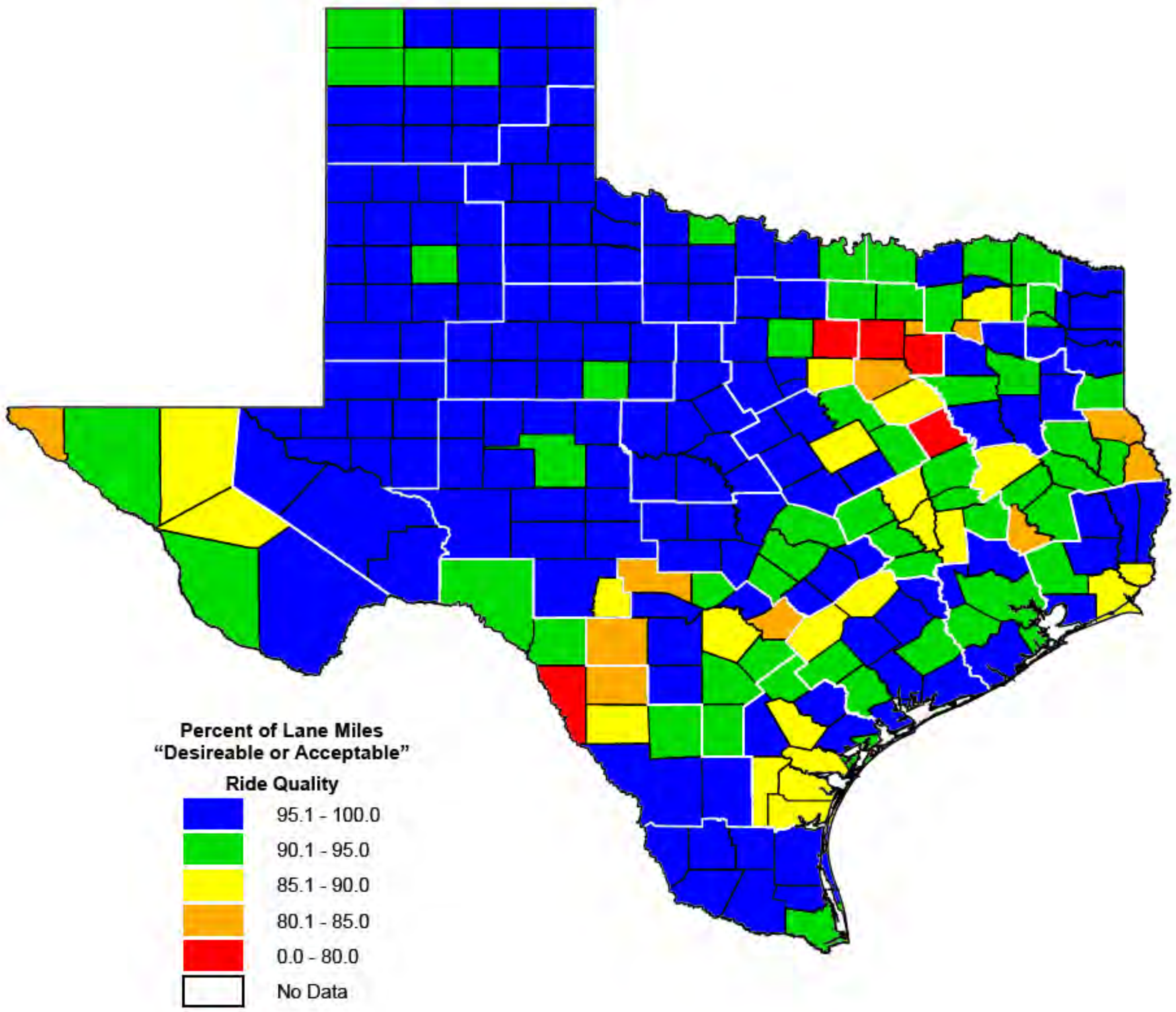
Maps 6.5 and 6.6 on the following pages show Ride Quality level of service in each county for fiscal years 2004 and 2005. These maps show the percentage of lane miles in each county that were maintained at a “Desirable” or “Acceptable” level of service. Counties in red had the lowest Ride Quality level of service, while counties in blue had the highest Ride Quality level of service.

The maintenance level of service for Ride Quality got worse in FY 2005. This trend is consistent with the observed decline in ACP Ride Quality described in Chapter 3. The decrease in the percentage of “Desirable” mileage was matched by increases in the other level of service categories.

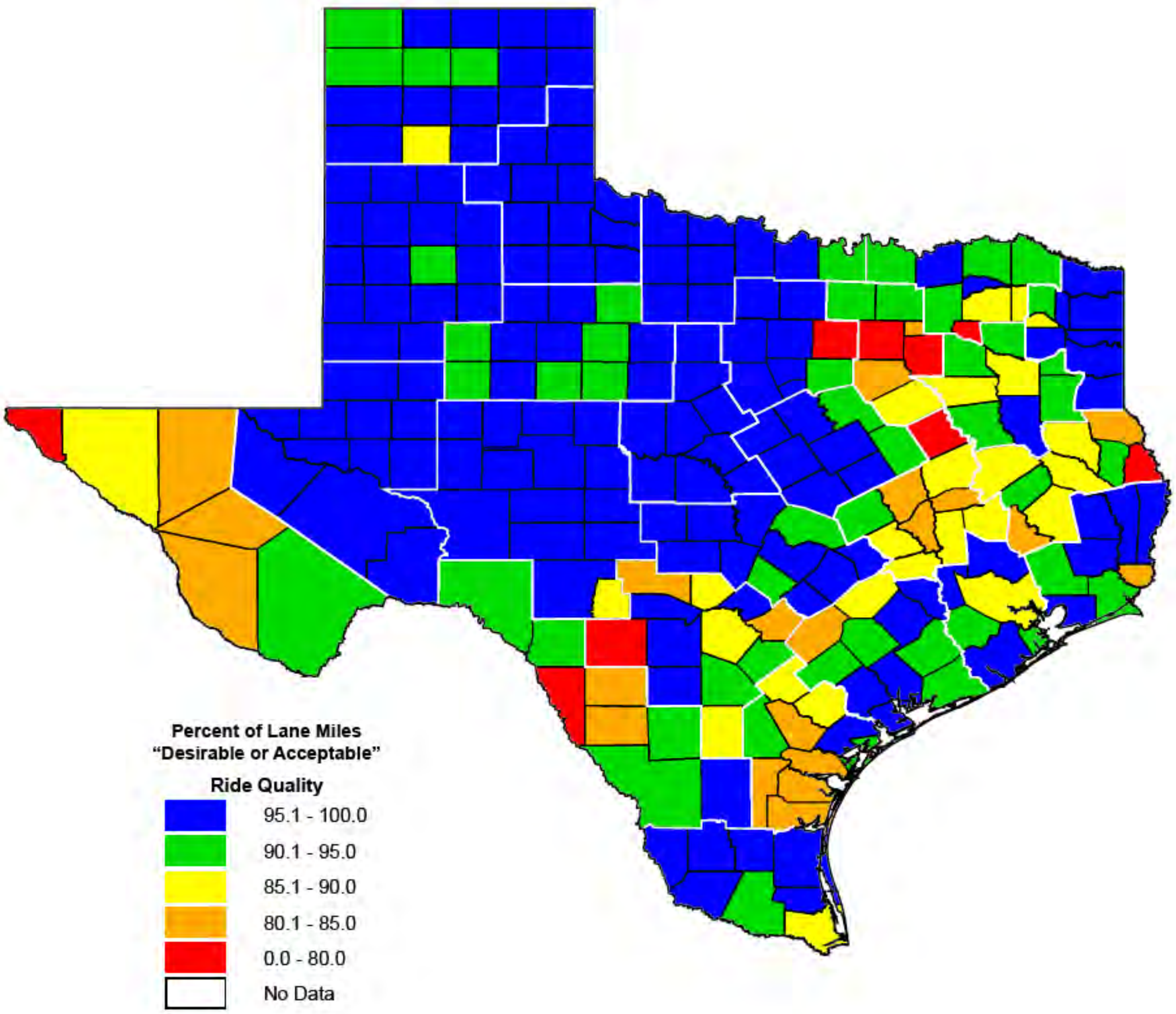
It should be noted that the Ride Quality level of service definitions are based in part on traffic. This means that high-traffic roads must have better ride quality to provide “Desirable” or “Acceptable” level of service. As a result, it is harder for urban and metropolitan counties to show up as having “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 2004.



Map 6.6 — Ride Quality Level of Service, FY 2005.



Combined Maintenance Level of Service

Figure 6.4 shows the statewide distribution for Combined level of service for fiscal years 2002 through 2005.

30.18 percent of flexible lane miles provided an overall "Desirable" level of service in FY 2005.

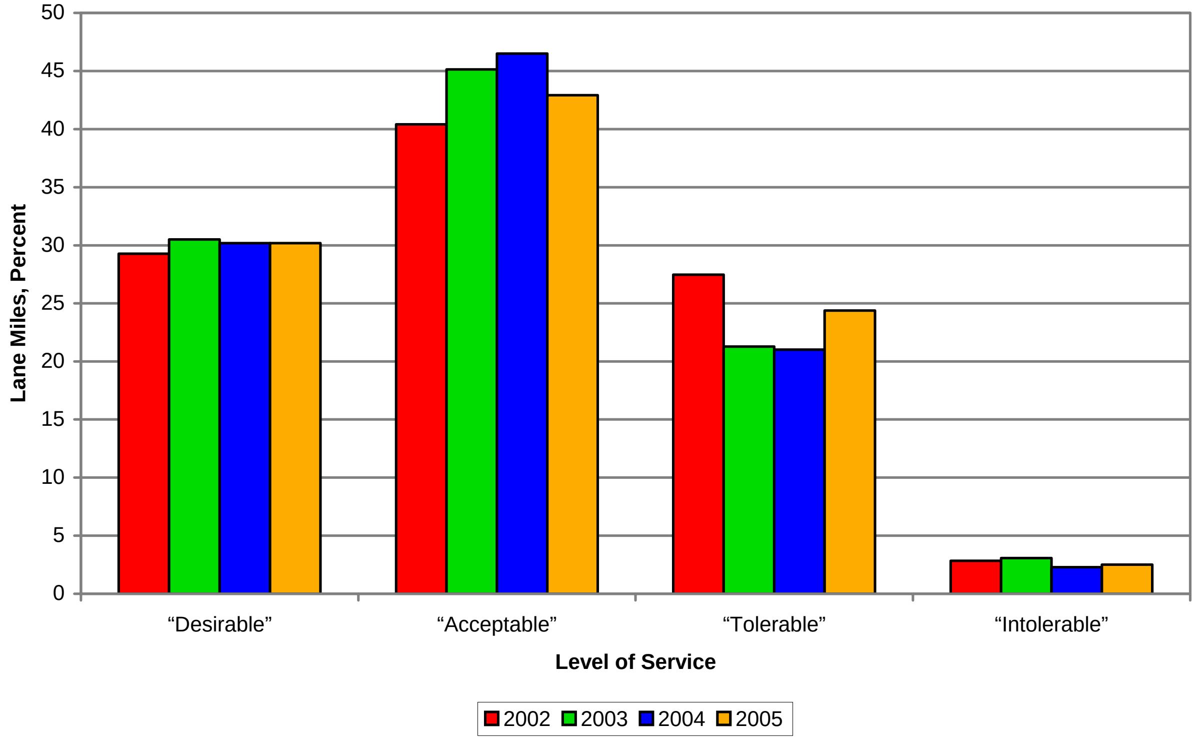


Figure 6.4 — Combined Maintenance Level of Service, FY 2002-2005.

The Combined Maintenance Level of Service shows that:

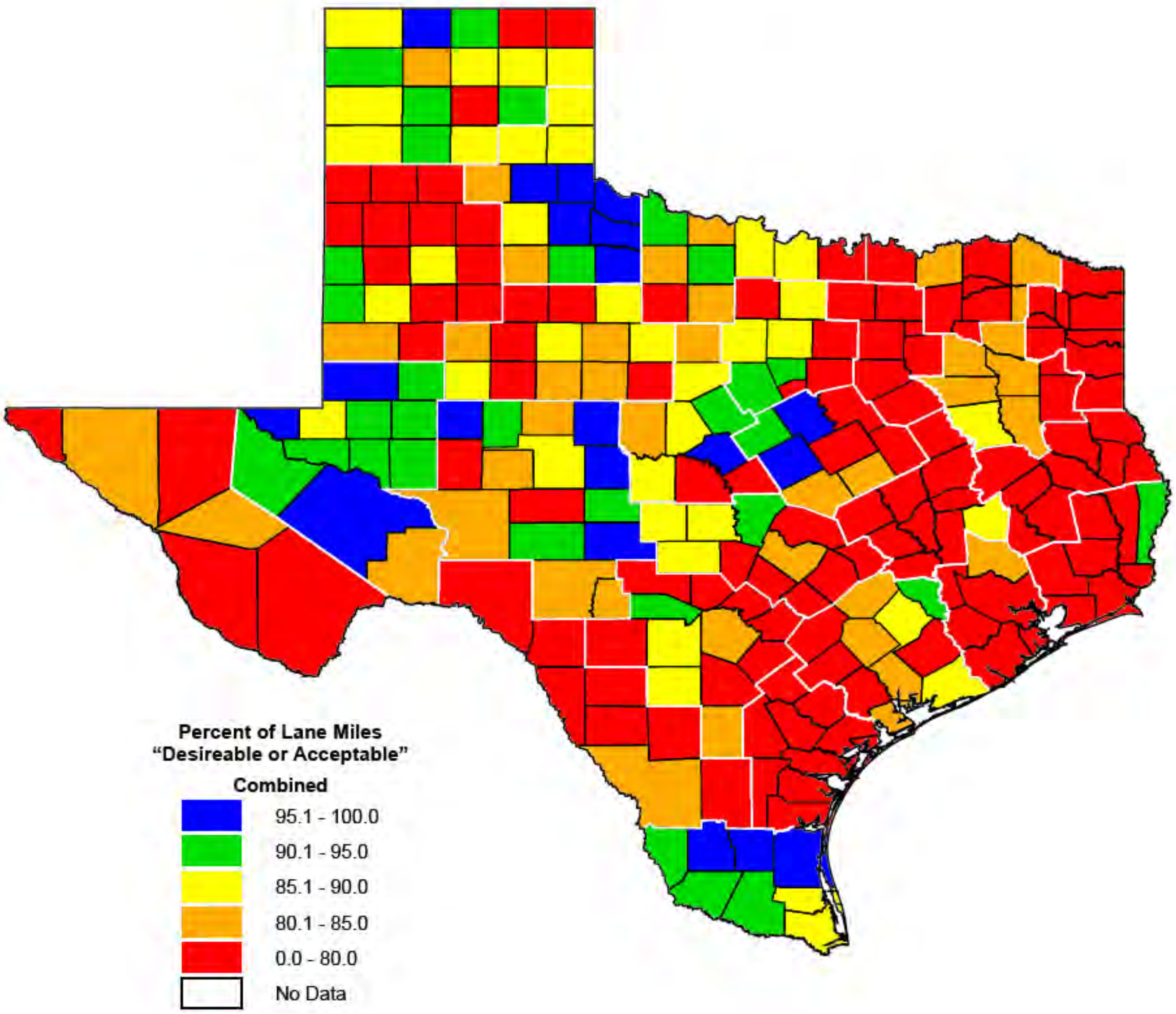
- "Desirable" mileage remained the same (30.18% in 2004 to 30.18% in 2005)
- "Acceptable" mileage decreased (from 46.50% in 2004 to 42.92% in 2005)
- "Tolerable" mileage increased (from 21.03% in 2004 to 24.39% in 2005)
- "Intolerable" mileage increased (from 2.29% in 2004 to 2.50% in 2005).

Maps 6.7 and 6.8 on the following pages show Combined level of service in each county for fiscal years 2004 and 2005. 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.

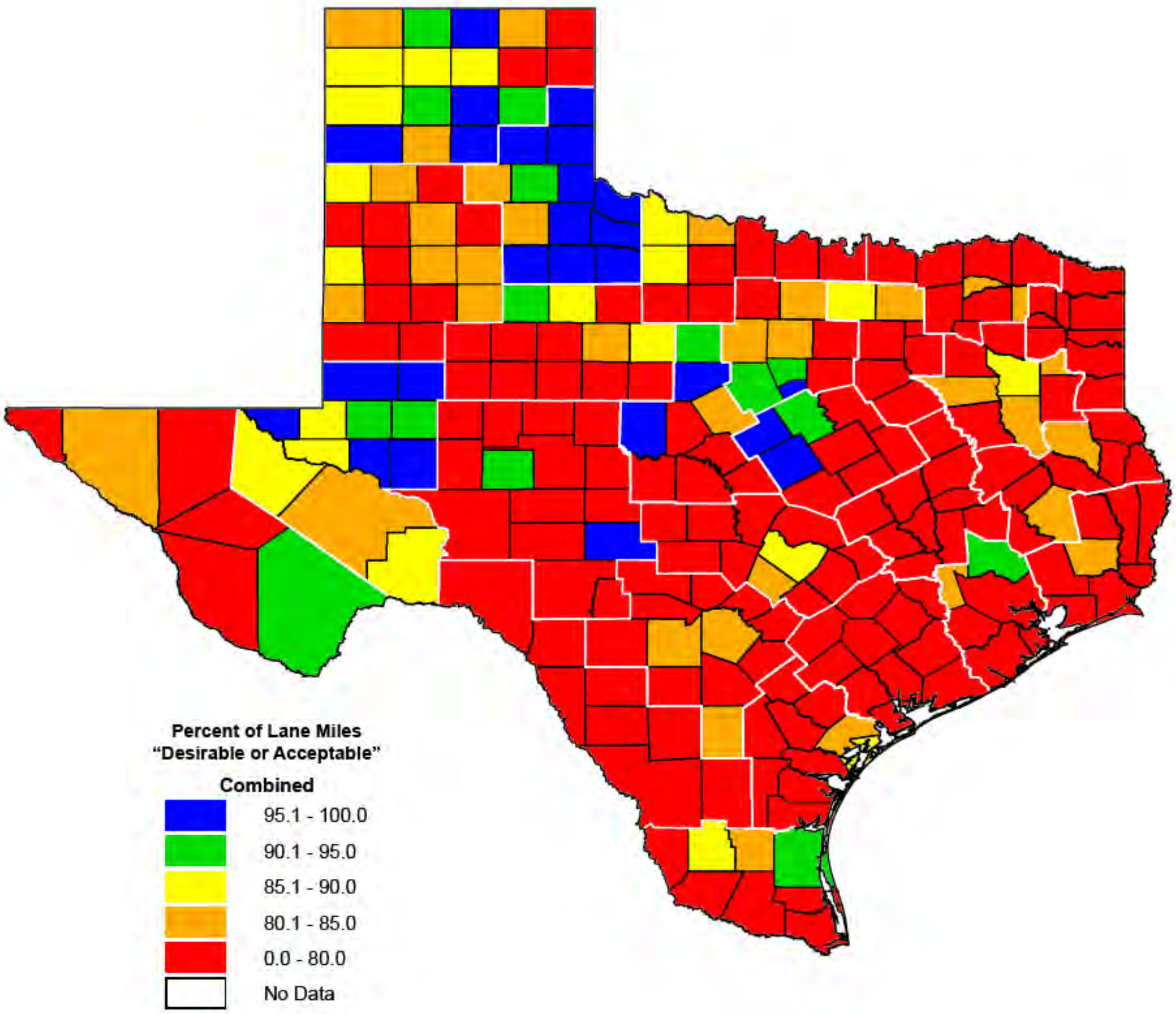
The “Combined” level of service got worse in FY 2005 because of worsening Rutting and Ride Quality. This trend is consistent with the observed worsening Rutting and Ride Quality described in Chapter 3. Although the percentage of “Desirable” mileage stayed the same in FY 2005, the percentage of “Acceptable” mileage decreased and the percentages of “Tolerable” and “Intolerable” mileage increased.

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 that the same mileage 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 2004.



Map 6.8 — Combined Maintenance Level of Service, FY 2005.



The U.S. Bureau of Public Roads shut off all federal highway aid to Texas in 1925 because of the poor state of maintenance. In 1928, the department spent $495 per mile for maintenance. Most of the money spent was for work to satisfy the U.S. Bureau of Public Roads to regain federal aid.

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 2004 and 2005.

These distributions show that the overall level of service provided by Texas flexible pavements got worse overall in all traffic categories in FY 2005.

"Low-traffic" roads got worse in FY 2005. Although there was a three-percent increase in "Desirable" mileage (the blue slices), there was an eight-percent decrease in "Acceptable" mileage (the green slices). "Tolerable" mileage (the yellow slices) increased by five percent and "Intolerable" mileage (the red slices) stayed the same.

"Low-traffic" roads accounted for 28.03 percent of the lane miles but only 1.75 percent of the vehicles miles traveled in FY 2005. Both of these percentages decreased in FY 2005.

"Medium-traffic" roads got worse in FY 2005. "Desirable" mileage decreased by one percent and "Acceptable" mileage decreased by three percent. "Tolerable" mileage increased by three percent and "Intolerable" mileage increased by one percent.

"Medium-traffic" roads accounted for 59.05 percent of the lane miles and 44.03 percent of the vehicles miles traveled in FY 2005. The percentage of statewide lane miles increased but the percentage of vehicle miles traveled decreased in FY 2005.

"High-traffic" roads got worse, but very slightly, in FY 2005. "Desirable" mileage stayed the same, but "Acceptable" mileage decreased by one percent. "Tolerable" mileage stayed the same, but "Intolerable" mileage increased by one percent.

"High-traffic" roads accounted for only 12.92 percent of the lane miles but 54.22 percent of the vehicles miles traveled in FY 2005. Both of these percentages increased in FY 2005.

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 by five- to seven-times (or more) of the original preventive maintenance treatment cost.

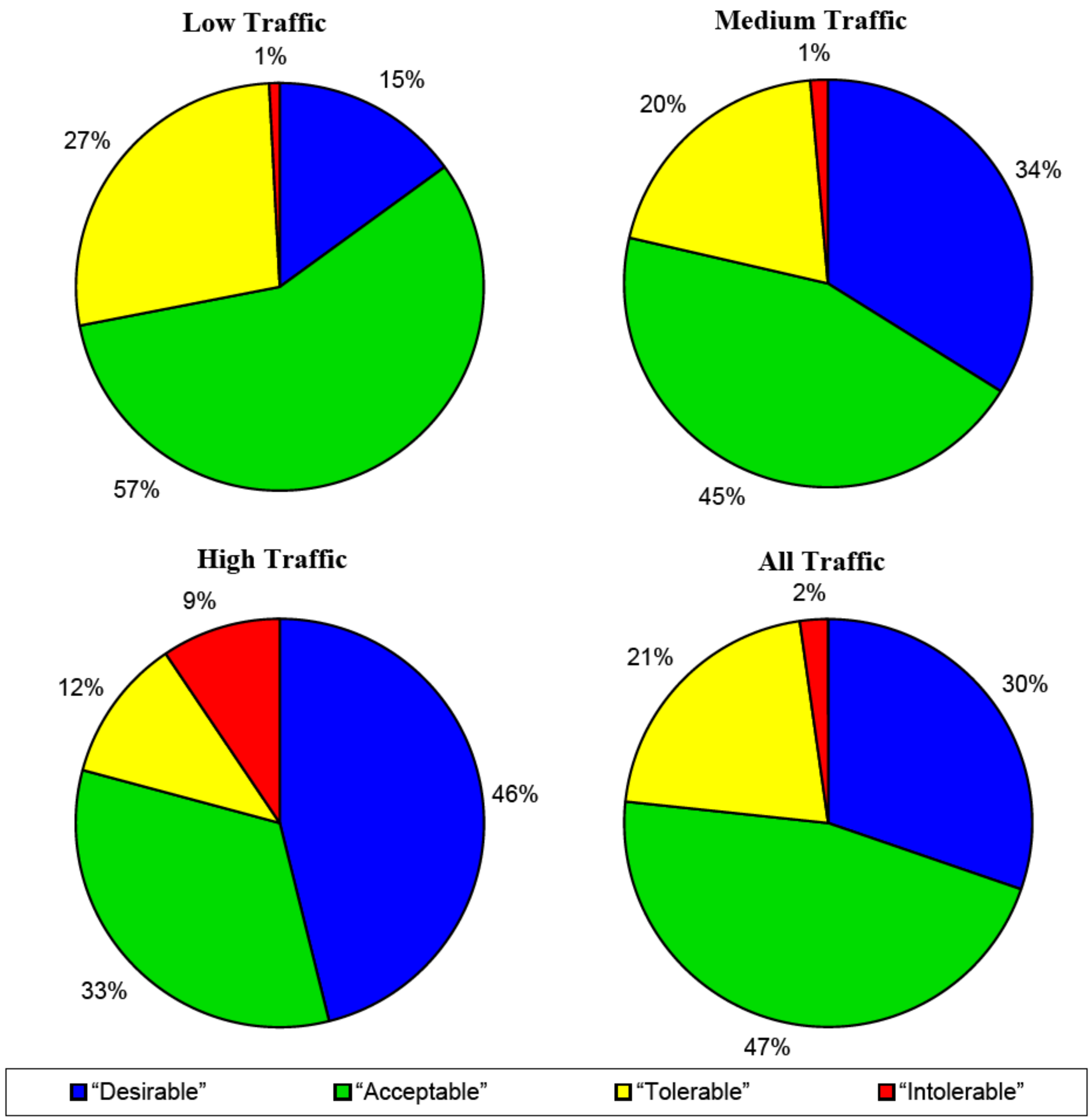


Figure 6.5 — Combined Maintenance Level of Service for FY 2004, by Traffic Category.

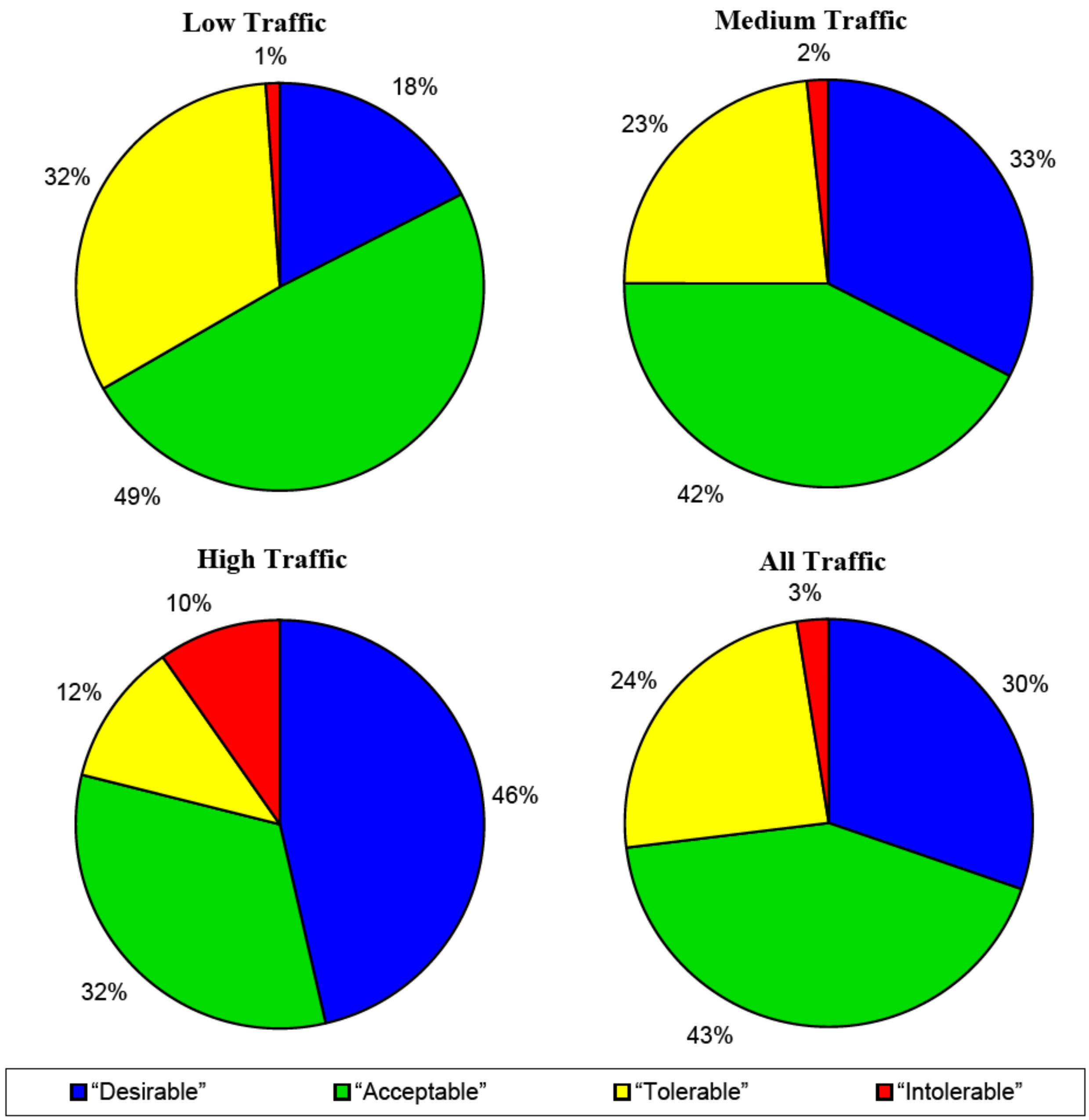


Figure 6.6 — Combined Maintenance Level of Service for FY 2005, by Traffic Category.

The Texas Highway Department assumed responsibility for maintenance on January 1, 1924. Before that, maintenance was a concern of each county. During the first year, costs reached $4.5 million. By 1930, the department's maintenance costs began to run about $1 million a month.

Discussion

The overall "Combined" level of service maintained on Texas flexible (ACP) pavements got worse in FY 2005. Although the percentage of "Desirable" mileage stayed the same, the percentage of "Acceptable" mileage decreased and the percentages of "Tolerable" and "Intolerable" mileage increased.

Rutting level of service worsened noticeably in FY 2005, mainly because of an increase in the amount of mileage providing "Tolerable" level of service.

Alligator Cracking level of service improved very slightly in FY 2005. This contradicts the observed increase in Alligator Cracking described in Chapter 3, which only describes the increase in PMIS sections with Alligator Cracking. However, an increase in the percentage of PMIS sections with Alligator Cracking would show up as an increase in the percentages of "Acceptable," "Tolerable, or "Intolerable" mileage, which is exactly what happened – those percentages went up and the percentage of "Desirable" mileage (with no Alligator Cracking) went down in FY 2005.

Ride Quality level of service got worse in FY 2005 because of a decrease in the amount of mileage providing "Desirable" level of service.

"High-traffic" level of service got worse in FY 2005 because of a one-percent increase in the amount of "Intolerable" mileage. "High-traffic" roads carried the majority of vehicle miles traveled in FY 2005 — 54.22 percent — despite being only 12.92 percent of the lane miles. This means that more than half of the public's perception of the overall quality of Texas pavements is based on the condition of these "high-traffic" roads.

"Low-traffic" and "Medium-traffic" levels of service also got worse in FY 2005 because of increases in the amount of "Tolerable" and "Intolerable" mileage.

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 2005, despite a slight improvement in the Alligator Cracking level of service, because of declines in Rutting and Ride Quality levels of service. All traffic levels — "High," "Medium," and "Low" — also provided a lower level of service in FY 2005.

The department was spending about $75 million annually on the construction, maintenance, and betterment of the FM system by 1967.

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, State and National strategic planning, legislative reporting, and for funding of pavement projects in the annual Unified Transportation Program (UTP).

Performance Measures Analyzed in This Chapter

This chapter reports the FY 2002-2005 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.

The FY 2005 PMIS results show continued improvement being made towards the statewide pavement condition goal, but the rate of improvement has slowed. In fact, if the FY 2005 rate of improvement continues, it will not be possible to meet the goal of having 90 percent of Texas pavement lane miles in "Good" or better condition by FY 2012.

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 2002 through 2005. It includes all mainlanes and frontage roads with a Condition Score of 70 or above ("Very Good" and "Good" mileage).

87.34 percent of statewide pavement lane miles were in "Good" or better condition in FY 2005. 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, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	91.49%	90.87%	90.83%	89.23%
Amarillo	84.01%	80.17%	85.67%	86.89%
Atlanta	89.56%	92.24%	93.48%	93.94%
Austin	82.42%	87.10%	88.50%	89.81%
Beaumont	76.83%	74.40%	84.24%	81.47%
Brownwood	90.98%	94.27%	95.74%	94.28%
Bryan	83.36%	86.09%	84.42%	84.50%
Childress	92.95%	90.63%	90.62%	92.17%
Corpus Christi	80.01%	81.14%	82.24%	78.15%
Dallas	63.55%	72.62%	76.14%	77.53%
El Paso	84.66%	85.03%	87.99%	83.35%
Fort Worth	86.84%	85.81%	85.41%	84.75%
Houston	75.14%	73.82%	73.51%	77.54%
Laredo	82.73%	80.42%	83.43%	83.30%
Lubbock	84.18%	86.13%	88.68%	89.82%
Lufkin	83.12%	85.99%	86.21%	87.25%
Odessa	94.96%	96.15%	95.04%	95.55%
Paris	78.57%	82.24%	86.07%	85.60%
Pharr	89.44%	90.66%	90.26%	88.43%
San Angelo	92.35%	94.10%	95.27%	95.93%
San Antonio	83.69%	84.94%	83.64%	82.98%
Tyler	85.18%	81.34%	88.75%	90.88%
Waco	88.13%	87.98%	90.14%	91.55%
Wichita Falls	87.59%	90.39%	91.05%	93.00%
Yoakum	83.51%	85.31%	87.88%	90.54%
STATEWIDE	84.22%	85.28%	87.02%	87.34%

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 7.2 shows the percentage of lane miles (mainlanes and frontage roads) rated for fiscal years 2002 through 2003.

Table 7.2 — Total Lane Miles Rated, FY 2002-2003.

District	Fiscal Year					
	2002			2003		
	Lane Miles		Percent Rated	Lane Miles		Percent Rated
	Rated	Total		Rated	Total	
Abilene	8,160.7	8,407.2	**97.07%**	8,240.9	8,423.8	**97.83%**
Amarillo	9,032.1	9,348.9	**96.61%**	8,894.8	9,363.5	**94.99%**
Atlanta	5,964.7	6,433.3	**92.72%**	6,215.3	6,587.6	**94.35%**
Austin	8,127.3	8,623.0	**94.25%**	8,150.2	8,683.8	**93.86%**
Beaumont	5,557.6	5,684.7	**97.76%**	5,363.0	5,684.2	**94.35%**
Brownwood	5,789.2	5,830.6	**99.29%**	5,672.4	5,809.0	**97.65%**
Bryan	6,562.8	6,990.4	**93.88%**	6,868.0	7,007.4	**98.01%**
Childress	5,218.4	5,395.0	**96.73%**	5,254.6	5,392.8	**97.44%**
Corpus Christi	6,543.9	6,931.8	**94.40%**	6,923.1	7,011.5	**98.74%**
Dallas	9,012.0	10,056.4	**89.61%**	8,810.0	10,256.3	**85.90%**
El Paso	4,472.1	4,727.5	**94.60%**	4,515.2	4,733.4	**95.39%**
Fort Worth	7,872.3	8,577.0	**91.78%**	8,008.6	8,610.7	**93.01%**
Houston	9,118.4	9,799.9	**93.05%**	9,163.3	9,867.5	**92.86%**
Laredo	4,874.2	5,004.3	**97.40%**	4,840.1	4,988.5	**97.03%**
Lubbock	11,149.1	12,083.5	**92.27%**	11,569.5	11,970.5	**96.65%**
Lufkin	6,179.5	6,385.5	**96.77%**	6,166.8	6,386.0	**96.57%**
Odessa	7,872.5	8,159.5	**96.48%**	7,815.3	8,054.9	**97.03%**
Paris	6,719.3	7,158.5	**93.86%**	6,691.9	7,158.9	**93.48%**
Pharr	5,354.8	5,652.7	**94.73%**	5,283.9	5,693.5	**92.81%**
San Angelo	6,629.9	7,177.1	**92.38%**	6,575.7	7,190.1	**91.45%**
San Antonio	10,144.1	10,457.9	**97.00%**	10,287.7	10,465.0	**98.31%**
Tyler	8,492.9	8,693.1	**97.70%**	8,385.4	8,700.7	**96.38%**
Waco	7,482.1	7,769.7	**96.30%**	7,063.4	7,672.1	**92.07%**
Wichita Falls	6,160.5	6,355.3	**96.93%**	6,202.4	6,368.5	**97.39%**
Yoakum	7,498.3	7,939.7	**94.44%**	7,541.6	7,930.7	**95.09%**
STATEWIDE	**179,988.7**	**189,642.5**	**94.91%**	**180,503.1**	**190,010.9**	**95.00%**

Table 7.3 shows the percentage of lane miles (mainlanes and frontage roads) rated for fiscal years 2004 through 2005.

Table 7.3 — Total Lane Miles Rated, FY 2004-2005.

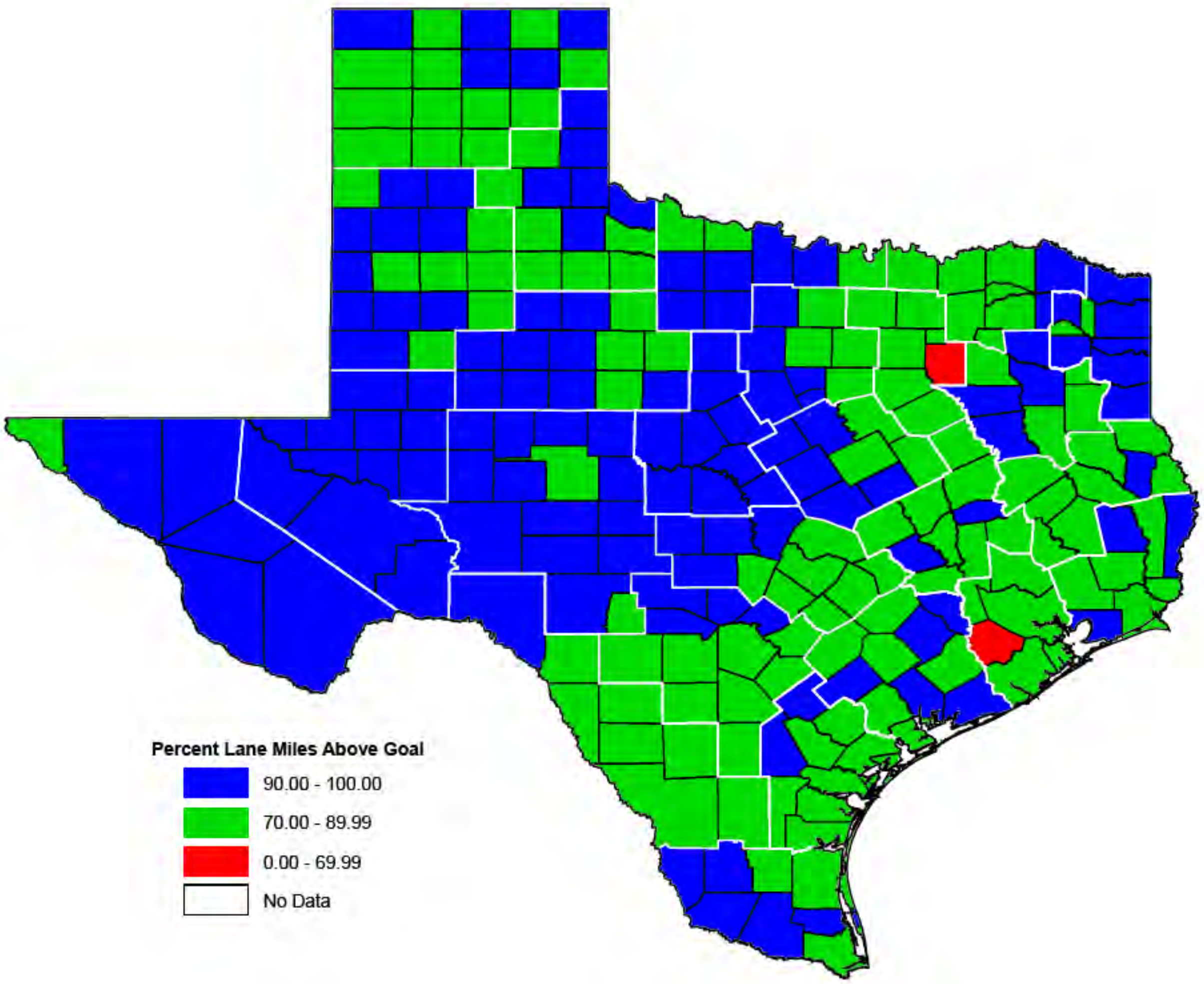
District	Fiscal Year					
	2004			2005		
	Lane Miles		Percent Rated	Lane Miles		Percent Rated
	Rated	Total		Rated	Total	
Abilene	8,309.6	8,428.8	**98.59%**	8,405.2	8,435.0	**99.65%**
Amarillo	9,131.1	9,370.7	**97.44%**	8,886.8	9,369.7	**94.85%**
Atlanta	6,088.8	6,451.7	**94.38%**	6,244.0	6,453.1	**96.76%**
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%**	4,524.7	4,751.8	**95.22%**
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%**	**183,590.6**	**191,415.3**	**95.91%**

Statewide Pavement Condition Goal Maps, FY 2004-2005

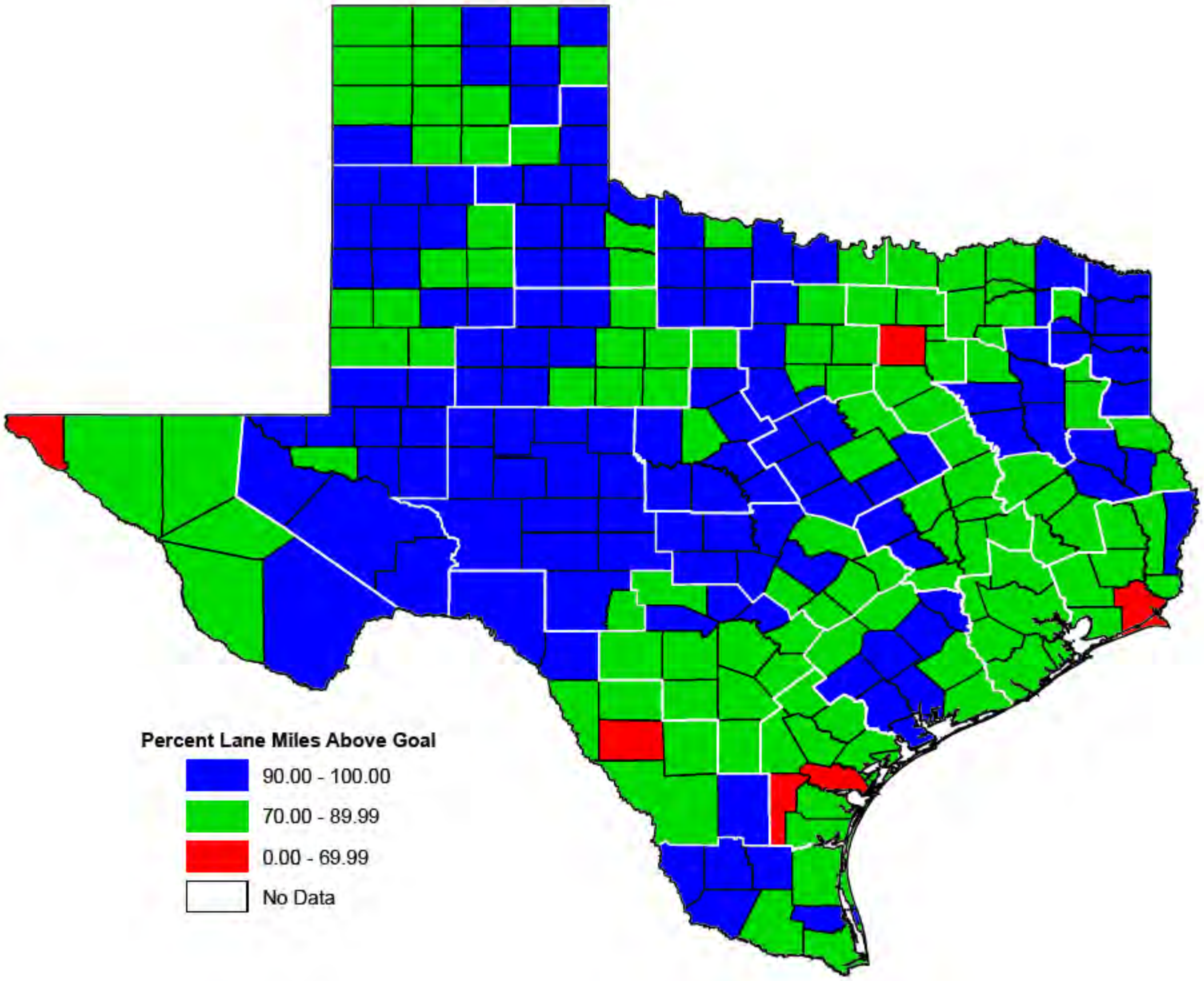
Maps 7.1 and 7.2 show the percentage of lane miles that meet the statewide pavement condition goal, for FY 2004 and FY 2005, by county. The percentages are weighted by lane miles, and include all mainlanes and frontage roads. Counties in blue already meet the statewide pavement condition goal (90 percent or more "Good" or better), while counties in red are well below the goal (less than 70 percent "Good" or better).

The maps show continued progress towards meeting the statewide pavement condition goal. The number of "red" counties went up from two in FY 2004 to six in FY 2005, but that was offset by improvements in other counties. The challenge for the remaining years will be to preserve mileage above the goal while continuing to improve mileage that is still below the goal. This effort will require careful mixture of preventive maintenance and rehabilitation treatments, as well as longer-lasting treatments for pavements subject to heavy traffic or adverse climate.

Map 7.1 — Percentage of Lane Miles Above Pavement Condition Goal, FY 2004.



Map 7.2 — Percentage of Lane Miles Above Pavement Condition Goal, FY 2005.



Statewide Substandard Utility Values, FY 2002-2003.

Table 7.4 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).

The top five pavement problem items at the start of the goal in FY 2002 were: ACP Ride Quality, ACP Failures, ACP Patching, ACP Alligator Cracking, and JCP Ride Quality. Rigid pavement distress types and ride quality made up the next five problem items.

Table 7.4 — Statewide Substandard Utility Values, FY 2002-2003.

Priority	Fiscal Year					
	2002			2003		
	Utility Id	Overall Utility Average	Substandard Utility (<0.7) Lane Miles	Utility Id	Overall Utility Average	Substandard Utility (<0.7) Lane Miles
1	ACP Ride	83.60	6,188.4	ACP Ride	83.94	5,746.4
2	ACP Failures	88.28	5,686.6	ACP Patching	86.88	5,498.6
3	ACP Patching	87.88	5,354.1	ACP Alligator Cracking	88.30	4,721.0
4	ACP Alligator Cracking	89.81	4,317.3	JCP Ride	62.85	966.6
5	JCP Ride	62.96	1,058.5	ACP Failures	91.69	3,806.3
6	CRCP Portland Concrete Patching	74.46	779.5	CRCP Portland Concrete Patching	74.81	743.5
7	CRCP Ride	77.66	659.0	CRCP Ride	75.11	712.5
8	JCP Portland Concrete Patching	81.75	474.6	JCP Portland Concrete Patching	80.18	450.2
9	JCP Failures	81.80	368.2	JCP Failures	81.90	349.6
10	CRCP Punchouts	86.66	318.1	CRCP Punchouts	86.75	315.7
11	CRCP Spalled Cracks	90.46	252.5	ACP Longitudinal Cracking	96.84	575.2
12	ACP Longitudinal Cracking	96.93	606.3	CRCP Spalled Cracks	92.16	174.9
13	JCP Failed Joints & Cracks	92.73	124.2	ACP Block Cracking	98.89	395.1
14	ACP Block Cracking	98.55	560.3	JCP Failed Joints & Cracks	94.06	72.5
15	CRCP Asphalt Concrete Patching	96.21	90.0	CRCP Asphalt Concrete Patching	96.76	75.7
16	ACP Transverse Cracking	98.56	109.5	ACP Deep Rutting	98.97	186.6
17	ACP Deep Rutting	99.41	49.2	ACP Transverse Cracking	98.60	52.0
18	JCP Longitudinal Cracks	99.25	0.6	JCP Longitudinal Cracks	99.47	1.4
19	JCP Shattered Slabs	99.86	1.6	JCP Shattered Slabs	99.94	1.4
20	ACP Shallow Rutting	99.16	0.0	ACP Shallow Rutting	98.62	0.0

Table 7.5 shows lane miles above the pavement condition goal, by pavement type, in FY 2002 and FY 2003. None of the pavement types were above the goal in FY 2002 or FY 2003.

Table 7.5 — Lane Miles Above Condition Goal, by Pavement Type, FY 2002-2003.

Pavement Type	Fiscal Year					
	2002			2003		
	Lane Miles		Percent Above Goal	Lane Miles		Percent Above Goal
	Above Goal	Rated		Above Goal	Rated	
Flexible or Asphalt Concrete Pavements (ACP)	143,103.2	168,015.3	85.17%	145,085.0	168,442.1	86.13%
Continuously Reinforced Concrete Pavement (CRCP)	6,403.6	8,212.7	77.97%	6,679.9	8,389.5	79.62%
Jointed Concrete Pavement (JCP)	2,081.0	3,760.7	55.34%	2,160.6	3,671.5	58.85%
STATEWIDE	151,587.8	179,988.7	84.22%	153,925.5	180,503.1	85.28%

Statewide Substandard Utility Values, FY 2004-2005.

Table 7.6 shows the statewide "substandard utility values" for FY 2004-2005. The distress type lists for all four years were very similar. The top five "problem" distress types – ACP Ride Quality, ACP Patching, JCP Ride Quality, ACP Alligator Cracking, and ACP Failures – changed order occasionally but stayed in the top five. Distress types 6-10 – CRCP Ride Quality, CRCP Portland Concrete Patching, JCP Portland Concrete Patching, JCP Failures, and CRCP Punchouts – only changed in FY 2005 when CRCP Portland Concrete Patching and CRCP Ride Quality swapped places.

Table 7.6 — 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 7.7 shows lane miles above the pavement condition goal, by pavement type, in FY 2004 and FY 2005. ACP and CRCP improved during each of the last three years, but JCP got worse in FY 2004 and FY 2005.

Table 7.7 — 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%	7,779.3	9,400.3	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%	160,341.4	183,590.6	87.34%

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

Table 7.8 shows the number of lane miles considered to be in need of rehabilitation, based on the PMIS Distress Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score of 59 or below.

Table 7.8 — Lane Miles With Distress Score 1-59, FY 2002-2005.

District	Fiscal Year				2003-2005
	2002	2003	2004	2005	Average
Abilene	233.5	215.4	246.3	261.2	241.0
Amarillo	602.3	942.9	558.2	456.1	652.4
Atlanta	138.2	124.7	115.3	59.1	99.7
Austin	636.5	369.8	258.5	241.1	289.8
Beaumont	588.2	628.0	267.7	383.9	426.5
Brownwood	127.2	74.4	40.2	86.2	66.9
Bryan	424.0	275.4	394.4	300.1	323.3
Childress	89.0	116.0	178.4	158.4	150.9
Corpus Christi	593.4	519.6	574.6	690.8	595.0
Dallas	1,737.0	1,225.9	1,012.2	883.1	1,040.4
El Paso	199.1	156.8	194.6	191.9	181.1
Fort Worth	378.3	365.1	365.6	500.9	410.5
Houston	1,266.9	1,283.9	1,417.2	1,007.6	1,236.2
Laredo	346.1	448.9	412.0	367.4	409.4
Lubbock	893.4	928.9	763.8	667.5	786.7
Lufkin	347.8	248.3	196.0	114.0	186.1
Odessa	126.0	112.4	133.1	143.4	129.6
Paris	455.7	411.8	300.4	231.4	314.5
Pharr	186.2	168.4	107.8	198.9	158.4
San Angelo	203.6	152.8	118.1	76.6	115.8
San Antonio	601.7	552.4	744.4	762.1	686.3
Tyler	352.8	540.8	386.8	232.8	386.8
Waco	345.1	393.8	251.9	226.6	290.8
Wichita Falls	267.1	188.7	214.9	152.2	185.3
Yoakum	375.4	320.0	219.0	201.8	246.9
STATEWIDE	**11,514.5**	**10,765.1**	**9,471.4**	**8,595.1**	**9,610.5**

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

Table 7.9 shows the percent of lane miles considered to be in need of rehabilitation, based on the PMIS Distress Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score of 59 or below.

Table 7.9 — Percent of Lane Miles With Distress Score 1-59, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	2.86%	2.61%	2.96%	3.11%
Amarillo	6.66%	10.52%	6.10%	5.08%
Atlanta	2.31%	2.00%	1.89%	0.95%
Austin	7.82%	4.53%	3.09%	2.91%
Beaumont	10.55%	11.67%	4.93%	6.89%
Brownwood	2.20%	1.31%	0.70%	1.49%
Bryan	6.45%	4.01%	5.84%	4.45%
Childress	1.70%	2.21%	3.34%	2.94%
Corpus Christi	9.06%	7.49%	8.38%	10.43%
Dallas	19.03%	13.69%	10.96%	9.01%
El Paso	4.44%	3.47%	4.27%	4.23%
Fort Worth	4.72%	4.51%	4.35%	5.94%
Houston	13.81%	13.81%	14.58%	10.66%
Laredo	7.08%	9.25%	8.36%	7.48%
Lubbock	8.01%	8.02%	6.54%	5.66%
Lufkin	5.63%	4.02%	3.17%	1.82%
Odessa	1.60%	1.43%	1.66%	1.78%
Paris	6.77%	6.14%	4.57%	3.38%
Pharr	3.47%	3.18%	2.02%	3.72%
San Angelo	3.06%	2.32%	1.75%	1.17%
San Antonio	5.92%	5.37%	7.12%	7.30%
Tyler	4.15%	6.44%	4.57%	2.76%
Waco	4.60%	5.54%	3.40%	3.08%
Wichita Falls	4.32%	3.04%	3.46%	2.47%
Yoakum	5.00%	4.24%	2.85%	2.68%
STATEWIDE	**6.38%**	**5.94%**	**5.16%**	**4.67%**

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

Table 7.10 shows the number of lane miles considered to be in need of rehabilitation, based on the PMIS Ride Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Ride Score of 1.9 or below.

Table 7.10— Lane Miles With Ride Score 0.1-1.9, FY 2002-2005.

District	Fiscal Year				2003-2005
	2002	2003	2004	2005	Average
Abilene	238.4	240.2	168.9	242.1	217.1
Amarillo	226.5	200.6	119.8	149.2	156.5
Atlanta	52.6	49.8	25.8	24.2	33.3
Austin	31.3	31.5	22.0	13.7	22.4
Beaumont	110.6	145.4	72.8	117.0	111.7
Brownwood	75.8	39.4	19.0	26.2	28.2
Bryan	239.4	232.4	171.8	243.2	215.8
Childress	34.2	31.2	25.8	25.6	27.5
Corpus Christi	292.6	317.3	213.0	323.6	284.6
Dallas	540.0	364.8	263.0	301.5	309.8
El Paso	310.6	380.3	231.2	347.9	319.8
Fort Worth	96.9	143.0	165.3	116.8	141.7
Houston	111.4	134.3	113.6	136.2	128.0
Laredo	436.5	386.3	248.9	259.5	298.2
Lubbock	77.2	68.3	45.2	89.6	67.7
Lufkin	277.5	173.1	201.0	216.6	196.9
Odessa	96.2	76.6	88.6	63.4	76.2
Paris	394.4	301.8	122.2	154.2	192.7
Pharr	79.2	45.8	28.0	35.8	36.5
San Angelo	71.2	65.8	50.4	59.0	58.4
San Antonio	323.6	322.5	245.1	294.5	287.4
Tyler	133.8	110.2	29.2	53.6	64.3
Waco	133.8	120.6	117.3	66.4	101.4
Wichita Falls	47.6	64.5	53.8	60.2	59.5
Yoakum	225.6	230.8	118.0	168.4	172.4
STATEWIDE	4,656.9	4,276.5	2,959.7	3,588.4	3,608.2

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

Table 7.11 shows the percent of lane miles considered to be in need of rehabilitation, based on the PMIS Ride Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Ride Score of 1.9 or below.

Table 7.11— Percent of Lane Miles With Ride Score 0.1-1.9, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	2.89%	2.89%	2.03%	2.88%
Amarillo	2.50%	2.25%	1.30%	1.66%
Atlanta	0.85%	0.78%	0.41%	0.38%
Austin	0.38%	0.38%	0.26%	0.16%
Beaumont	1.97%	2.64%	1.33%	2.07%
Brownwood	1.31%	0.69%	0.33%	0.45%
Bryan	3.50%	3.34%	2.47%	3.49%
Childress	0.65%	0.59%	0.48%	0.47%
Corpus Christi	4.24%	4.53%	3.04%	4.76%
Dallas	5.61%	3.85%	2.78%	2.97%
El Paso	6.91%	8.40%	5.02%	7.50%
Fort Worth	1.20%	1.74%	1.97%	1.38%
Houston	1.15%	1.39%	1.15%	1.36%
Laredo	8.77%	7.83%	5.04%	5.23%
Lubbock	0.67%	0.58%	0.38%	0.74%
Lufkin	4.38%	2.76%	3.19%	3.40%
Odessa	1.21%	0.96%	1.10%	0.78%
Paris	5.62%	4.35%	1.81%	2.21%
Pharr	1.47%	0.86%	0.52%	0.65%
San Angelo	1.06%	0.97%	0.73%	0.87%
San Antonio	3.15%	3.10%	2.34%	2.80%
Tyler	1.57%	1.29%	0.34%	0.63%
Waco	1.75%	1.69%	1.56%	0.89%
Wichita Falls	0.76%	1.02%	0.85%	0.95%
Yoakum	2.96%	3.02%	1.54%	2.20%
STATEWIDE	**2.53%**	**2.32%**	**1.59%**	**1.91%**

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

Table 7.12 shows the number of lane miles considered to be in need of preventive maintenance, based on the PMIS Distress Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score between 70 and 89, inclusive.

Table 7.12— Lane Miles With Distress Score 70-89, FY 2002-2005.

District	Fiscal Year				2003-2005
	2002	2003	2004	2005	Average
Abilene	605.7	589.5	532.7	546.2	556.1
Amarillo	1,436.2	1,608.7	1,373.0	1,228.8	1,403.5
Atlanta	961.7	682.4	716.2	514.6	637.7
Austin	1,284.9	1,144.1	1,157.5	1,184.4	1,162.0
Beaumont	697.9	827.8	594.6	559.2	660.5
Brownwood	865.2	687.8	634.2	723.2	681.7
Bryan	593.9	732.9	651.3	599.4	661.2
Childress	597.4	900.2	598.0	563.5	687.2
Corpus Christi	823.3	999.9	1,063.1	835.9	966.3
Dallas	1,180.5	1,206.1	1,000.0	883.5	1,029.9
El Paso	1,213.0	483.5	479.7	508.2	490.5
Fort Worth	1,013.7	875.0	837.6	883.7	865.4
Houston	1,359.2	1,406.6	1,215.6	1,199.3	1,273.8
Laredo	470.8	571.1	541.3	594.6	569.0
Lubbock	1,447.2	1,034.0	879.9	761.3	891.7
Lufkin	670.7	746.7	820.0	731.6	766.1
Odessa	464.2	383.4	462.6	357.6	401.2
Paris	878.4	910.9	809.6	894.6	871.7
Pharr	471.4	599.9	514.6	677.9	597.5
San Angelo	611.8	648.0	533.2	496.2	559.1
San Antonio	1,258.2	1,302.0	1,086.6	1,448.0	1,278.9
Tyler	1,793.0	2,029.8	2,041.3	1,656.6	1,909.2
Waco	769.6	801.0	786.1	838.6	808.6
Wichita Falls	768.8	685.4	689.2	618.9	664.5
Yoakum	1,354.4	1,075.8	1,148.0	1,033.6	1,085.8
STATEWIDE	23,591.1	22,932.5	21,165.9	20,339.4	21,479.3

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

Table 7.13 shows the percent of lane miles considered to be in need of preventive maintenance, based on the PMIS Distress Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score between 70 and 89, inclusive.

Table 7.13— Percent of Lane Miles With Distress Score 70-89, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	7.87%	7.63%	6.88%	7.06%
Amarillo	18.33%	21.74%	17.23%	15.35%
Atlanta	17.20%	11.49%	12.35%	8.59%
Austin	18.75%	15.69%	15.28%	15.61%
Beaumont	14.93%	18.81%	12.05%	11.32%
Brownwood	16.11%	12.75%	11.38%	13.16%
Bryan	10.23%	11.64%	10.85%	9.77%
Childress	12.20%	18.72%	12.29%	11.28%
Corpus Christi	14.84%	16.64%	18.00%	15.10%
Dallas	17.27%	16.48%	12.70%	10.33%
El Paso	29.10%	11.38%	11.37%	12.12%
Fort Worth	13.71%	11.72%	10.77%	11.59%
Houston	18.53%	18.88%	15.69%	14.98%
Laredo	10.88%	13.76%	12.59%	13.79%
Lubbock	15.16%	10.25%	8.42%	7.10%
Lufkin	12.30%	13.45%	14.52%	12.54%
Odessa	6.11%	5.03%	6.00%	4.59%
Paris	15.23%	15.45%	13.81%	14.51%
Pharr	9.41%	12.14%	10.43%	13.84%
San Angelo	9.85%	10.32%	8.19%	7.84%
San Antonio	13.89%	14.09%	11.89%	15.81%
Tyler	23.02%	27.47%	26.50%	20.79%
Waco	11.30%	12.50%	11.37%	12.21%
Wichita Falls	13.95%	11.94%	11.92%	10.57%
Yoakum	20.53%	16.03%	16.53%	14.70%
STATEWIDE	**13.07%**	**12.66%**	**11.52%**	**11.06%**

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

Table 7.14 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 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score between 60 and 69, inclusive.

Table 7.14— Lane Miles With Distress Score 60-69, FY 2002-2005.

District	Fiscal Year				2003-2005
	2002	2003	2004	2005	Average
Abilene	245.1	310.0	332.7	405.0	349.2
Amarillo	611.1	622.4	619.2	513.6	585.1
Atlanta	246.4	157.1	184.4	199.2	180.2
Austin	652.8	499.1	525.3	449.6	491.3
Beaumont	312.2	352.7	227.7	244.8	275.1
Brownwood	294.0	203.2	164.2	189.0	185.5
Bryan	341.4	300.2	360.4	313.2	324.6
Childress	234.2	334.0	289.6	231.2	284.9
Corpus Christi	405.8	403.9	377.7	396.8	392.8
Dallas	556.5	411.7	346.6	357.1	371.8
El Paso	113.0	118.2	142.2	147.9	136.1
Fort Worth	238.1	254.3	267.2	312.1	277.9
Houston	570.1	561.9	552.2	435.1	516.4
Laredo	210.9	253.8	218.4	236.5	236.2
Lubbock	715.3	562.8	472.7	398.5	478.0
Lufkin	383.1	369.2	342.3	327.6	346.4
Odessa	165.2	101.2	164.1	135.2	133.5
Paris	510.3	401.7	406.6	449.4	419.2
Pharr	170.4	180.0	289.2	252.6	240.6
San Angelo	233.4	160.4	127.6	128.4	138.8
San Antonio	502.0	502.5	570.8	523.3	532.2
Tyler	370.0	464.6	375.0	243.0	360.9
Waco	352.1	301.7	235.9	255.8	264.5
Wichita Falls	399.8	285.0	221.5	162.8	223.1
Yoakum	533.2	511.6	506.8	288.8	435.7
STATEWIDE	9,366.4	8,623.2	8,320.3	7,596.5	8,180.0

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 7.15 shows the percent of lane miles considered to be in need of preventive maintenance or rehabilitation, based on the PMIS Distress Score, for fiscal years 2002 through 2005. It includes all mainlanes and frontage roads with a Distress Score between 60 and 69, inclusive.

Table 7.15— Percent of Lane Miles With Distress Score 60-69, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	3.09%	3.86%	4.12%	4.97%
Amarillo	7.23%	7.76%	7.21%	6.03%
Atlanta	4.22%	2.58%	3.08%	3.22%
Austin	8.70%	6.41%	6.49%	5.60%
Beaumont	6.26%	7.42%	4.41%	4.72%
Brownwood	5.19%	3.63%	2.86%	3.32%
Bryan	5.55%	4.55%	5.67%	4.86%
Childress	4.56%	6.50%	5.62%	4.42%
Corpus Christi	6.81%	6.30%	6.01%	6.69%
Dallas	7.53%	5.32%	4.22%	4.01%
El Paso	2.64%	2.71%	3.26%	3.41%
Fort Worth	3.12%	3.29%	3.32%	3.93%
Houston	7.21%	7.01%	6.65%	5.15%
Laredo	4.65%	5.76%	4.84%	5.20%
Lubbock	6.97%	5.29%	4.33%	3.58%
Lufkin	6.57%	6.23%	5.71%	5.32%
Odessa	2.13%	1.31%	2.08%	1.70%
Paris	8.13%	6.38%	6.49%	6.79%
Pharr	3.29%	3.51%	5.54%	4.90%
San Angelo	3.62%	2.49%	1.92%	1.99%
San Antonio	5.25%	5.16%	5.88%	5.40%
Tyler	4.54%	5.92%	4.64%	2.96%
Waco	4.92%	4.50%	3.30%	3.59%
Wichita Falls	6.76%	4.73%	3.69%	2.70%
Yoakum	7.48%	7.08%	6.80%	3.95%
STATEWIDE	**5.19%**	**4.76%**	**4.53%**	**4.13%**

Pavement Condition Performance Measure — Texas Legislature

Table 7.16 shows the percentage of lane miles (mainlanes only) in "Good" or better condition, based on the PMIS Condition Score, for fiscal years 2002 through 2005. It includes all mainlane miles with Condition Score of 70 or above (classes "A" and "B").

87.92 percent of the lane miles were in "Good" or better condition in FY 2005.

Table 7.16— Percentage of Lane Miles in "Good" or Better Condition, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	91.80%	90.78%	91.57%	90.24%
Amarillo	83.96%	79.71%	85.34%	86.94%
Atlanta	90.09%	92.39%	93.75%	94.21%
Austin	82.39%	87.23%	88.56%	89.83%
Beaumont	77.39%	75.06%	85.12%	82.64%
Brownwood	90.94%	94.28%	95.67%	94.17%
Bryan	84.25%	86.49%	84.69%	84.71%
Childress	93.32%	90.72%	90.94%	92.68%
Corpus Christi	80.41%	81.06%	82.22%	78.14%
Dallas	64.79%	73.64%	78.36%	79.86%
El Paso	85.01%	85.07%	88.47%	83.91%
Fort Worth	86.47%	85.76%	86.10%	85.10%
Houston	76.13%	75.10%	74.83%	79.09%
Laredo	83.32%	80.42%	83.70%	83.61%
Lubbock	84.15%	86.07%	88.49%	89.50%
Lufkin	83.12%	85.99%	86.21%	87.22%
Odessa	94.70%	95.90%	94.67%	95.51%
Paris	78.09%	81.85%	86.10%	85.67%
Pharr	90.22%	90.92%	90.56%	88.66%
San Angelo	92.35%	94.10%	95.19%	95.93%
San Antonio	84.35%	85.62%	84.35%	83.76%
Tyler	85.32%	81.49%	89.01%	91.15%
Waco	88.61%	88.08%	90.98%	92.27%
Wichita Falls	88.12%	91.20%	92.05%	94.20%
Yoakum	83.56%	85.37%	87.93%	90.80%
STATEWIDE	**84.63%**	**85.56%**	**87.53%**	**87.92%**

This measure used to be reported to the Texas Legislature for documenting TxDOT's performance. This measure is **not** the same as the Texas Transportation Commission's statewide pavement condition goal, which includes all mainlanes and frontage roads.

FHWA Strategic Goal for NHS Ride Quality

The Federal Highway Administration (FHWA) recently established a strategic goal for ride quality on the National Highway System (NHS). The goal is to have 93.5 percent of NHS mainlane miles with IRI less than 170 inches per mile (which is the same as a PMIS Ride Score greater than 2.5) nationwide.

Table 7.17 shows the percentage of lane miles (mainlanes only) that meet the FHWA strategic goal for NHS ride quality, for fiscal years 2002 through 2005. It includes all mainlane NHS miles with IRI less than 170 inches per mile.

95.68 percent of the mainlane NHS lane miles had IRI less than 170 inches per mile in FY 2005.

Table 7.17— Percent of NHS Lane Miles With IRI Less Than 170, FY 2002-2005.

District	Fiscal Year			
	2002	2003	2004	2005
Abilene	99.00%	98.94%	99.50%	98.29%
Amarillo	97.28%	97.53%	98.68%	97.71%
Atlanta	97.32%	97.66%	98.53%	98.32%
Austin	98.81%	98.30%	98.91%	98.87%
Beaumont	82.34%	84.68%	87.29%	85.61%
Brownwood	99.35%	98.84%	98.72%	98.26%
Bryan	98.29%	99.47%	99.04%	98.82%
Childress	97.87%	98.62%	98.61%	99.18%
Corpus Christi	97.10%	97.52%	97.40%	97.15%
Dallas	85.05%	91.27%	91.27%	90.55%
El Paso	93.72%	93.07%	95.73%	90.61%
Fort Worth	91.76%	92.31%	92.65%	94.17%
Houston	93.19%	90.34%	92.40%	91.16%
Laredo	97.24%	97.48%	97.24%	96.11%
Lubbock	98.49%	98.07%	99.08%	98.11%
Lufkin	99.05%	99.13%	98.85%	98.86%
Odessa	98.89%	98.98%	98.96%	99.01%
Paris	95.04%	97.12%	97.36%	96.87%
Pharr	95.22%	97.04%	97.17%	97.20%
San Angelo	99.36%	99.60%	99.40%	99.55%
San Antonio	94.98%	96.13%	96.67%	96.18%
Tyler	98.29%	97.09%	99.33%	98.61%
Waco	96.74%	95.82%	95.26%	96.51%
Wichita Falls	96.51%	95.54%	96.61%	97.16%
Yoakum	97.65%	98.58%	99.39%	99.81%
STATEWIDE	95.12%	95.56%	96.28%	95.68%

The first Farm-to-Market road was built between Mt. Enterprise and Shiloh in Rusk County, a distance of 5.8 miles. The project began in April 1936 and was completed in January 1937 at a total cost of $48,015.12 or $8,278.47 per mile.

Discussion

PMIS-related performance measures showed the continued overall improvement in statewide pavement condition in FY 2005.

In the third year of the Texas Transportation Commission's statewide pavement condition goal, the percentage of lane miles (mainlanes and frontage roads) in "Good" or better condition was 87.34 percent in FY 2005, up from 87.02 percent in FY 2004, 85.28 percent in FY 2003, and 84.22 percent in FY 2002. The rate of improvement slowed in FY 2005. If this rate continues, it will not be possible to meet the FY 2012 goal of 90 percent "Good" or better. The top five problem items for pavements still below the goal in FY 2005 were: ACP Ride Quality, ACP Patching, JCP Ride Quality, ACP Alligator Cracking, and ACP Failures. Rigid pavement distress types and ride quality made up the next five problem items, as they have since FY 2002.

The Texas Legislature monitors a performance measure very similar to the Commission's pavement condition goal, but for mainlanes only. This measure also improved, going up from 87.53 percent in FY 2004 to 87.92 percent in FY 2005.

The UTP Category 1 performance measures matched the observed trends in pavement distress and ride quality. Rehab lane miles based on Distress Score (1-59) dropped from 9,471.4 in FY 2004 to 8,595.1 in FY 2005. Rehab lane miles based on Ride Score (0.1-1.9) rose from 2,959.7 in FY 2004 to 3,588.4 in FY 2005. Preventive maintenance lane miles based on Distress Score (70-89) dropped from 21,165.9 in FY 2004 to 20,339.4 in FY 2005. All of these were consistent with the observed statewide trends of improving distress and worsening ride quality.

It should be noted that it is possible for some lane miles to be included in both preventive maintenance <u>and</u> rehab for UTP Category 1. Analysis of the FY 2005 PMIS data found that 543.5 lane miles statewide had Distress Score 70-89 and Ride Score 0.1-1.9, and thus were counted as eligible for preventive maintenance and rehab. For comparison purposes, this value was 464.0 lane miles in FY 2004 and 783.5 lane miles in FY 2003.

Also, the UTP Category 1 criteria are not based on specific distress types, thus they will not match the lane mile estimates for pavement needs described in the next chapter of this report ("Estimate of Total Pavement Needs").

Summary

PMIS-related performance measures showed the overall improvement in statewide pavement condition in FY 2005. In the third year of the Texas Transportation Commission's statewide pavement condition goal, the percentage of lane miles (mainlanes and frontage roads) in "Good" or better condition was 87.34 percent in FY 2005, up from 87.02 percent in FY 2004. The rate of improvement slowed in FY 2005. If this rate continues, it will not be possible to meet the FY 2012 goal of 90 percent "Good" or better. UTP Category 1 performance measures showed decreasing lane miles needing repair based on pavement distress and increasing lane miles needing repair based on ride quality.

U. S. 81 and U. S. 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 a roadside historical marker, the gold in the sand was valued at 54 cents per ton, or $31,000 in these sections of highway.

Chapter 8 Estimate of Total 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 total 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:

- 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).

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 FY2002 through FY 2005 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.

Also, FY 2002 and FY 2003 PM Needs Estimate results in this report do not exactly match those that have been published in previous *Condition of Texas Pavements* reports. Last year's report (FY 2001-2004) corrected an error which overestimated FY 2002 and FY 2003 PM needs based on pavement age, and that correction is included in this year's report.

Total Pavement Needs

Figure 8.1 shows the PMIS estimate for the total funding needed to repair Texas pavements for fiscal years 2002 through 2005.

$1,590 million is needed to repair Texas pavements in FY 2005.

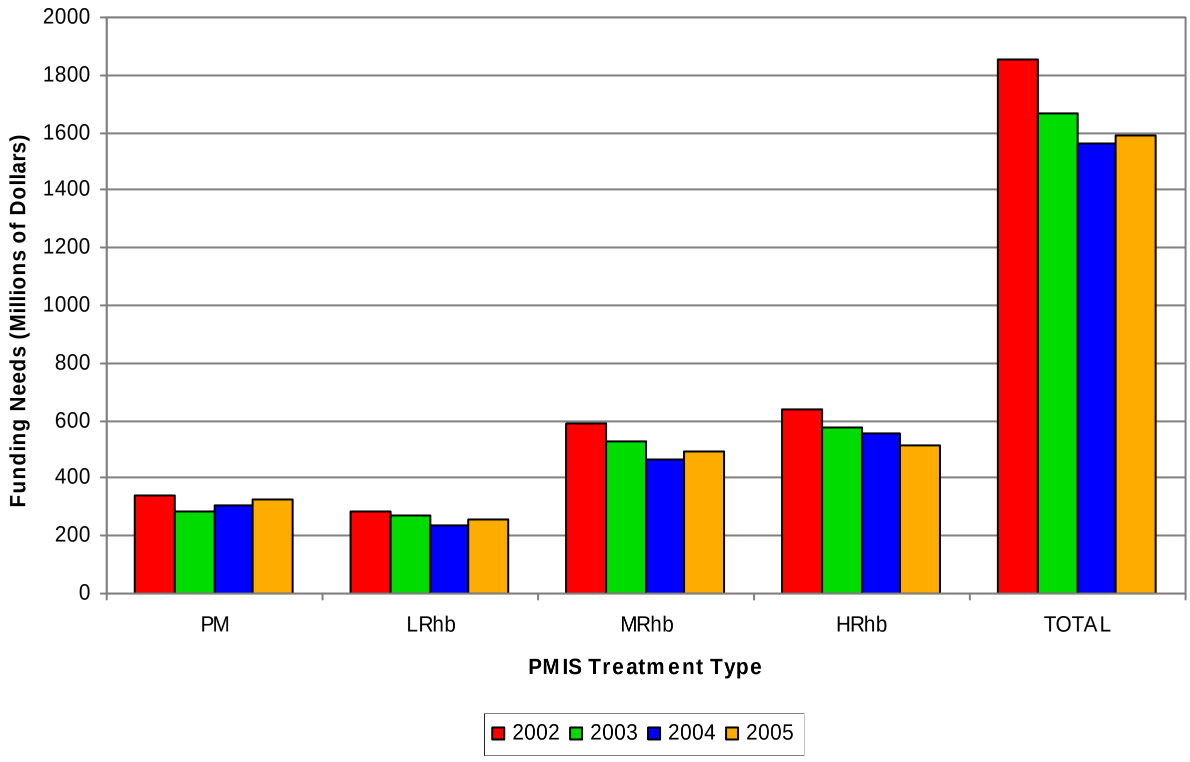


Figure 8.1 — Total Pavement Needs, FY 2002-2005.

The PMIS Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $306 million in 2004 to $327 million in 2005)
- Light Rehab (LRhb) increased (from $233 million in 2004 to $256 million in 2005)
- Medium Rehab (MRhb) increased (from $468 million in 2004 to $496 million in 2005)
- Heavy Rehab (HRhb) decreased (from $555 million in 2004 to $511 million in 2005)
- Total pavement needs increased (from $1,562 million in 2004 to $1,590 million in 2005).

IH Pavement Needs

Figure 8.2 shows the estimated pavement needs for the IH system for fiscal years 2002 through 2005.

Interstate highways make up 12.73 percent of the TxDOT-maintained lane mileage, but require 18.23 percent of the total pavement needs.

$290 million is needed to repair IH lane miles in FY 2005.

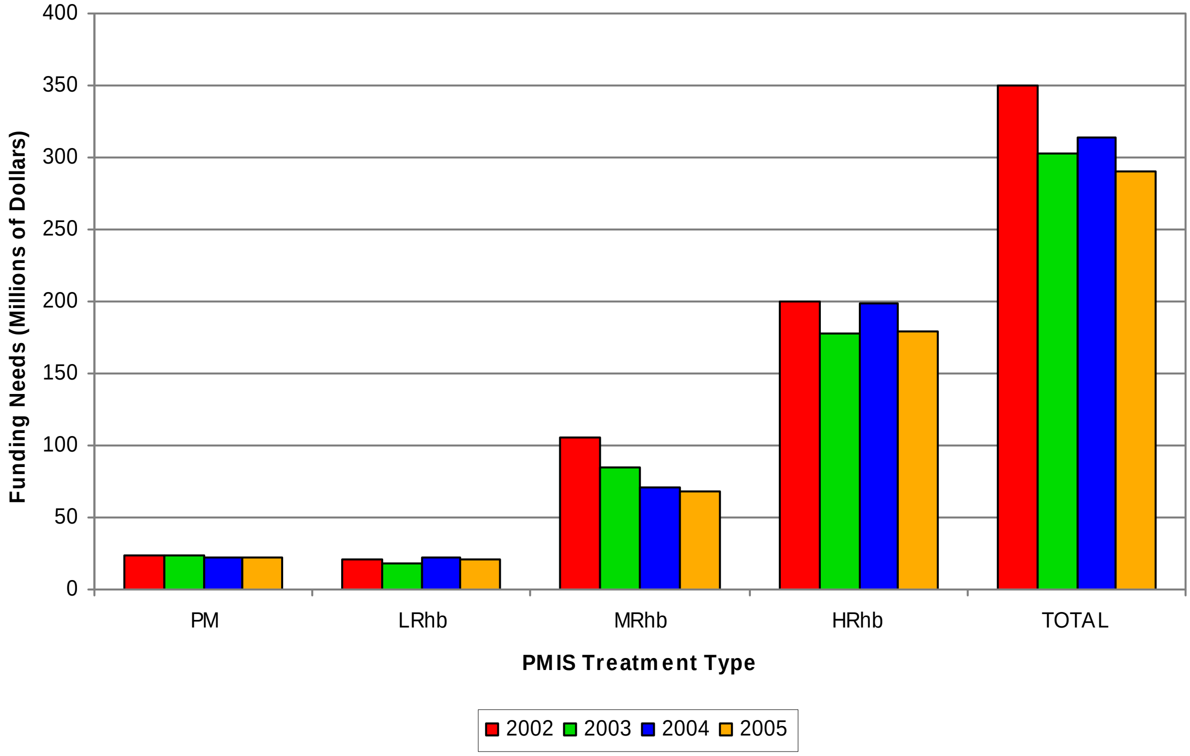


Figure 8.2 — IH Pavement Needs, FY 2002-2005.

The IH System Needs Estimate shows that:

- Preventive Maintenance (PM) decreased (from $22 million in 2004 to $22 million in 2005)
- Light Rehab (LRhb) decreased (from $22 million in 2004 to $21 million in 2005)
- Medium Rehab (MRhb) decreased (from $71 million in 2004 to $68 million in 2005)
- Heavy Rehab (HRhb) decreased (from $199 million in 2004 to $179 million in 2005)
- Total IH pavement needs decreased (from $314 million in 2004 to $290 million in 2005).

US Pavement Needs

Figure 8.3 shows the estimated pavement needs for the US system for fiscal years 2002 through 2005.

US highways make up 20.01 percent of the TxDOT-maintained lane mileage, and require 17.93 percent of the total pavement needs.

$285 million is needed to repair US lane miles in FY 2005.

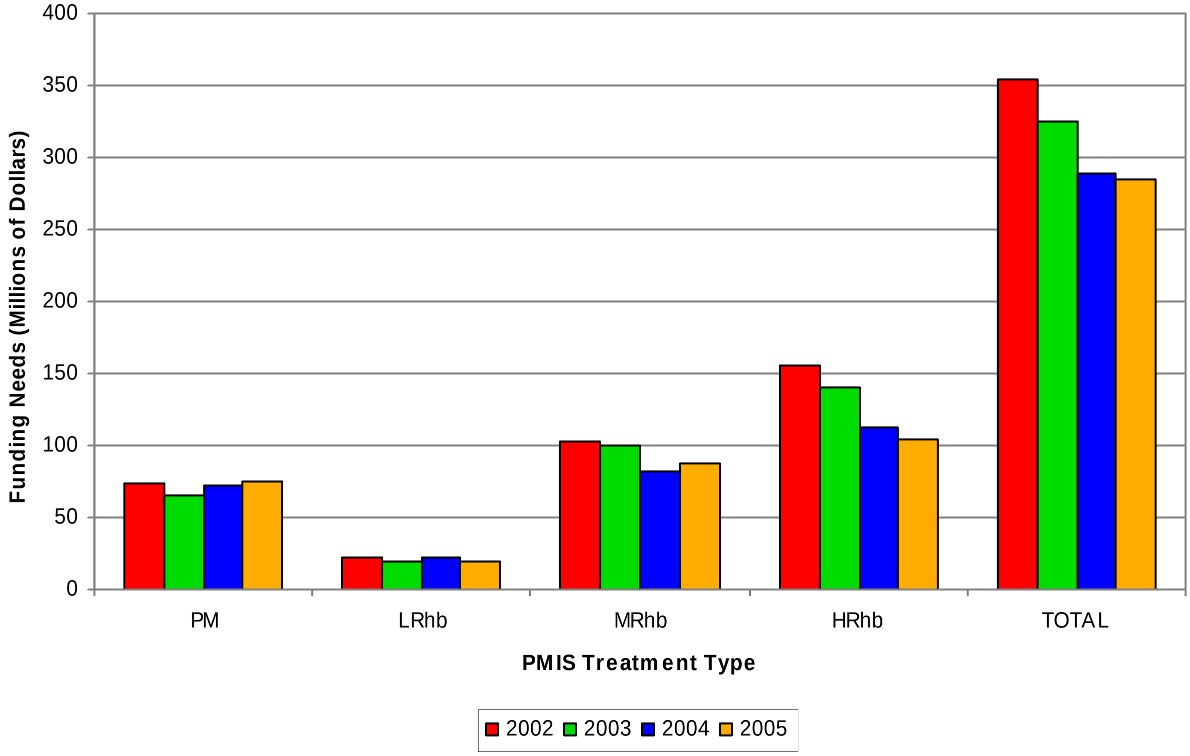


Figure 8.3 — US Pavement Needs, FY 2002-2005.

The US System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $72 million in 2004 to $75 million in 2005)
- Light Rehab (LRhb) decreased (from $22 million in 2004 to $19 million in 2005)
- Medium Rehab (MRhb) increased (from $82 million in 2004 to $87 million in 2005)
- Heavy Rehab (HRhb) decreased (from $113 million in 2004 to $104 million in 2005)
- Total US pavement needs decreased (from $289 million in 2004 to $285 million in 2005).

SH Pavement Needs

Figure 8.4 shows the estimated pavement needs for the SH system for fiscal years 2002 through 2005.

State highways make up 21.08 percent of the TxDOT-maintained lane mileage, and require 25.04 percent of the total pavement needs.

$398 million is needed to repair SH lane miles in FY 2005.

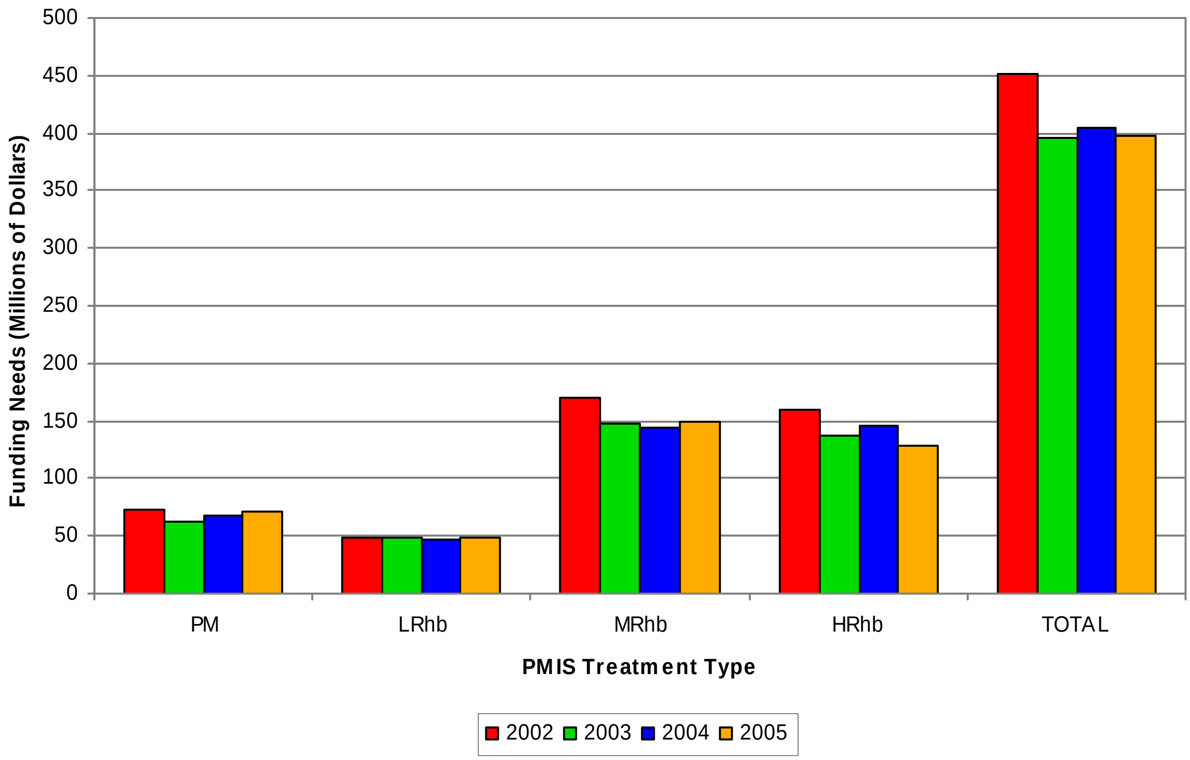


Figure 8.4 — SH Pavement Needs, FY 2002-2005.

The SH System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $67 million in 2004 to $72 million in 2005)
- Light Rehab (LRhb) increased (from $47 million in 2004 to $49 million in 2005)
- Medium Rehab (MRhb) increased (from $145 million in 2004 to $149 million in 2005)
- Heavy Rehab (HRhb) decreased (from $145 million in 2004 to $129 million in 2005)
- Total SH pavement needs decreased (from $404 million in 2004 to $398 million in 2005).

FM Pavement Needs

Figure 8.5 shows the estimated pavement needs for the FM system for fiscal years 2002 through 2005.

Farm-to-Market roads make up 44.24 percent of the TxDOT-maintained lane mileage, but only require 35.30 percent of the total pavement needs. Other systems (BR, PR, and PA) make up the remaining 1.95 percent of TxDOT-maintained lane mileage and 3.50 percent of the total pavement needs.

$561 million is needed to repair FM lane miles in FY 2005.

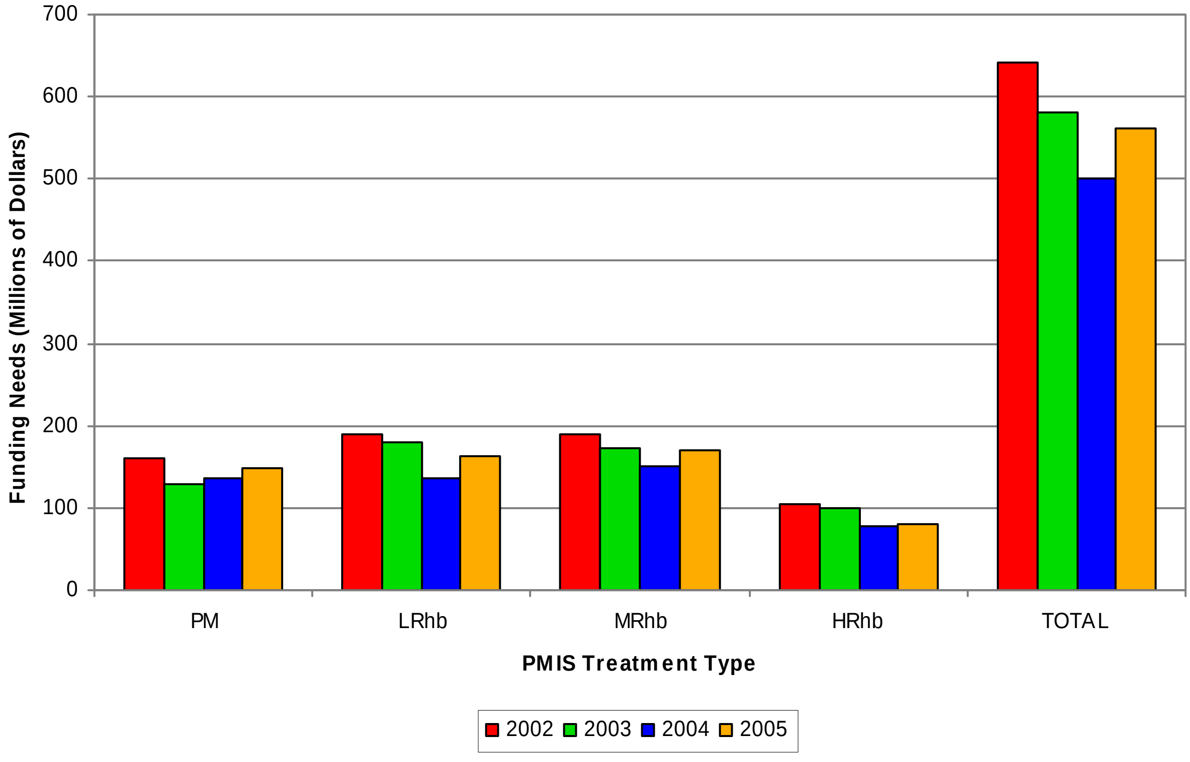


Figure 8.5 — FM Pavement Needs, FY 2002-2005.

The FY System Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $136 million in 2004 to $149 million in 2005)
- Light Rehab (LRhb) increased (from $136 million in 2004 to $162 million in 2005)
- Medium Rehab (MRhb) increased (from $151 million in 2004 to $170 million in 2005)
- Heavy Rehab (HRhb) increased (from $78 million in 2004 to $81 million in 2005)
- Total FM pavement needs increased (from $501 million in 2004 to $561 million in 2005).

Flexible Pavement Needs

Figure 8.6 shows the estimated pavement needs for flexible pavements for fiscal years 2002 through 2005.

Flexible pavements make up 92.51 percent of the TxDOT-maintained lane mileage, but only require 61.50 percent of the total pavement needs.

$978 million is needed to repair flexible pavements in FY 2005.

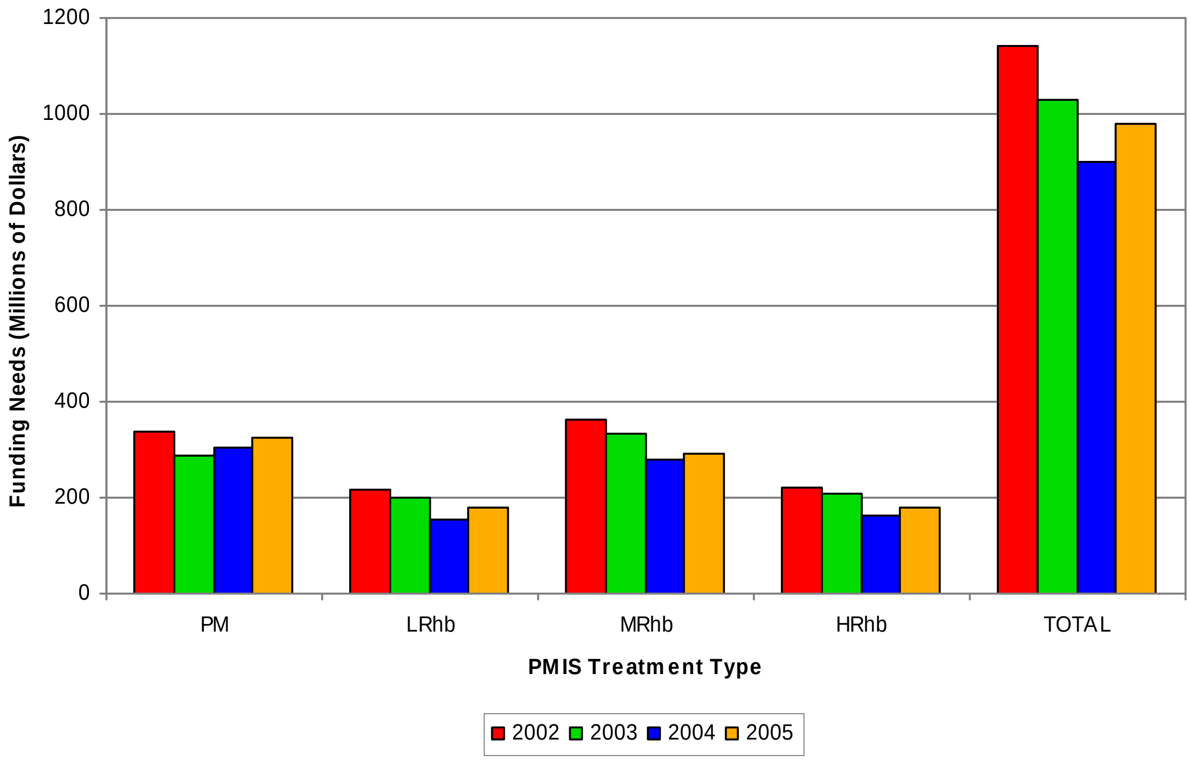


Figure 8.6 — Flexible Pavement Needs, FY 2002-2005.

The Flexible Pavement Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $306 million in 2004 to $326 million in 2005)
- Light Rehab (LRhb) increased (from $153 million in 2004 to $181 million in 2005)
- Medium Rehab (MRhb) increased (from $280 million in 2004 to $293 million in 2005)
- Heavy Rehab (HRhb) increased (from $162 million in 2004 to $178 million in 2005)
- Total flexible pavement needs increased (from $901 million in 2004 to $978 million in 2005).

CRCP Pavement Needs

Figure 8.7 shows the estimate pavement needs for CRCP for fiscal years 2002 through 2005.

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

CRCP pavements make up only 5.19 percent of the TxDOT-maintained lane mileage, but require 24.27 percent of the total pavement needs.

$386 million is needed to repair CRCP lane miles in FY 2005.

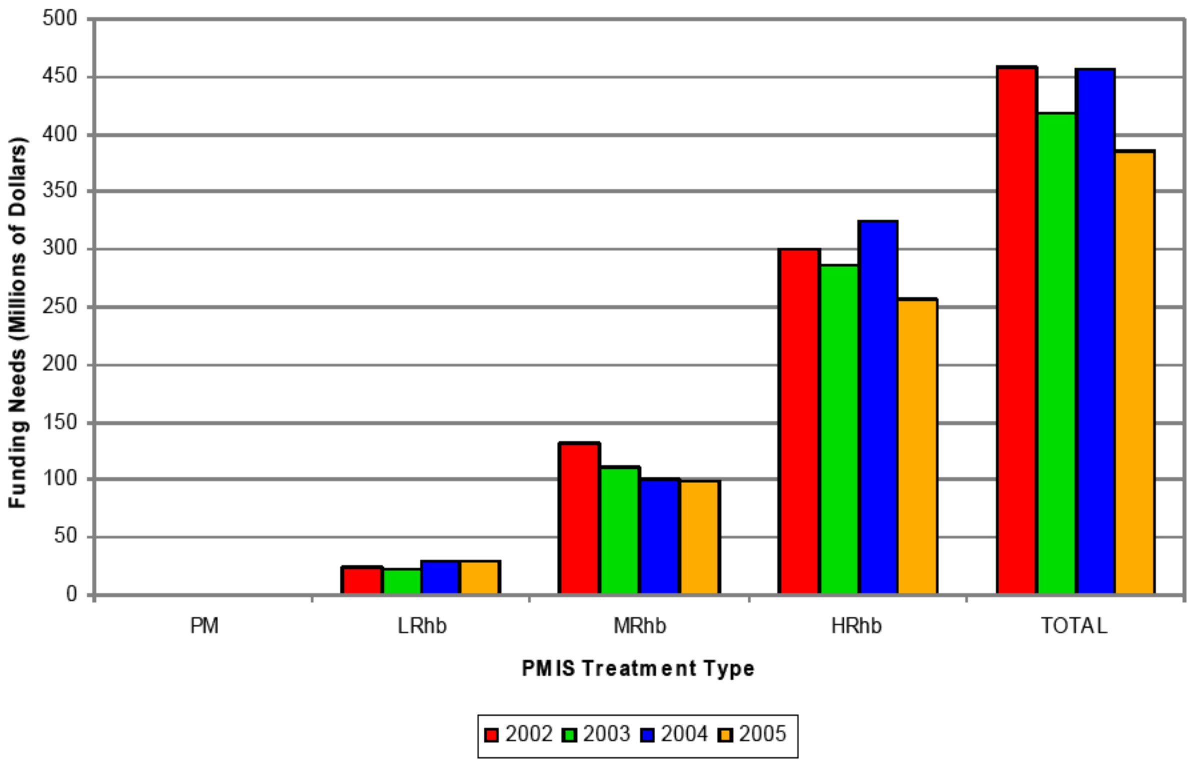


Figure 8.7 — CRCP Pavement Needs, FY 2002-2005.

The CRCP Needs Estimate shows that:

- Preventive Maintenance (PM) remained the same ($0 million in 2004 to $0 million in 2005)
- Light Rehab (LRhb) decreased (from $30 million in 2004 to $29 million in 2005)
- Medium Rehab (MRhb) decreased (from $101 million in 2004 to $100 million in 2005)
- Heavy Rehab (HRhb) decreased (from $325 million in 2004 to $257 million in 2005)
- Total CRCP needs decreased (from $457 million in 2004 to $386 million in 2005).

JCP Pavement Needs

Figure 8.8 shows the estimated pavement needs for JCP for fiscal years 2002 through 2005.

JCP pavements make up only 2.30 percent of the TxDOT-maintained lane mileage, but require 14.23 percent of the total pavement needs.

$226 million is needed to repair JCP lane miles in FY 2005.

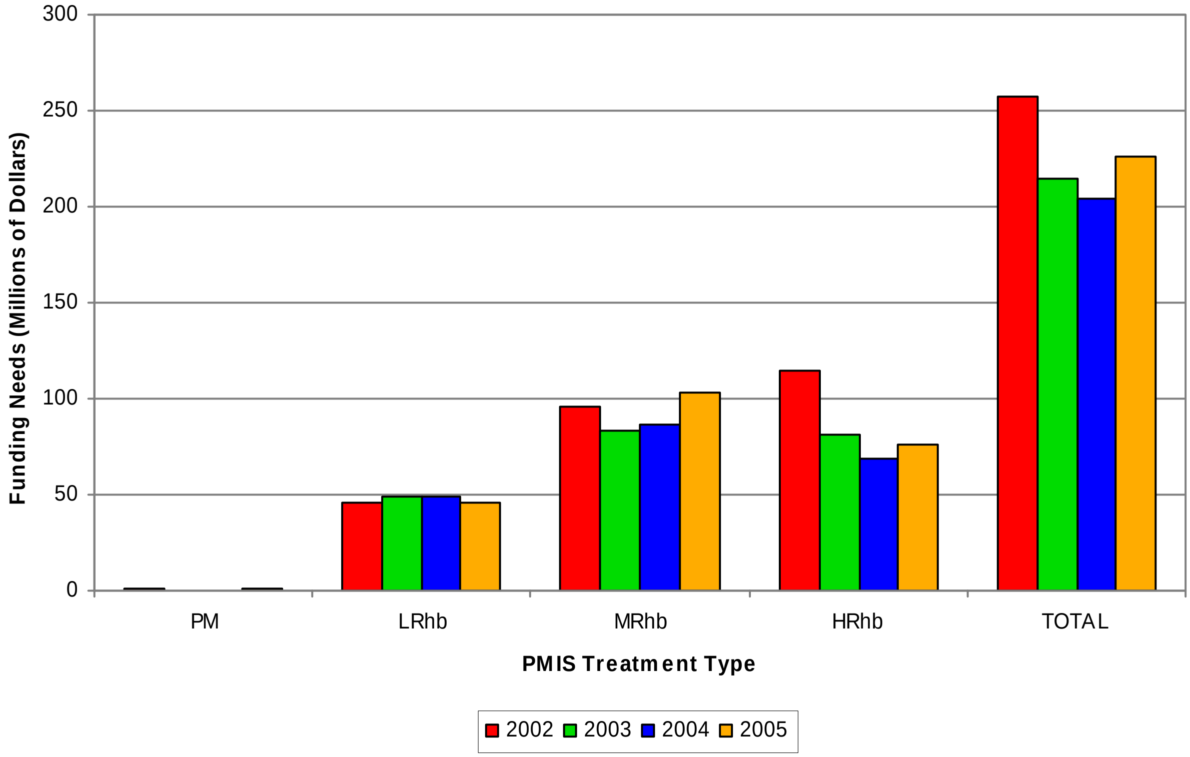


Figure 8.8 — JCP Pavement Needs, FY 2002-2005.

The JCP Needs Estimate shows that:

- Preventive Maintenance (PM) increased (from $0 million in 2004 to $1 million in 2005)
- Light Rehab (LRhb) decreased (from $49 million in 2004 to $46 million in 2005)
- Medium Rehab (MRhb) increased (from $86 million in 2004 to $103 million in 2005)
- Heavy Rehab (HRhb) increased (from $69 million in 2004 to $76 million in 2005)
- Total JCP needs increased (from $204 million in 2004 to $226 million in 2005).

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.

Location of Preventive Maintenance Needs, FY 2004-2005

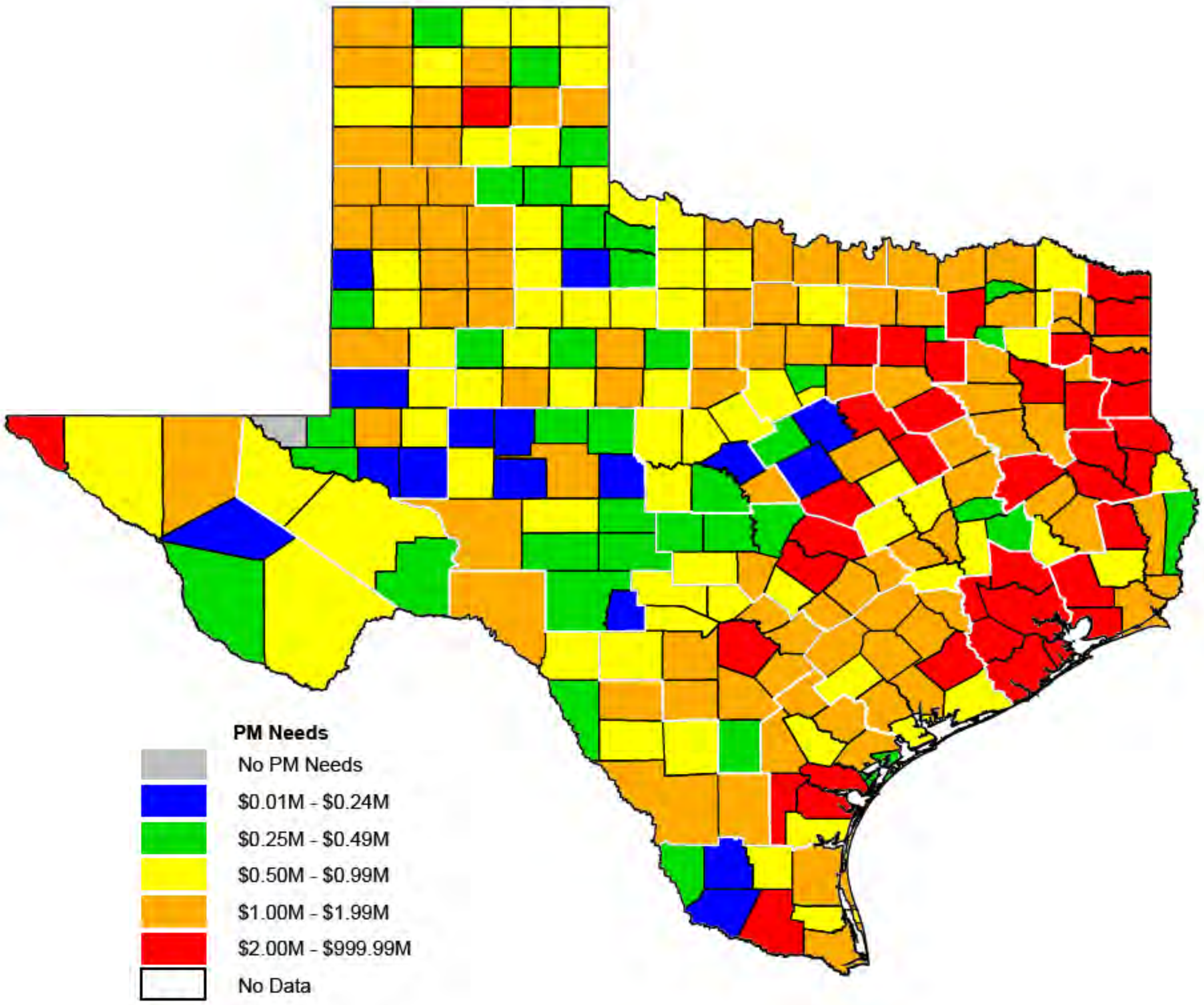
Maps 8.1 and 8.2 show preventive maintenance needs in each county for fiscal years 2004 and 2005. Counties in blue have the lowest need (less than $250,000) while counties in red have the highest need (more than $2,000,000).

Preventive maintenance needs increased from $306 million in FY 2004 to $327 million in FY 2005, despite a slight decrease in the amount of IH preventive maintenance needs. The increase in preventive maintenance needs was caused by a $24.7 million increase in lane miles with small amounts of Deep Rutting. Longitudinal Cracking on high-traffic ACP and Transverse Cracking on ACP mileage also contributed to the observed increase in preventive maintenance needs, even though overall pavement distress improved.

Preventive maintenance needs are widespread across the state.

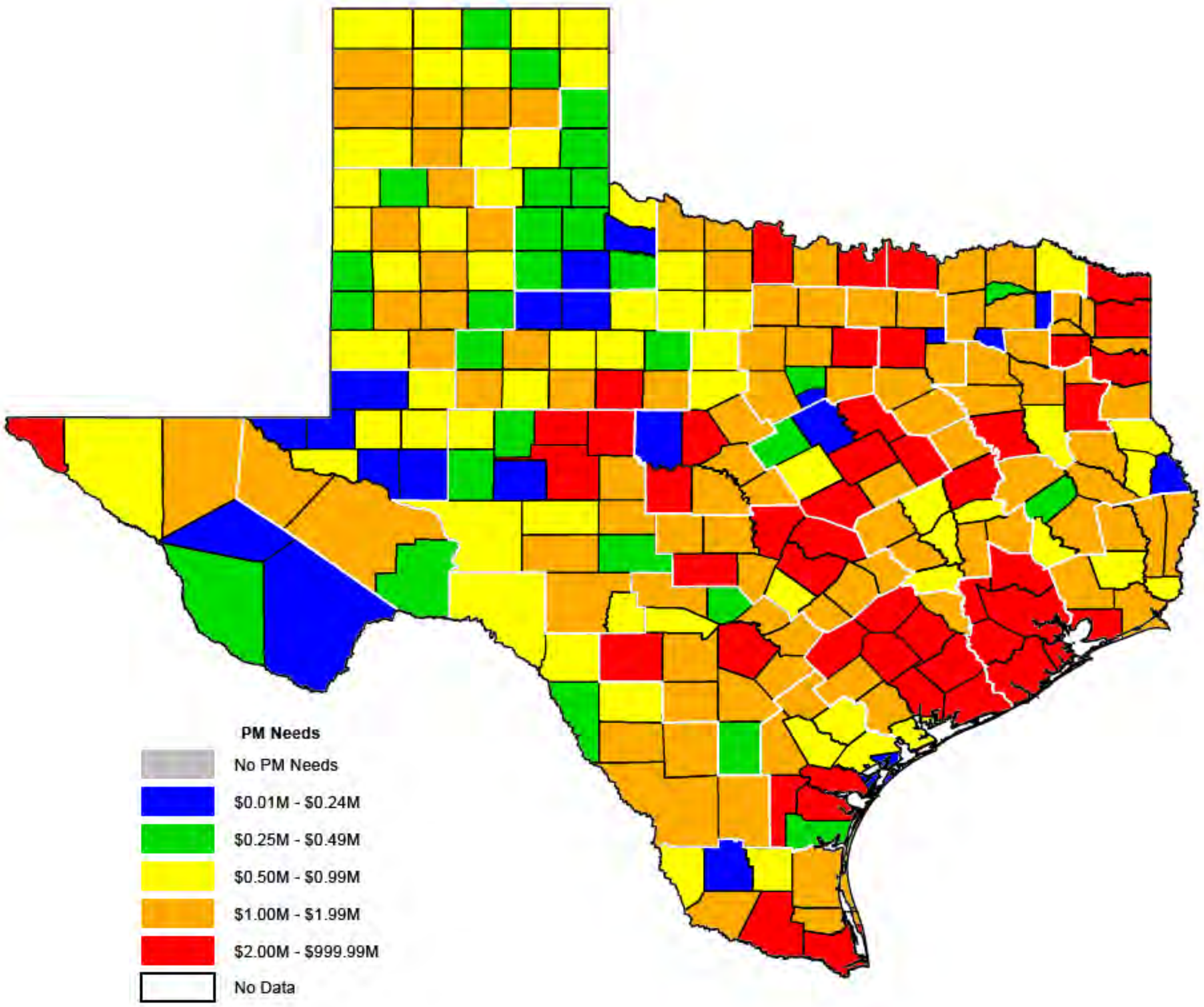
In PMIS, preventive maintenance primarily addresses non-load associated distress types on flexible pavements and JCP. PMIS also uses preventive maintenance to address small amounts of load-associated distress if the pavement is still in relatively good condition (no ride quality problems or other extensive 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 2004.



Statewide Preventive Maintenance Needs (FY 2004) — $306 million

Map 8.2 — Preventive Maintenance Needs, FY 2005.



Statewide Preventive Maintenance Needs (FY 2005) — $327 million

In 1921, Congress passed a new Federal Aid to Roads Act requiring states to have exclusive control in road design, construction, and maintenance. In 1923, the 38th Legislature imposed the first State gasoline tax—one cent per gallon. Three-fourths of the revenue went to the State Highway Fund. The remainder went to the School Fund. Since 1991, the state gas tax has been 20 cents a gallon.

Location of Rehabilitation Needs, FY 2004-2005

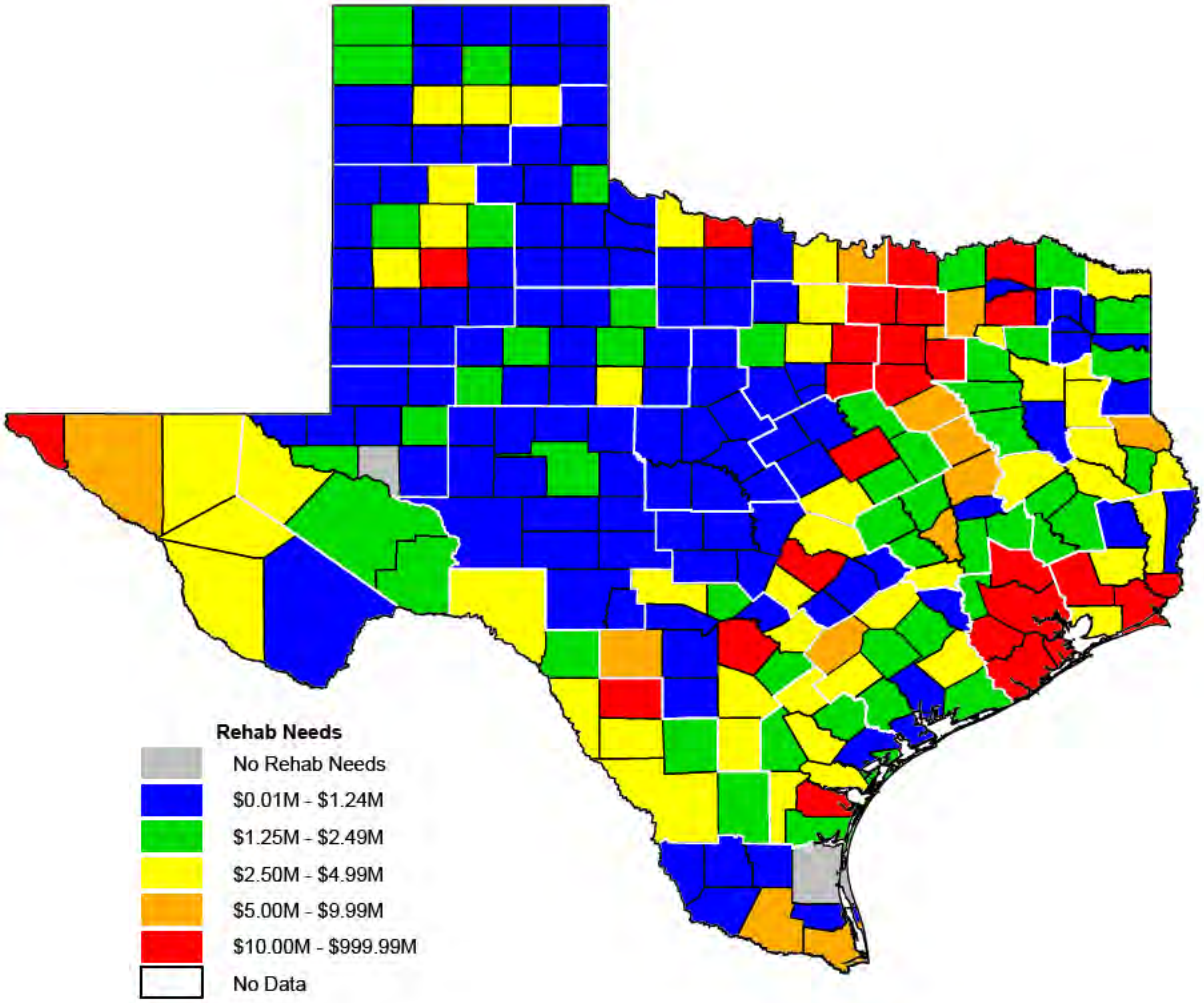
Maps 8.3 and 8.4 show rehabilitation needs in each county for fiscal years 2004 and 2005. Counties in blue have the lowest need (less than $1,250.000) while counties in red have the highest need (more than $10,000,000).

Statewide rehabilitation needs increased from $1,256 million in FY 2004 to $1,263 million in FY 2005, despite a $70.8 million decrease in CRCP rehab needs and a $44.2 million decrease in heavy rehab needs. Light rehab needs increased by $23.6 million because of increased ACP mileage with ride quality problems. Medium rehab needs increased by $27.7 million because of increased ACP and JCP ride quality problems. The increase in light and medium rehab offset the drop in heavy rehab and caused the overall increase in statewide rehab needs.

Unlike preventive maintenance, rehabilitation needs are mainly concentrated in and around the metropolitan counties. 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.

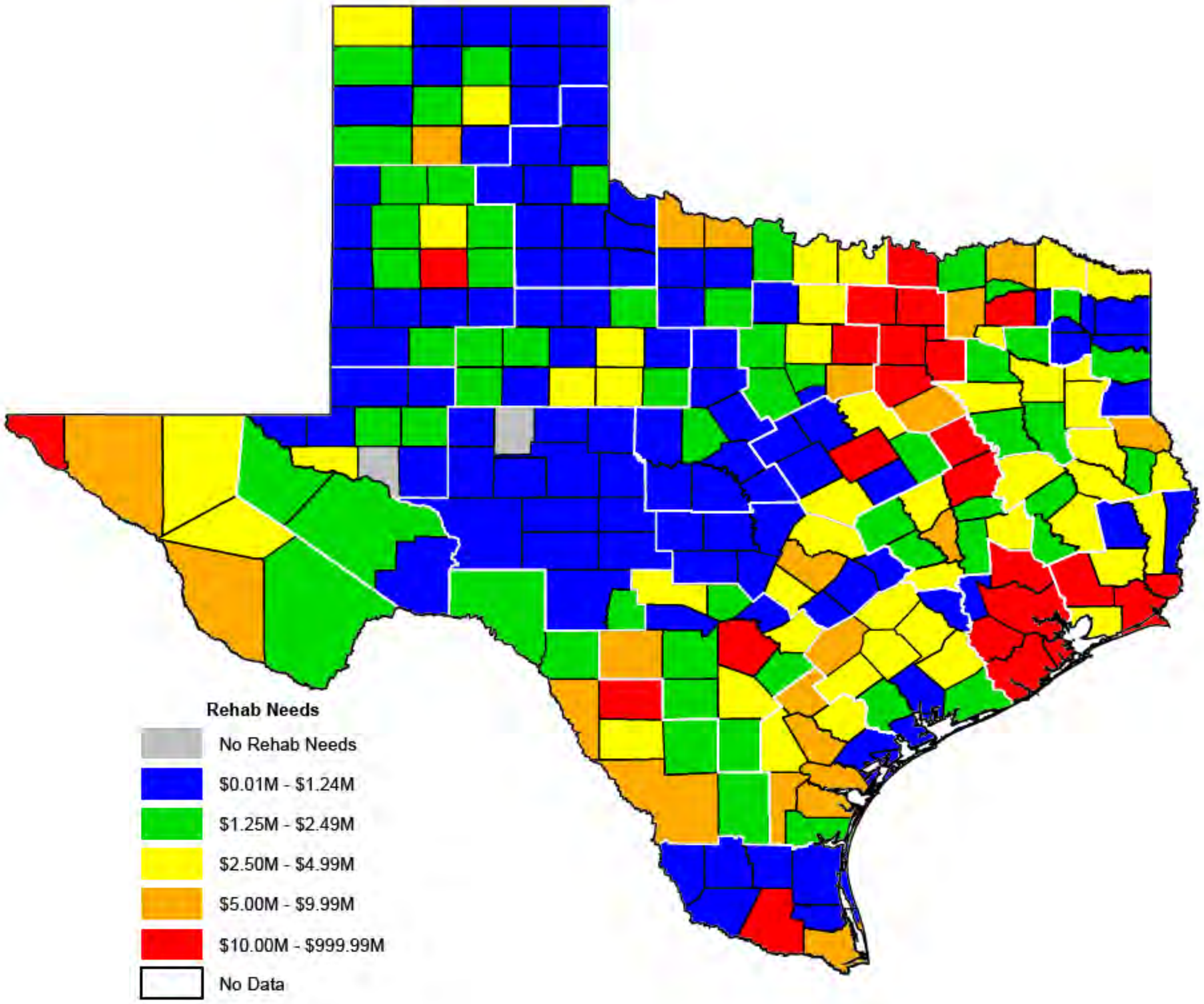
In PMIS, rehabilitation primarily addresses load-associated distress types to restore pavement structural strength. PMIS also uses rehabilitation to correct ride quality problems on rough roads.

Map 8.3 — Rehabilitation Needs, FY 2004.



Statewide Rehabilitation Needs (FY 2004) — $1,256 million

Map 8.4 — Rehabilitation Needs, FY 2005.



Statewide Rehabilitation Needs (FY 2005) — $1,263 million

Distribution of Lane Mile and Funding Needs, FY 2004-2005

Figure 8.9 shows the distribution of lane mile needs for fiscal years 2004 and 2005.

The percentage of lane miles needing treatment increased from 35 percent in FY 2004 to 38 percent in FY 2005. Preventive maintenance mileage rose by two percent and light rehab mileage rose by one percent. The percentage of lane miles needing medium rehab or heavy rehab stayed the same (four percent and one percent, respectively).

Figure 8.10 shows the distribution of funding needs for fiscal years 2004 and 2005.

The distribution of funds needed for pavement repair shows a shift away from heavy rehab and toward lighter treatments. The percentage of funding needs for heavy rehab dropped by three percent, while preventive maintenance, light rehab, and medium rehab each rose by one percent. As mentioned earlier in this Chapter, total funding needed for heavy rehab dropped by $44.2 million in FY 2005, but that was offset by a $71.8 million increase in funding needed for the other treatment types.

It should be noted that 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 does most of the work, but rehabilitation funds most of the work. Using the FY 2005 results as an example, 20.56 percent of the total funding needs could be used for preventive maintenance to treat 26.69 percent of the lane miles; but it would take 79.44 percent of the total funding needs used for rehab to treat 11.25 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 not 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.

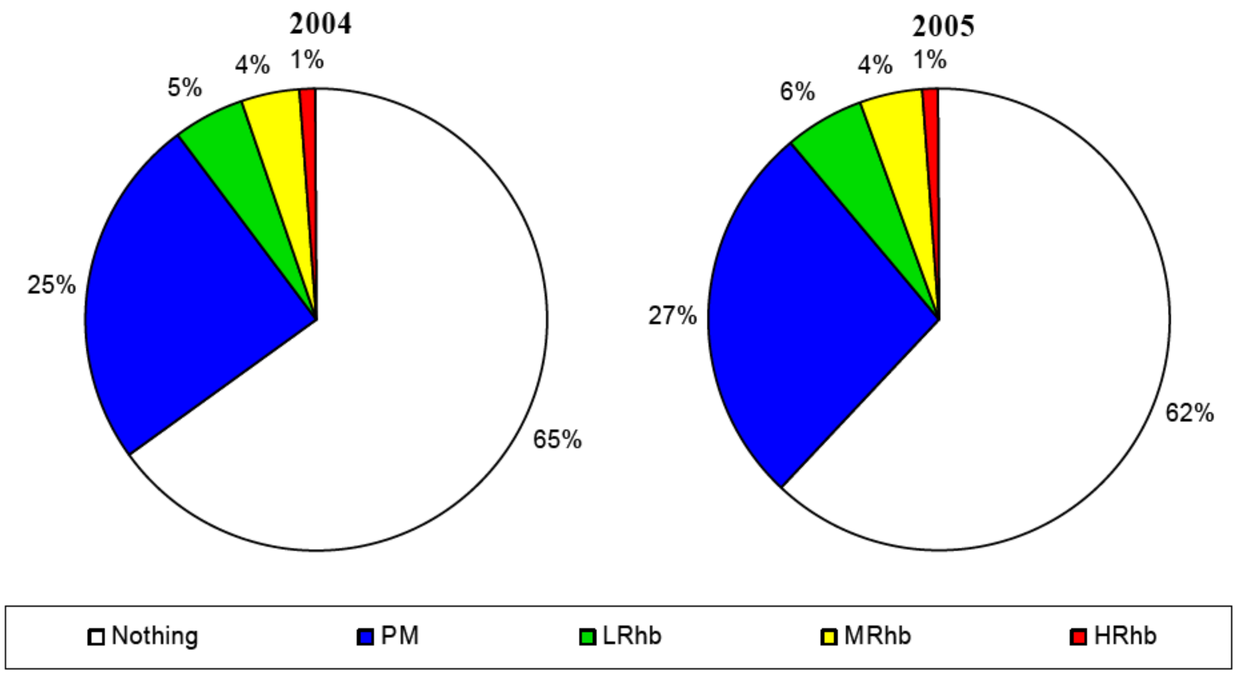


Figure 8.9 — Distribution of Lane Mile Needs, FY 2004-2005.

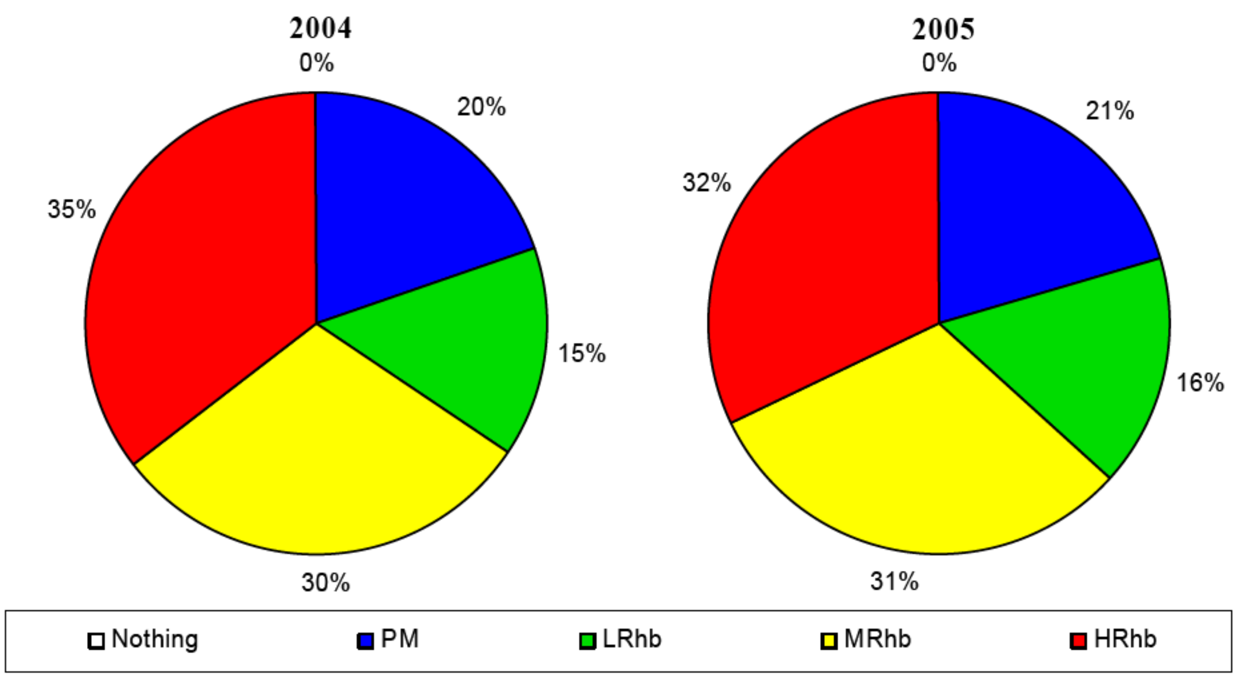


Figure 8.10 — Distribution of Funding Needs, FY 2004-2005.

The highest highway in Texas is at the end of a spur from SH 118 to the McDonald Observatory, on Mount Locke in the Davis Mountains of west Texas. It is 6,791 feet above sea level.

Discussion

The total funding needed to repair Texas pavements increased to $1,590 million in FY 2005, despite improvements in overall distress and condition.

IH, US, and SH pavement needs dropped by $34.8 million, but FM needs rose by $59.9 million in FY 2005. FM preventive maintenance needs rose because of an increase in mileage with small amounts of Deep Rutting. The Deep Rutting was not enough to reduce Distress Scores and it was not enough to lower overall pavement distress, but it was enough to trigger preventive maintenance treatments in the PMIS Needs Estimate program. FM rehab needs rose because of increased mileage with ride quality problems.

CRCP needs dropped by $70.8 million, but ACP and JCP needs rose by $98.5 million in FY 2005. Deep Rutting and ride quality problems caused the increase in ACP and JCP needs.

Preventive maintenance needs increased from $306 million in FY 2004 to $327 million in FY 2005, despite a slight decrease in the amount of IH preventive maintenance needs. Preventive maintenance needs increased because of a $24.7 million increase in funds needed to fix small amounts of Deep Rutting. Longitudinal Cracking on high-traffic ACP and Transverse Cracking on ACP mileage also contributed to the increase in preventive maintenance needs, even though overall pavement distress improved.

Statewide rehabilitation needs increased from $1,256 million in FY 2004 to $1,263 million in FY 2005, despite a $70.8 million decrease in CRCP rehab needs and a $44.2 million decrease in heavy rehab needs. Light rehab needs increased by $23.6 million because of increased ACP mileage with ride quality problems. Medium rehab needs increased by $27.7 million because of increased ACP and JCP ride quality problems. The increase in light and medium rehab offset the drop in heavy rehab and caused the overall increase in statewide rehab needs.

How can PMIS-estimated pavement needs increase in FY 2005 when overall distress and condition improve? Worsening ride quality and increasing amounts of ACP Deep Rutting are part of the answer, but another part of the answer is that the PMIS Needs Estimate program is not tied directly to Distress Score or Condition Score – it is based on pavement distress, Ride Score, traffic, number of lanes, and function classification. Increases in small amounts of certain distress types, such as ACP Deep Rutting, can trigger additional Needs Estimate treatments without necessarily reducing Distress Scores.

Summary

The total funding needed to repair Texas pavements increased to $1,590 million in FY 2005, despite improvements in overall distress and condition. Total pavement needs decreased for IH, US, SH, and CRCP; but increased for FM, ACP, and JCP. Rehabilitation needs increased to $1,263 million, and preventive maintenance needs increased to $327 million. Increased amounts of ACP Deep Rutting, Longitudinal Cracking on high-traffic ACP, ACP Transverse Cracking, and ride quality problems on ACP and JCP caused the increase in statewide pavement needs.

Loop 168 in downtown Tenaha in Shelby County is the shortest Texas highway. The road is 0.074 miles long, or 391 feet.

Chapter 9 Summary

The overall condition of Texas pavements improved in FY 2005 to the highest level in four years because of improved distress, even though statewide ride quality got worse.

Pavement condition and distress improved to the highest level in four years for each of the major highway systems (IH, US, SH, and FM). However, ride quality got worse for each of the major highway systems, after having improved in FY 2003 and FY 2004. IH mileage had the best overall ride quality but the worst overall distress; US had the best overall condition; SH had the worst overall condition; and FM had the best overall distress but the worst overall ride quality.

ACP condition and distress improved, but ride quality got worse. ACP had the best overall condition and distress of the three major pavement types, as it has since FY 2002. The decline in ACP ride quality followed three years of improvement. Shallow Rutting, Deep Rutting, Failures, Alligator Cracking, and Transverse Cracking all increased, but a large reduction in Patching offset those increases and caused overall ACP distress to improve.

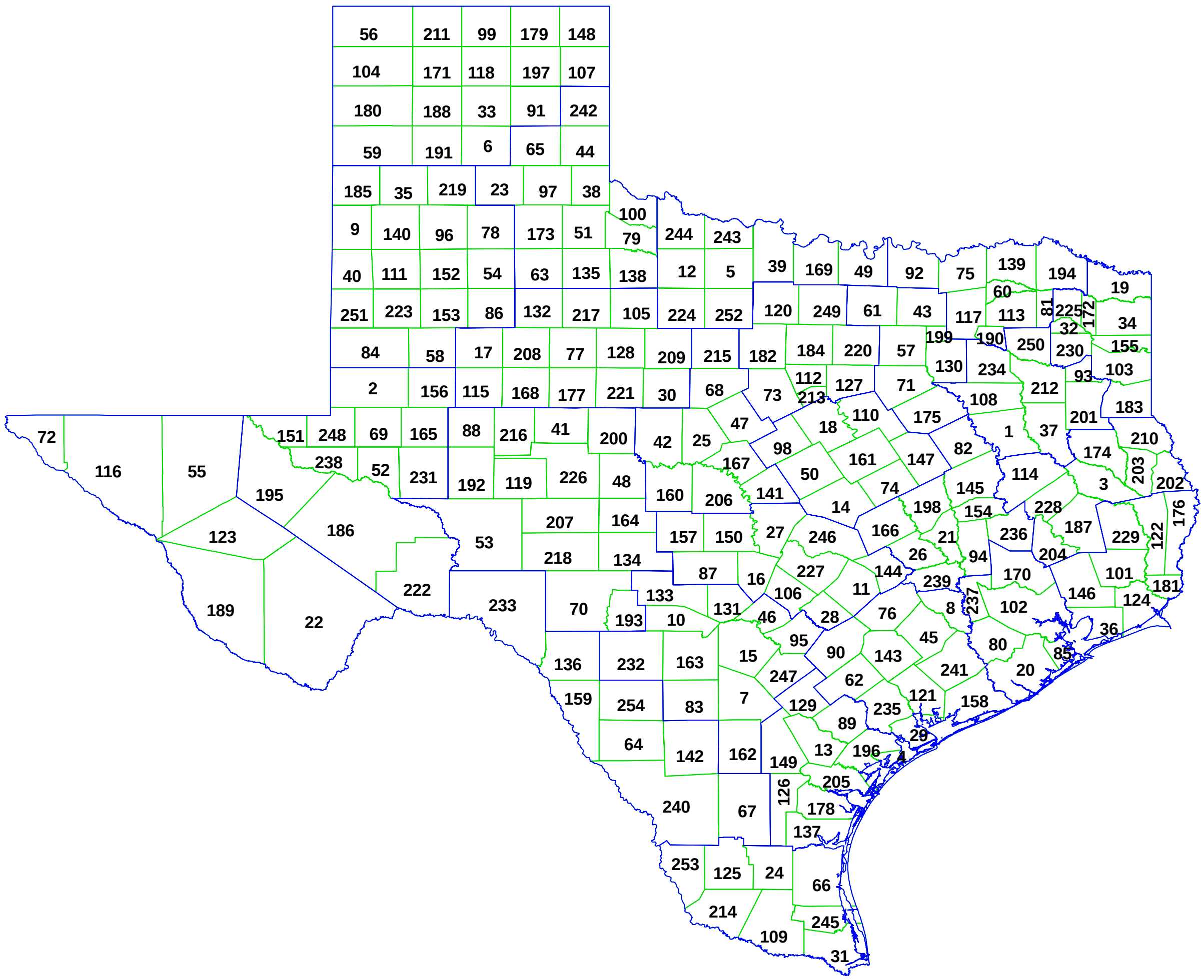
CRCP condition, distress, and ride quality improved to the highest level in four years. CRCP was the only pavement type to show improved ride quality in FY 2005 – in fact, it now has the best overall ride quality of the major pavement types in Texas. All CRCP distress types decreased, with Spalled Cracks showing the largest decrease.

JCP condition, distress, and ride quality got worse, after having improved in FY 2003 and FY 2004. JCP was the only pavement type to have worse condition and distress in FY 2005. Three of the five JCP distress types – Failed Joints and Cracks, Failures, and Shattered Slabs – decreased. However, Slabs with Longitudinal Cracks and Concrete Patches increased, and they were enough to lower the overall PMIS Distress Score for JCP.

The overall "Combined" level of service maintained on Texas flexible (ACP) pavements got worse in FY 2005, despite a slight improvement in the Alligator Cracking level of service, because of declines in Rutting and Ride Quality levels of service. All traffic levels — "High," "Medium," and "Low" — also provided a lower level of service in FY 2005.

PMIS-related performance measures showed the improvement in statewide pavement condition in FY 2005. In the third year of the Texas Transportation Commission's ten-year statewide pavement condition goal, the percentage of lane miles (mainlanes and frontage roads) in "Good" or better condition rose to 87.34 percent, up from 87.02 percent in FY 2004. The rate of improvement slowed in FY 2005, and if the rate continues, it will not be possible to meet the FY 2012 goal of 90 percent "Good" or better. UTP Category 1 measures showed fewer lane miles needing repair based on distress and more lane miles needing repair based on ride quality.

The total funding needed to repair Texas pavements increased to $1,590 million in FY 2005, despite improvements in overall distress and condition. Total pavement needs decreased for IH, US, SH, and CRCP; but increased for FM, ACP, and JCP. Rehabilitation needs increased to $1,263 million, and preventive maintenance needs increased to $327 million. Increased amounts of ACP Deep Rutting, Longitudinal Cracking on high-traffic ACP, ACP Transverse Cracking, and ride quality problems on ACP and JCP caused the increase in statewide pavement needs.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195 160 206 141 50 74 145 114 3 203 202
123 186 207 164 14 198 154 228 176
53 157 150 27 246 166 21 236 187 229 122
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189 22 222 233 70 133 193 10 131 46 106 11 239 237 8 170 146 181 124
28 76 102 36
95 90 143 45 80 85
136 232 163 15 247 62 241 20
159 254 83 7 129 121 158 235
89 29
64 142 162 149 13 196 4
126 205
240 67 178
137
253 125 24 66
214 109 245
31

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.

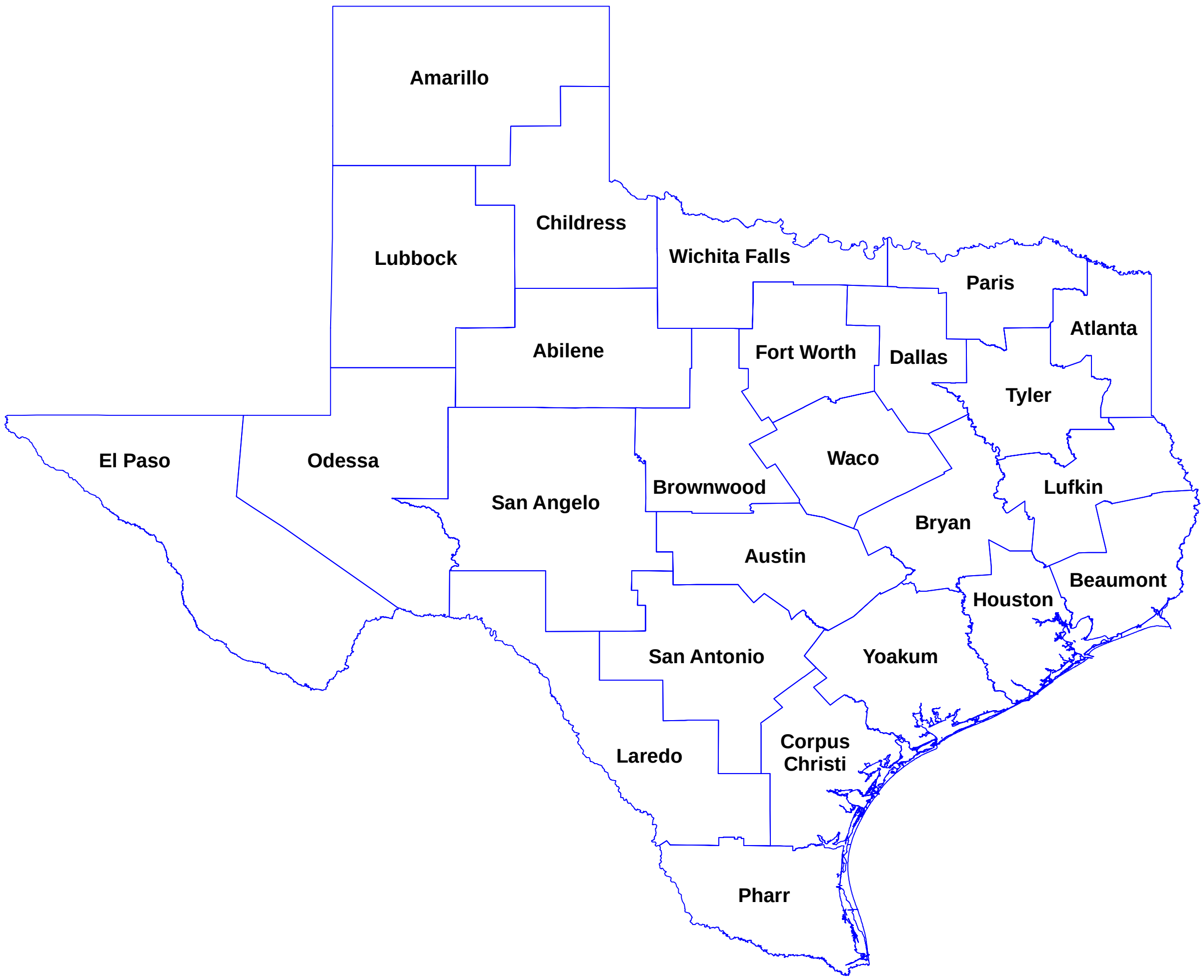

Table 9.2 — TxDOT Districts.

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

Texas Department of Transportation

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