

STATE OF FLORIDA



2002
FLEXIBLE PAVEMENT
CONDITION SURVEY
FACTS & FIGURES

FL/DOT/SMO/02-457
April 2002

STATE MATERIALS OFFICE

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Executive Summary

Since 1985, the Pavement Condition Unit of Pavement Systems Evaluation Section has been annually collecting, processing and analyzing the information on the condition and performance of the State Roadway System. The information provided by such a Pavement Condition Survey (PCS) program has been critical to the Department's effort to support informed highway planning, policy and decision making at State and local levels. This includes the apportionment and allocation of funding needs as well as the determination of appropriate cost-effective strategies to rehabilitate and preserve existing highway transportation infrastructure.

The condition survey is traditionally performed on the pavement lane that has deteriorated the most in each direction, and pavement sections are determined by construction limits or uniformity of conditions. All the sections rated are rated in terms of varying levels and amounts of specific distresses, namely, (1) ride quality, (2) rutting, and (3) cracking.

The Survey data is collected, reviewed, processed, and analyzed by the Pavement Systems Evaluation Section of the State Materials Office. Each county is forwarded to the District responsible for review and any concerns are addressed prior to the data collection being finalized. Once the data collection process is complete, the Central Pavement Management Office is responsible for processing, analysis and making the data available for use by the Department, consultants and others. Thereafter, the Central Program Development Office becomes responsible for reporting the condition of the State Highway System for Pavement Management purposes.

The present report provides essential information on the current condition of the Florida roadway system collected as part of the PCS program. It also includes a summary of the historical condition rating data.

SECTION I

Introduction

The Pavement Systems Evaluation Section of the State Materials Office is responsible for the Department's Annual Pavement Condition Survey. The Survey is conducted on the totality of the State-maintained Highway System.

The Survey is completed each year by a highly trained and experienced engineering staff, and requires each of the four teams about 25 weeks of travel each year to complete. Since the inception of the PCS program, there has been over 20 percent increase of lane miles surveyed (refer to Chart on page 5) while the number of the Pavement Condition Survey staff has decreased.

- ☞ Determine the present condition of the State Roadway System;
- ☞ Compare the present with past conditions;
- ☞ Predict deterioration rates;
- ☞ Predict rehabilitation funding needs;
- ☞ Provide justification for annual rehabilitation budget;
- ☞ Provide justification for project rehabilitation; and
- ☞ Provide justification for distribution of rehabilitation funds to Districts.

The condition survey is conducted in terms of varying levels and amounts of specific distresses, namely, (1) ride quality, (2) rutting, and (3) cracking. For each distress type, the pavement sections are rated on a zero to ten scale, where a rating of ten indicates a section in excellent condition. Currently, any section with a rating of six or less would become eligible for rehabilitation.

Cracking is a subjective survey conducted visually either from the roadway or from the shoulder. Rut and Ride are measured using an automated vehicle-mounted instrument called a Profiler that measures the longitudinal profile of the roadway. The ride quality is quantified in terms of Ride Number (RN). Ride Number is a mathematical processing of longitudinal profile measurements to produce an estimate of ride quality or user perception in accordance with ASTM Standard E1489.

In order to ensure a maximum accuracy and repeatability of the data collected, the testing equipment has to be well maintained and routinely calibrated. In addition, over 150 edit checks are currently implemented to test both the data accuracy and compliance with other parameters of the Pavement Management System. Comparisons of annual survey data to that of earlier years to review trends and identify potential errors are also performed. Furthermore, team members (raters) annually complete a comparative distress rating evaluation on selected pavement sections to enhance uniformity of the subjective crack rating. When necessary, and as appropriate, efforts have been made to upgrade the survey equipment and to improve the data analysis software resulting in increased speed of data collection and substantially improved accuracy of the survey results. These types of improvements now allow in-depth analysis on any segment of the highway system and completing the PCS on time and on target while maintaining a high level of accuracy in the survey results. For more detailed information about the Pavement Condition Surveys, please refer to the latest edition of the Rigid and Flexible Pavement Condition Survey Handbooks.

Since the mileage of flexible pavements represents approximately 97% of the entire System, the facts and figures contained in this report are for flexible pavements only unless otherwise noted.

Observations

- Crack ratings have remained stable for the past eleven years with a mean rating of approximately 8 (range of 8.02 to 8.21).
- Rut rating values for the State-maintained Highway System have improved from an average rating of 8 (or 8.35) in 1992 to 9 (or 8.91) in 2002.
- Ride rating values for the State-maintained Highway System have remained constant with a mean rating of approximately 8 (range of 8.02 to 8.24).
- 90.9% of this year's Crack ratings were within one point as compared to the previous year's. (*)
- 99.7% of this year's Rut ratings were within one point as compared to the previous year's. (*)
- 99.7% of this year's Ride ratings were within one point as compared to the previous year's. (*)
- Beginning with the 1999 survey, Laser sensors were implemented along with the use of Ride Number as a method of calculating Ride Ratings. This may explain the increase in serviceability observed thereafter.

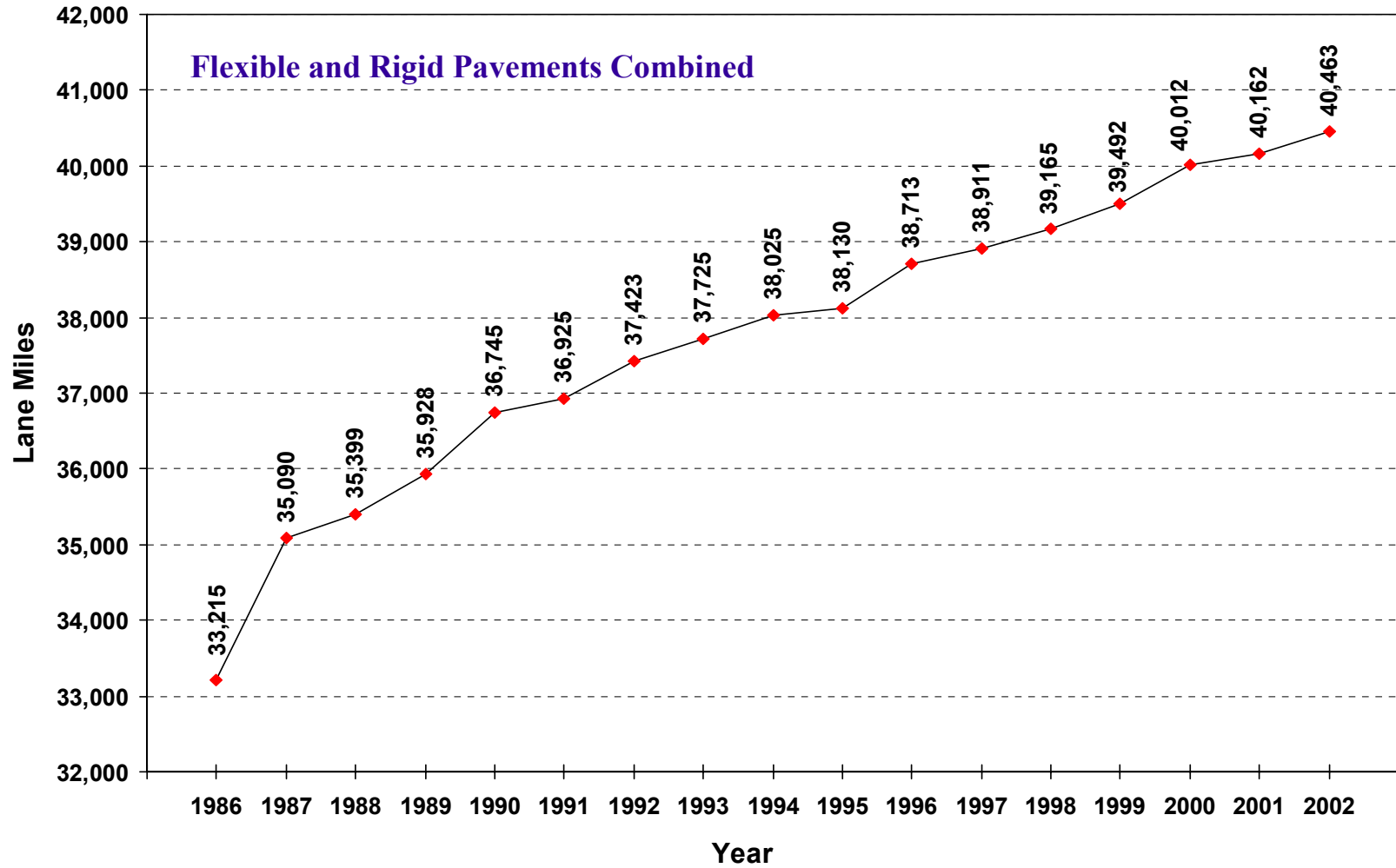
☞ Note: Sections that had known changes (under construction, rehabilitated, etc.) were excluded from analyses.

General Notes

- For multi-lane roadways: The worst lane in each direction is tested (normally the outermost traffic lane).
- For two lane roadways: The worst lane is tested (normally the same lane tested the previous year).
- Rated sections are determined by construction limits or significant changes in visual appearance (condition) of the pavement.
- Ride rating and Rut rating data are collected with four road profilers.
- Crack rating is subjective and collected visually (performed from windshield or roadway shoulder).
- Cracking is rated by severity levels and quantities for both the wheel path area and the area outside of the wheel path.

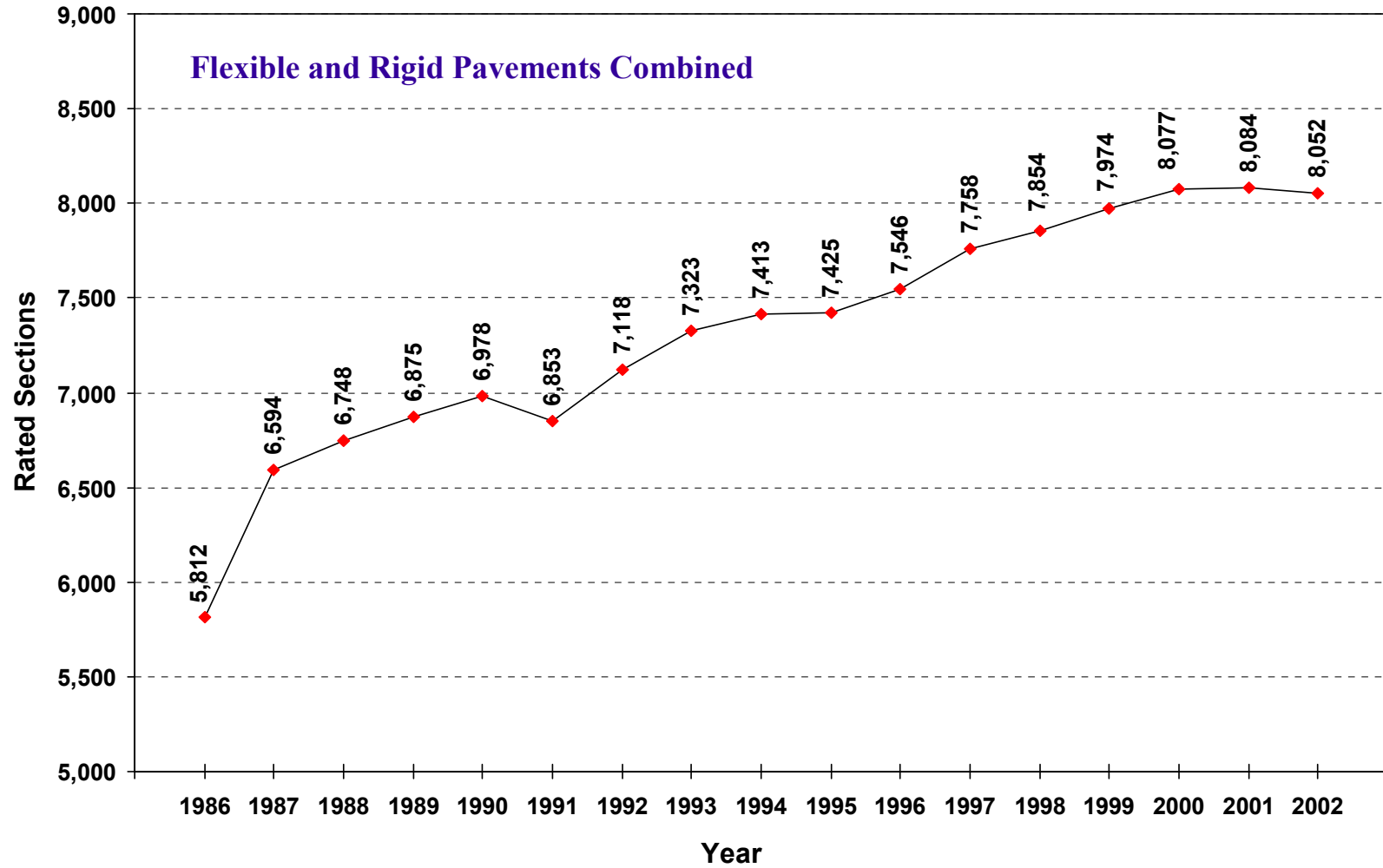
Production History

Lane Miles



Production History

Rated Sections

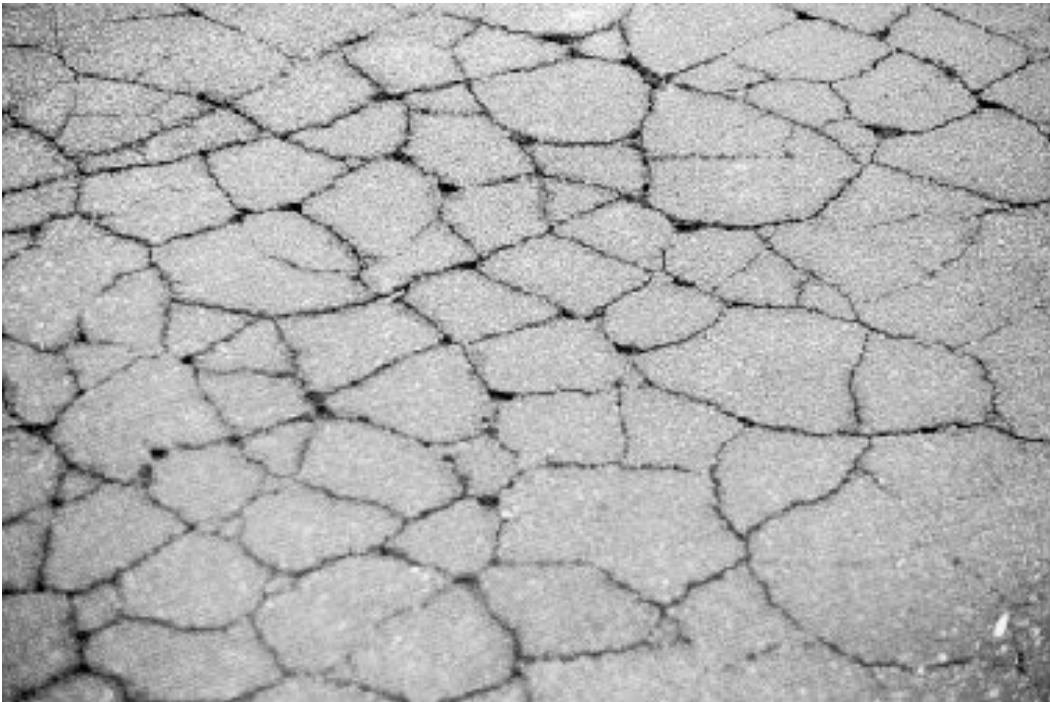


SECTION II

CRACK RATING

BY

SYSTEM AND DISTRICT



SECTION II

Crack Rating by System and District

Crack Rating Criteria

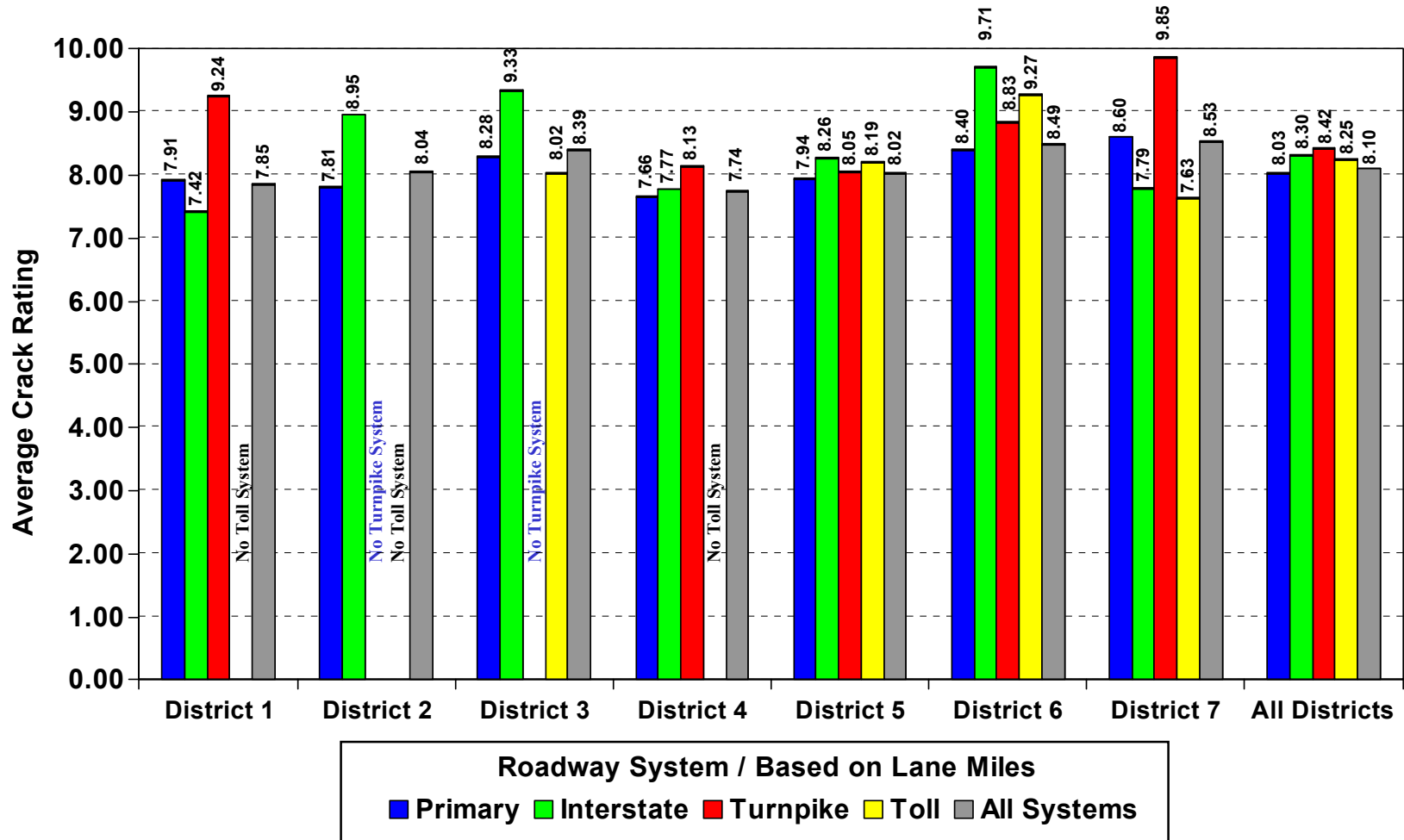
- Cracking is estimated as percentages of areas within the wheel paths (CW) and outside of the wheel paths (CO). These percentages are estimated separately for each of the two areas.
- Three types of cracking are rated depending upon severity levels (1B, II and III).
- Only the predominate type of cracking is used to determine the numerical deduct value that is subtracted from ten to establish the crack rating. However, the percentages of all types of cracking are used to calculate the percentage of pavement cracked.
- Cracking deficiency is rated on a zero to ten scale, where the rating of ten is best. Currently, a rating of six or less makes pavement segments eligible for rehabilitation.
- The Crack Rating is subtracted from a perfect score of ten.

$$\text{Crack Rating} = 10 - (\text{CW} + \text{CO})$$

Where: CW and CO are numerical factors for Cracking within the wheel paths (CW) and outside of the wheel paths (CO). These factors are based on the severity and extent of the type of cracking.

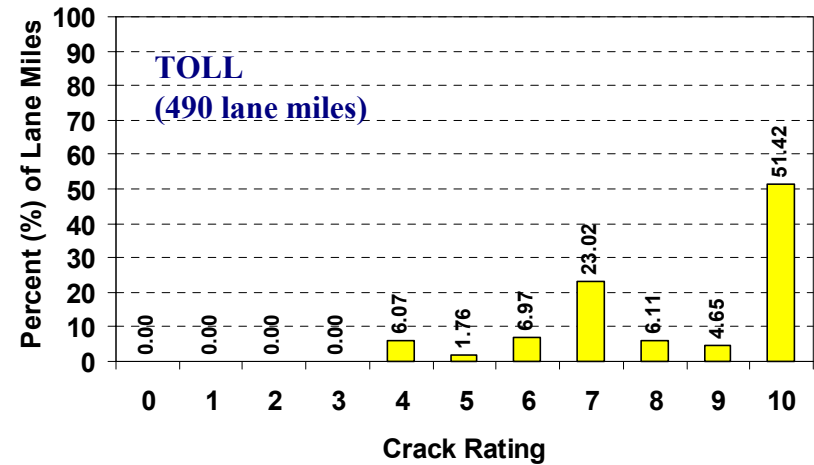
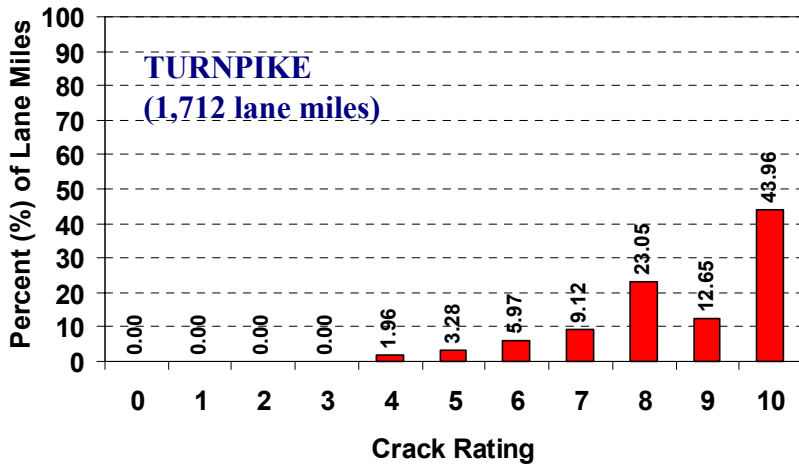
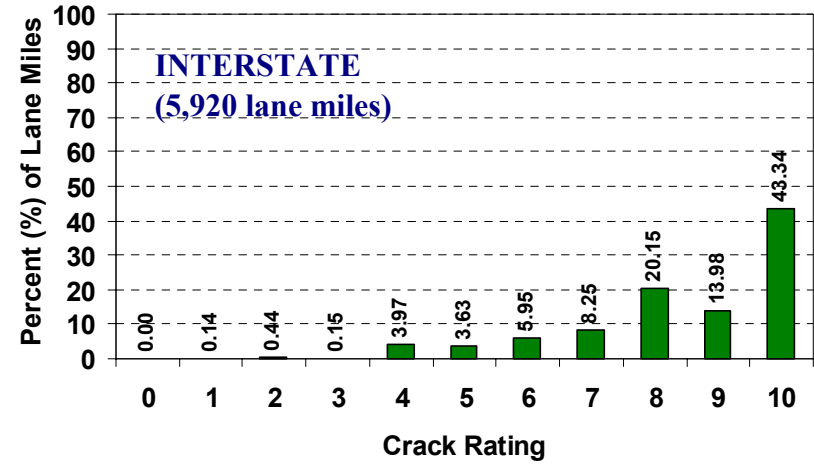
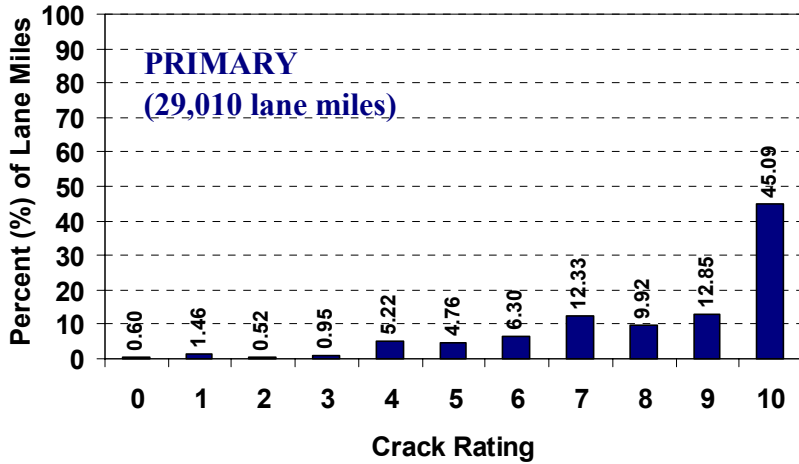
Crack Ratings by System and District

2002 Flexible Pavement Condition Survey



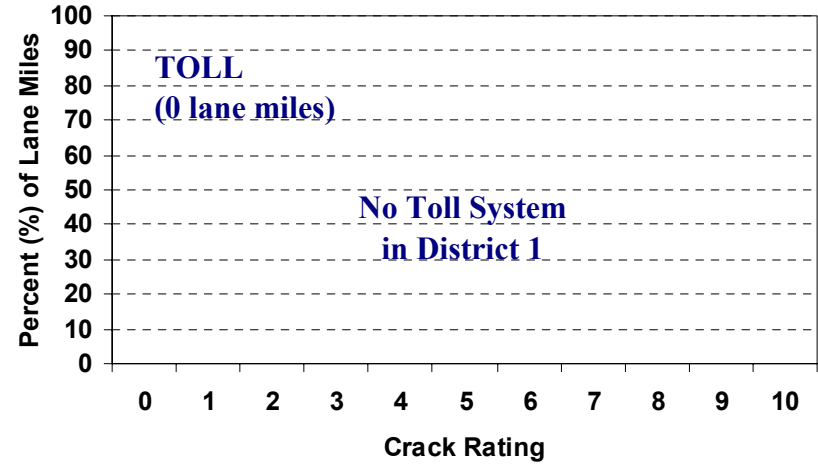
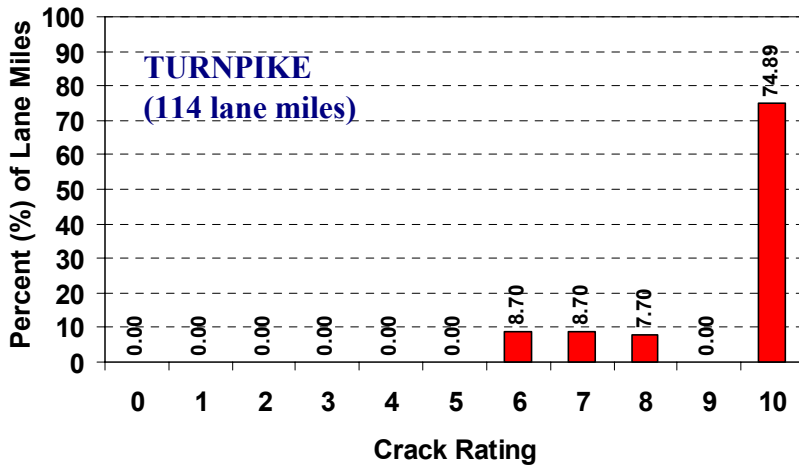
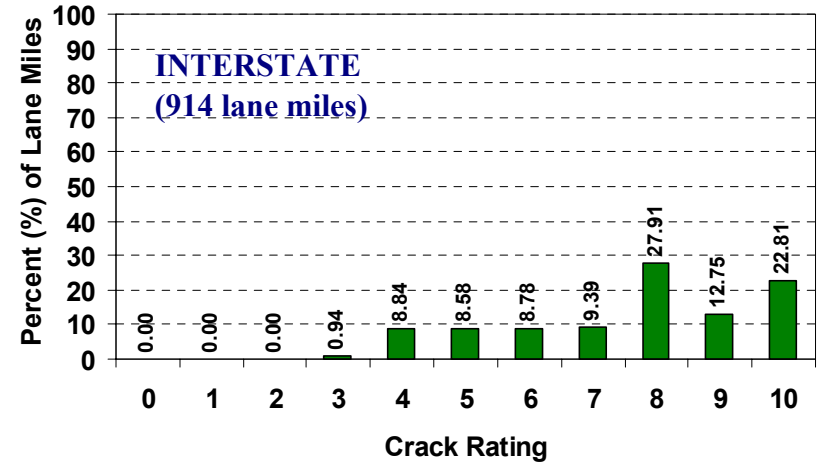
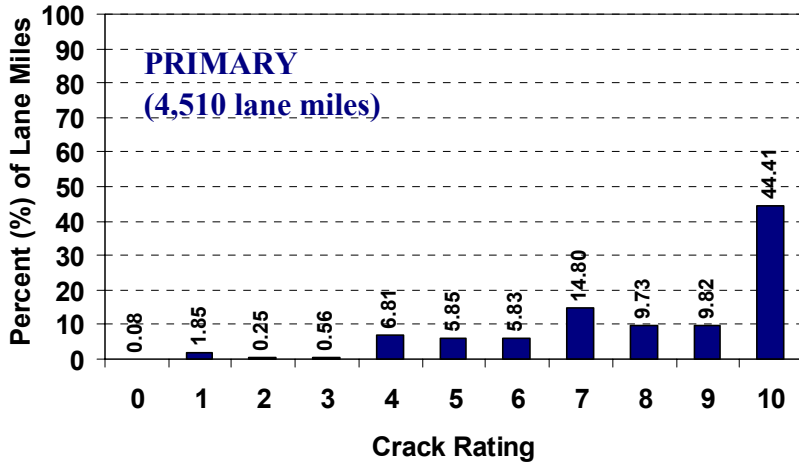
2002 Crack Distribution by System Statewide

01



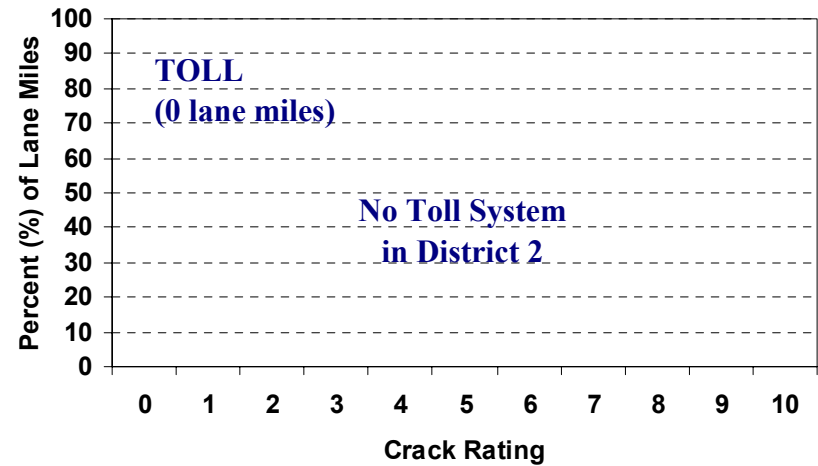
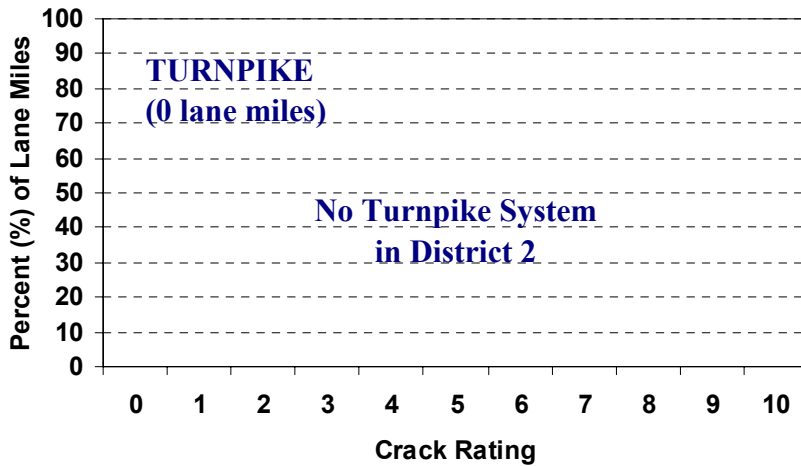
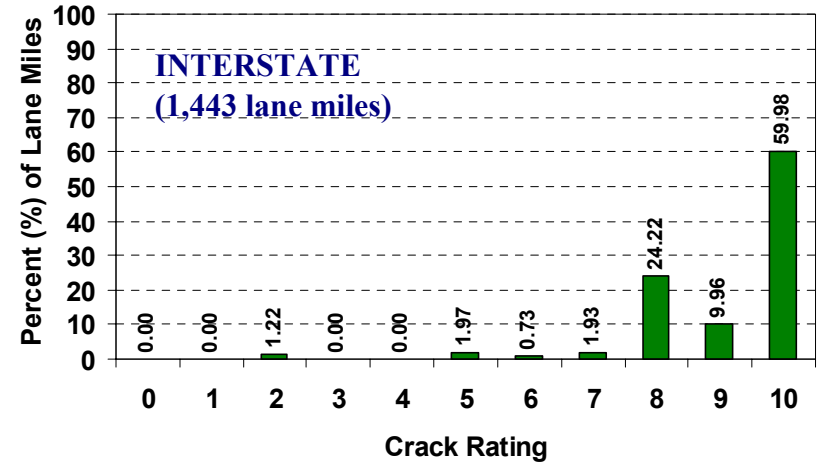
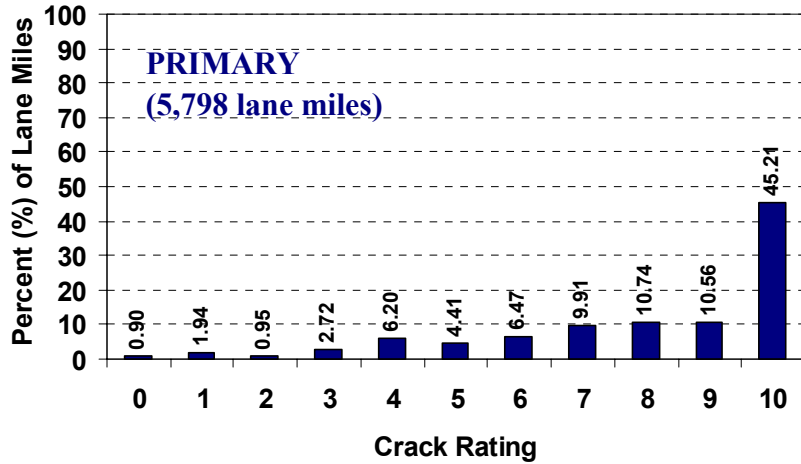
2002 Crack Distribution by System

District 1



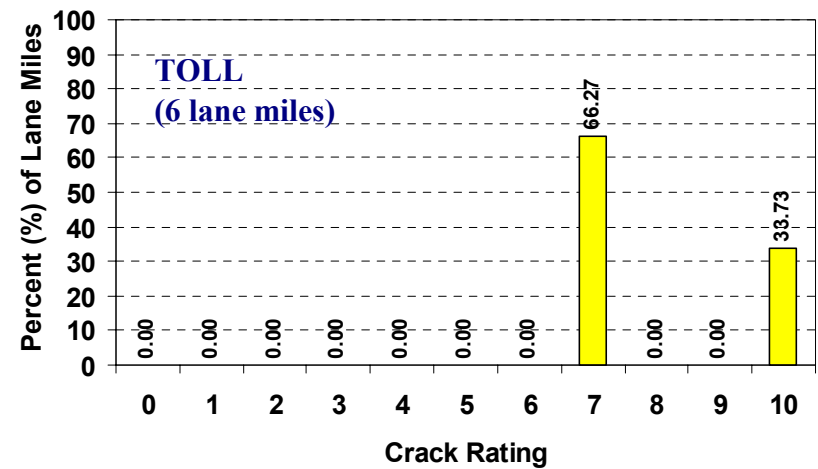
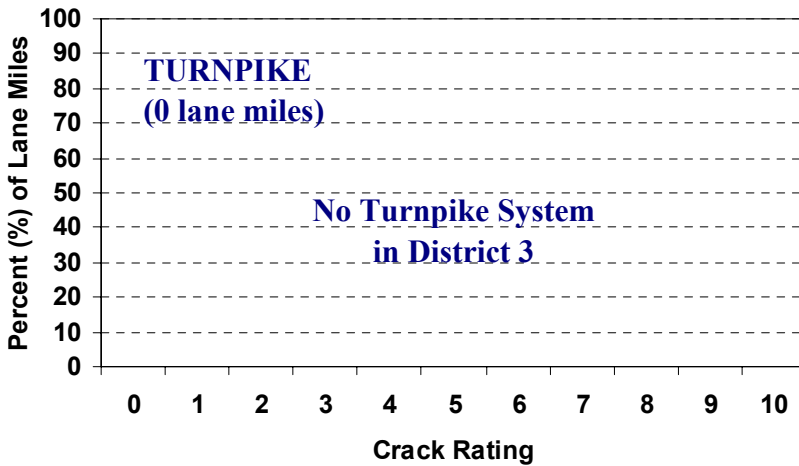
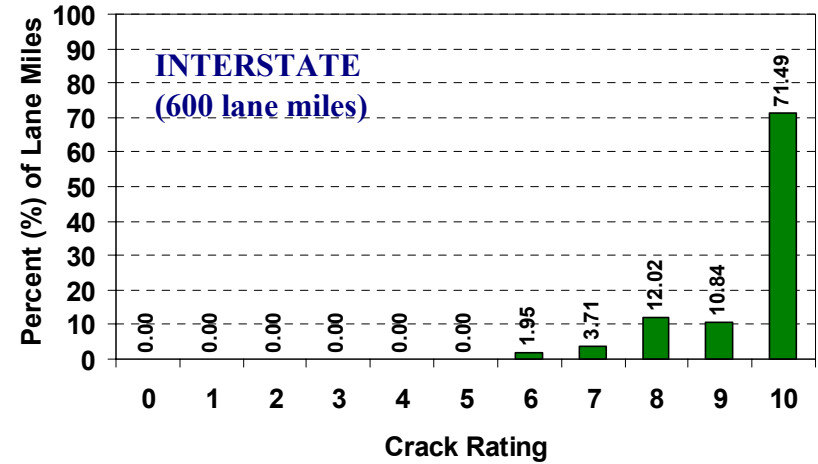
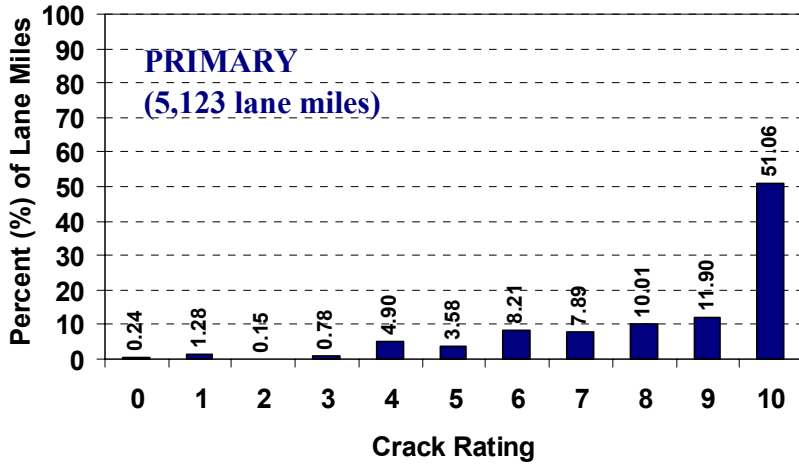
2002 Crack Distribution by System

District 2



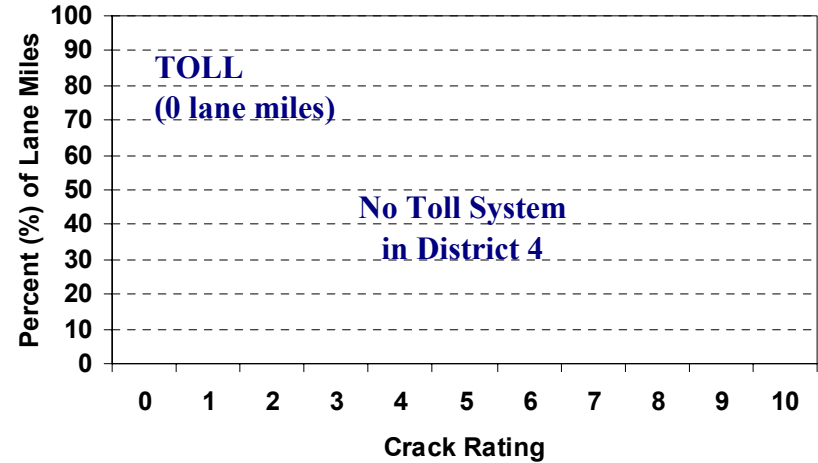
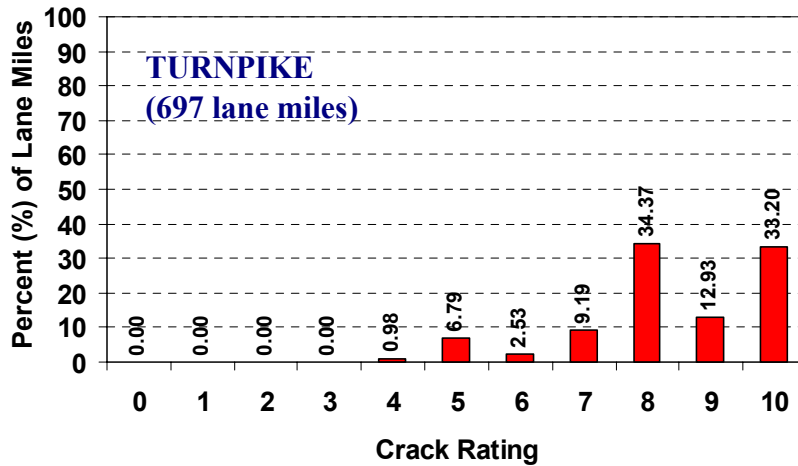
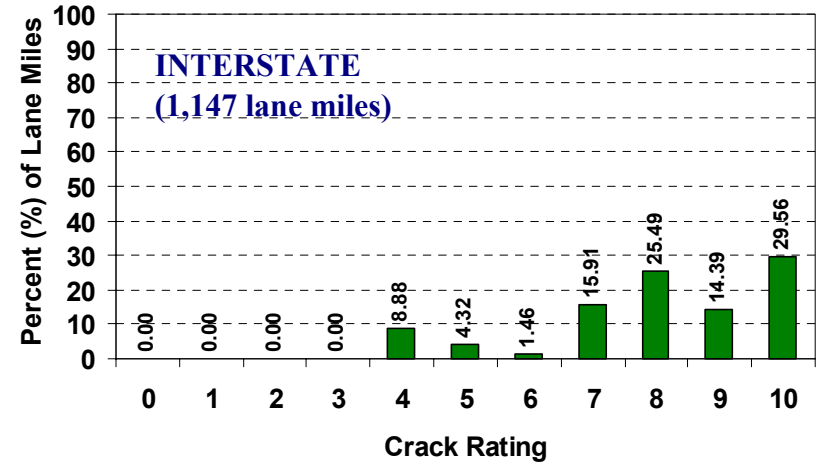
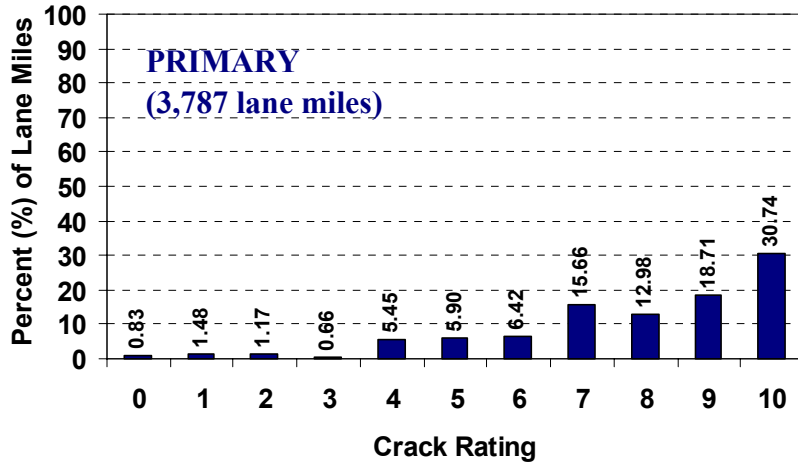
2002 Crack Distribution by System

District 3



2002 Crack Distribution by System

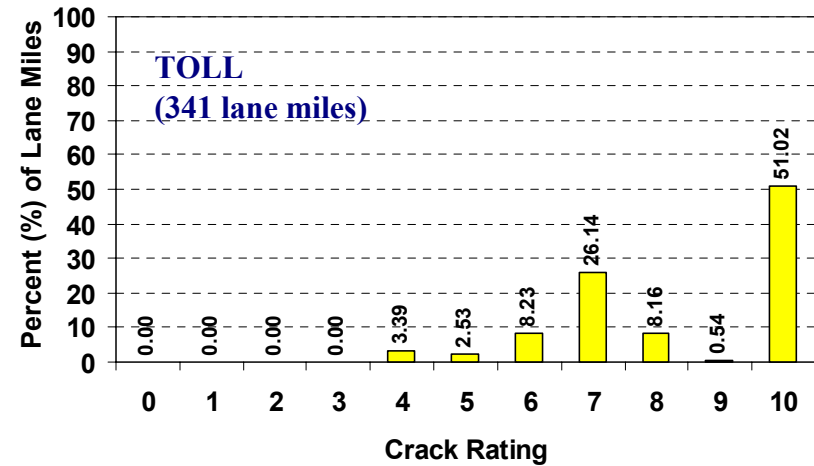
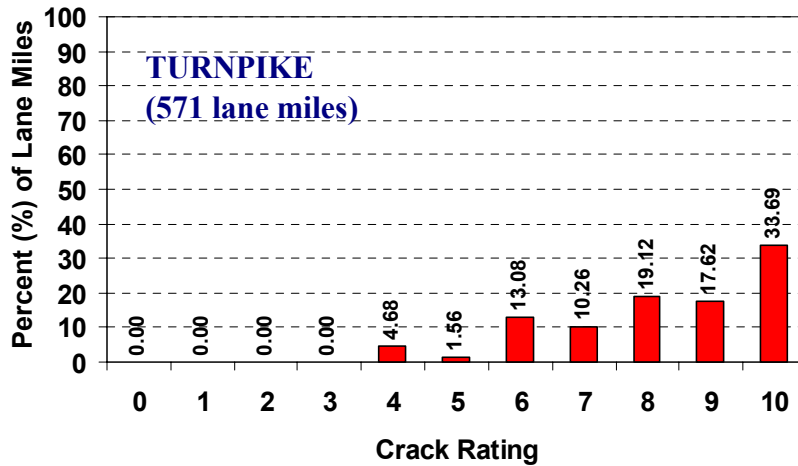
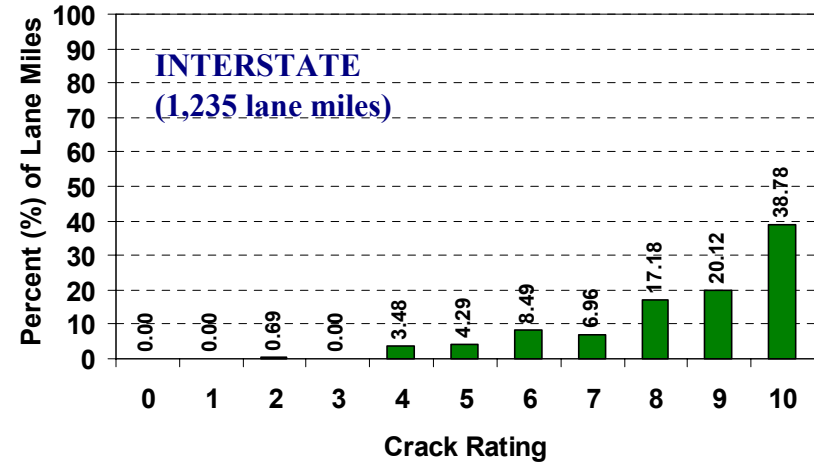
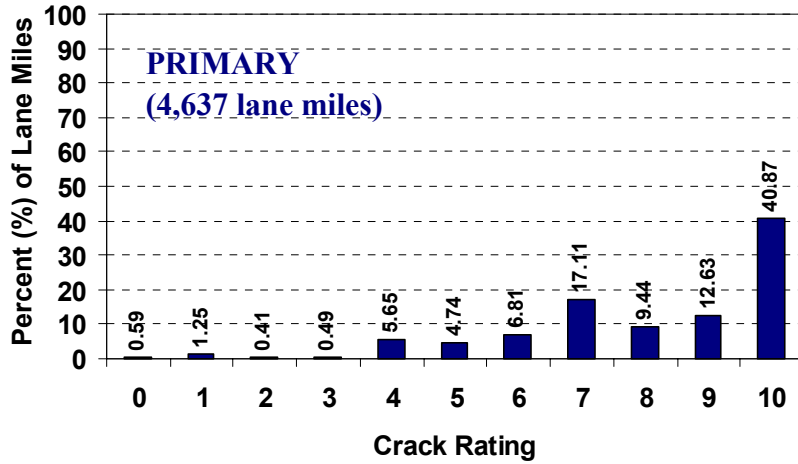
District 4



2002 Crack Distribution by System

District 5

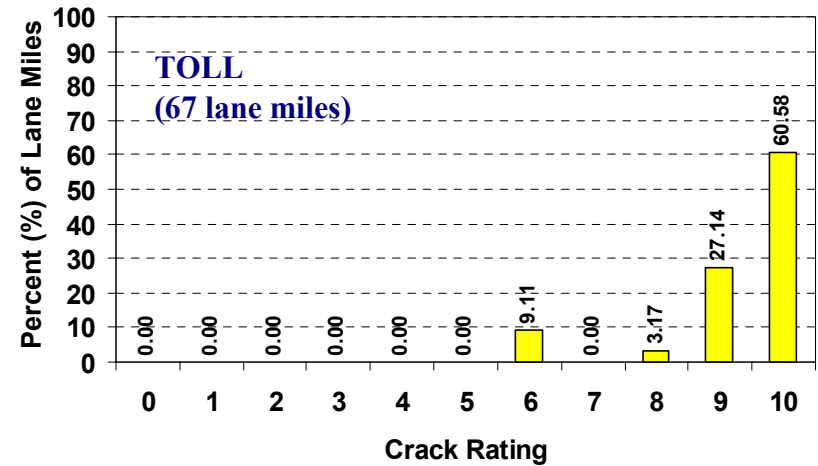
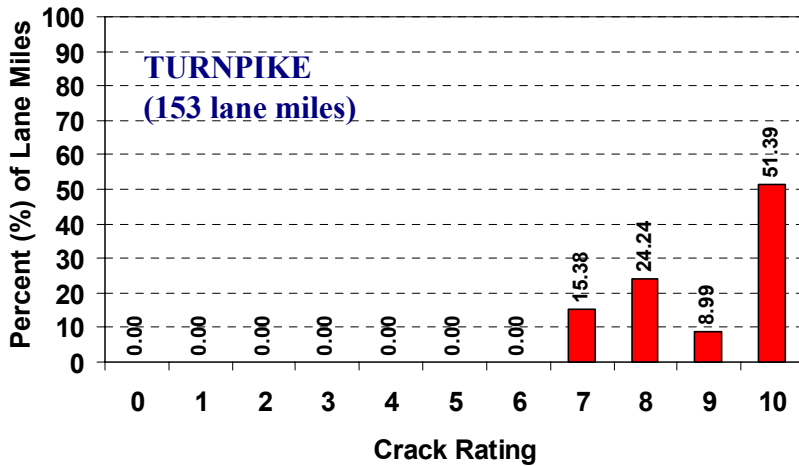
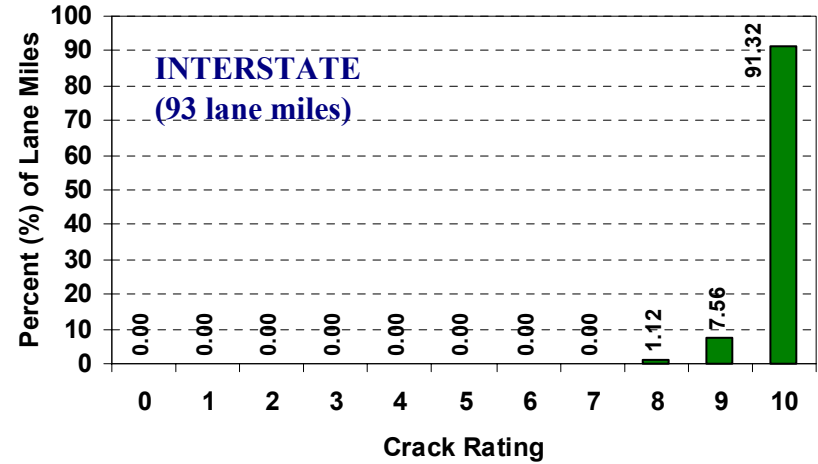
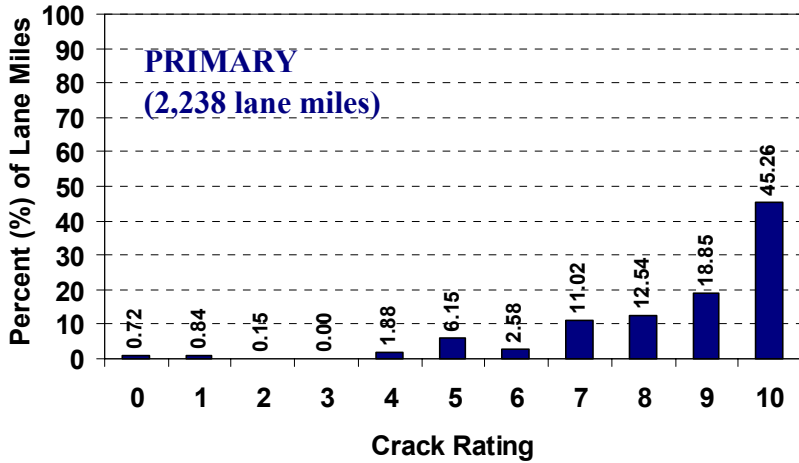
51



2002 Crack Distribution by System

District 6

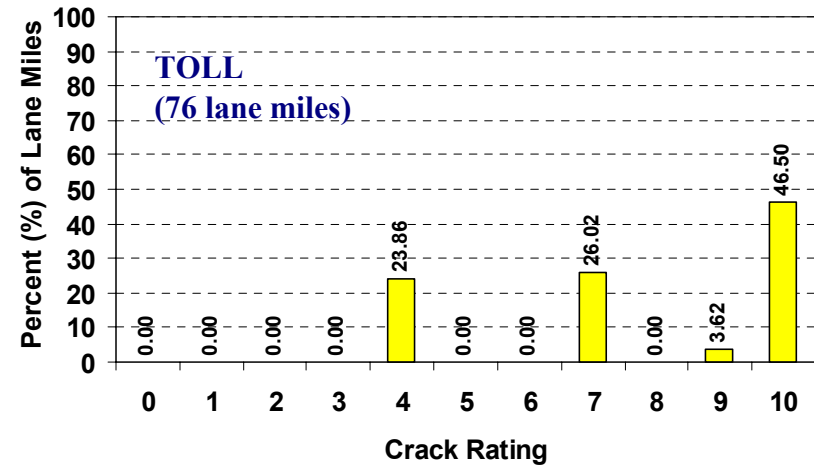
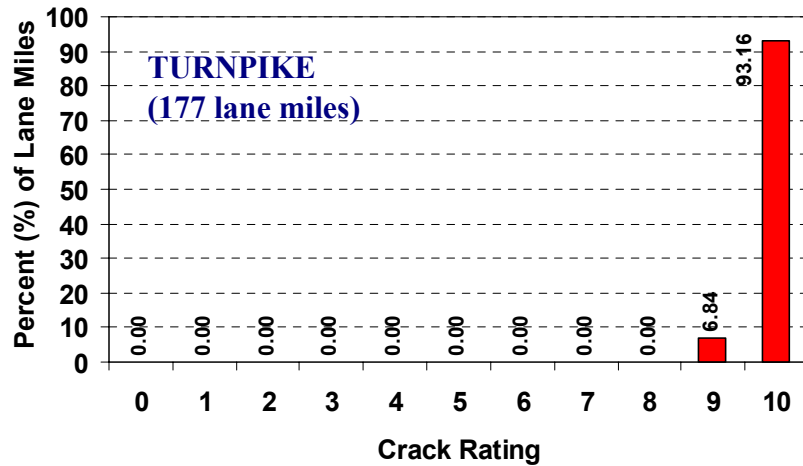
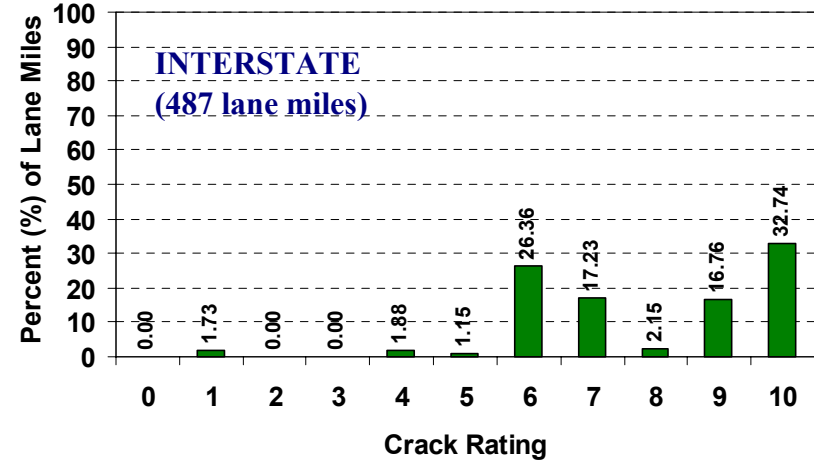
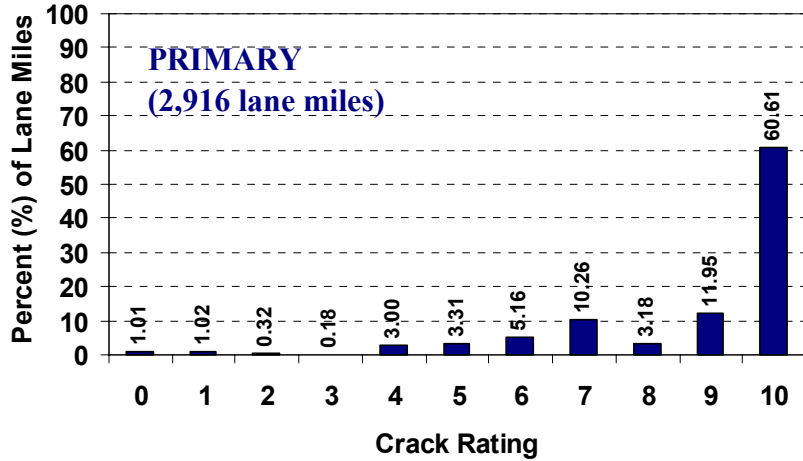
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2002 Crack Distribution by System

District 7

L1



SECTION III

RUT RATING

BY

SYSTEM AND DISTRICT



SECTION III

Rut Rating by System and District

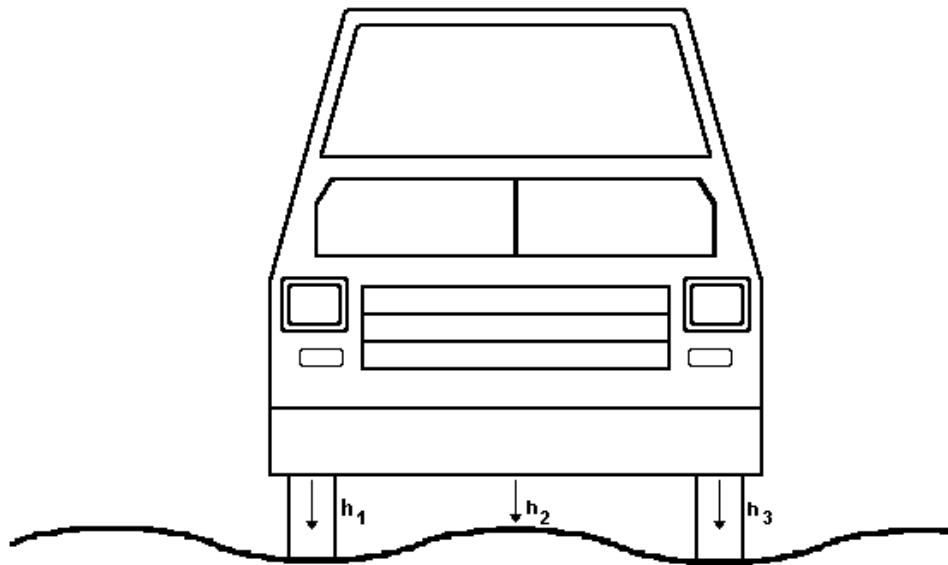
Rut Rating Criteria

- A Rut is a continuous longitudinal depression deviating from a surface plane defined by transverse cross slope and longitudinal profile. This depression normally occurs in the wheel path.
- A Rut Depth is defined herein as the difference in elevations between the center of the wheel path and the center of the travel lane.
- Rut Depth is measured simultaneously with the Ride values using a profiler. See illustration on next page.
- The profiler measures Rut Depth approximately 30 times per inch when traveling at 60 mph. The measurements are then stored on one-foot intervals for the survey.
- The average Rut Depth for both wheel paths is recorded and then converted to a one point deduct for every eighth (1/8) of an inch of average Rut Depth.
- Rut Depth is rated on a zero to ten scale, where ten is best. A ten would indicate no rutting while a six would indicate half (1/2) of an inch of rutting. Currently pavement sections with ratings of six or less are eligible for rehabilitation.
- Rut Depth for each measurement is calculated using the following equation:

$$\text{Rut Depth} = \frac{(h_1 - h_2) + (h_3 - h_2)}{2}$$

Where: h_1 , h_2 , and h_3 , are the respective distances between the sensor locations and the roadway surface directly below each sensor. See diagram on next page.

ROAD PROFILER



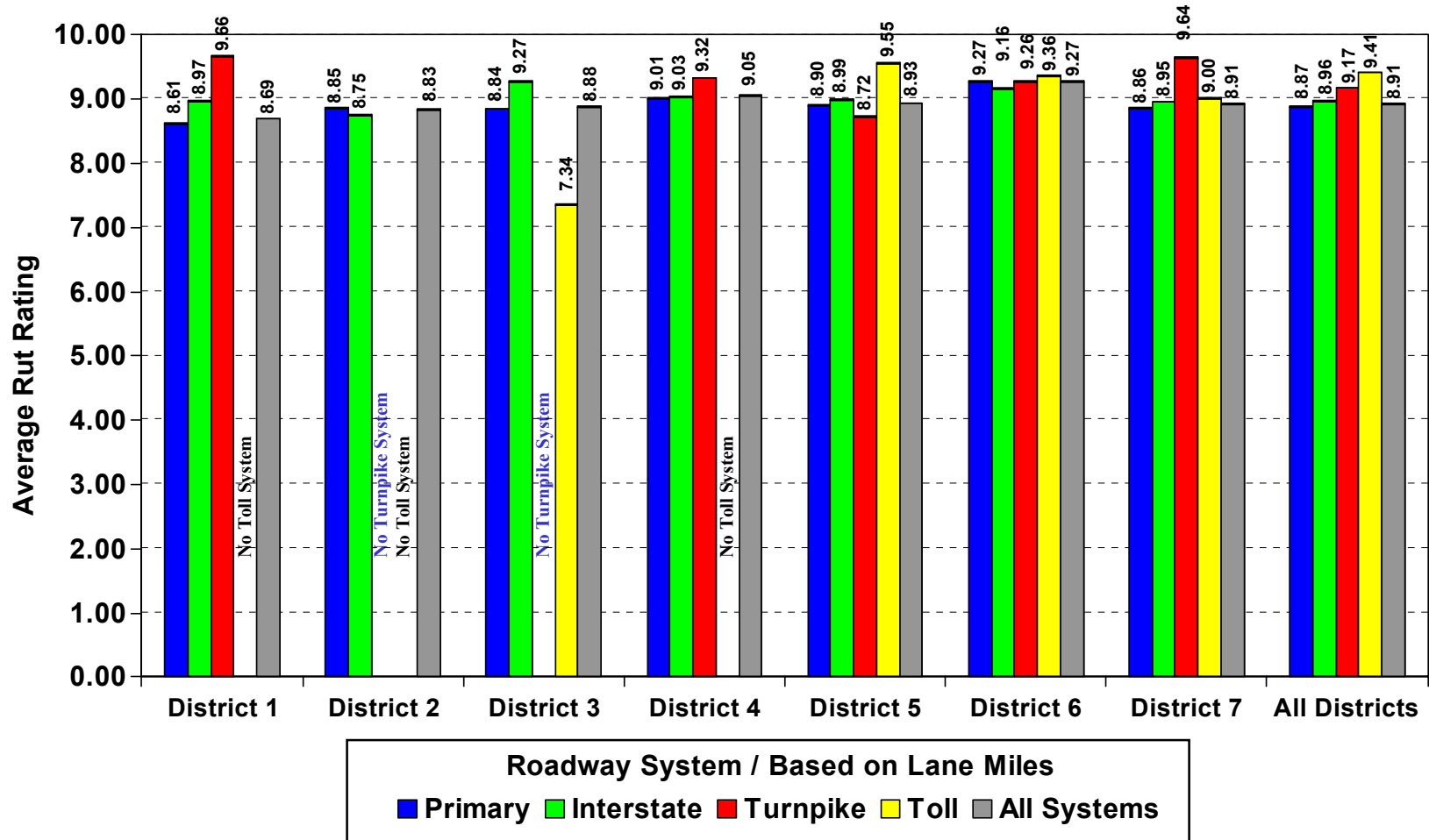
FRONT VIEW

$$\text{Rut Depth} = \frac{(h_1 - h_2) + (h_3 - h_2)}{2}$$

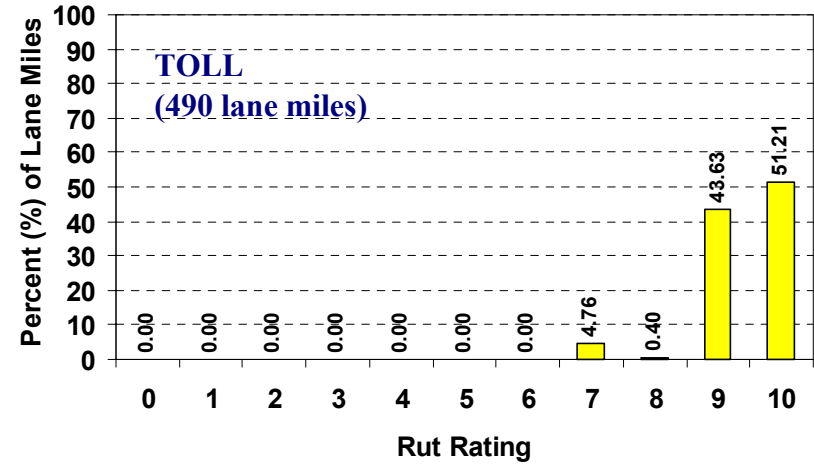
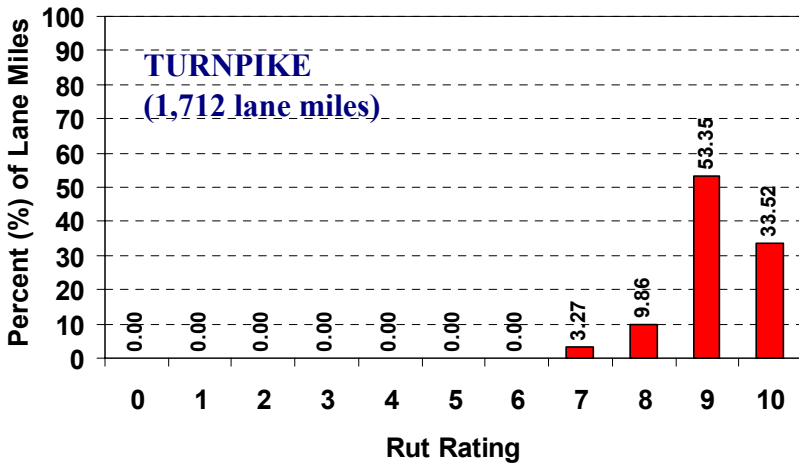
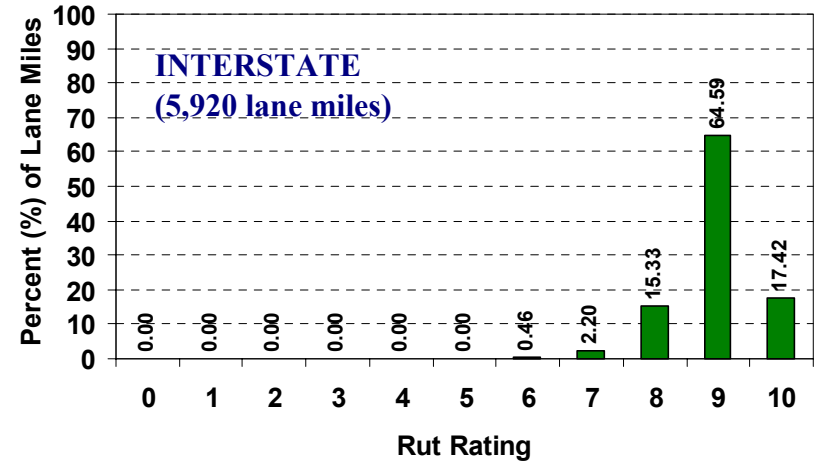
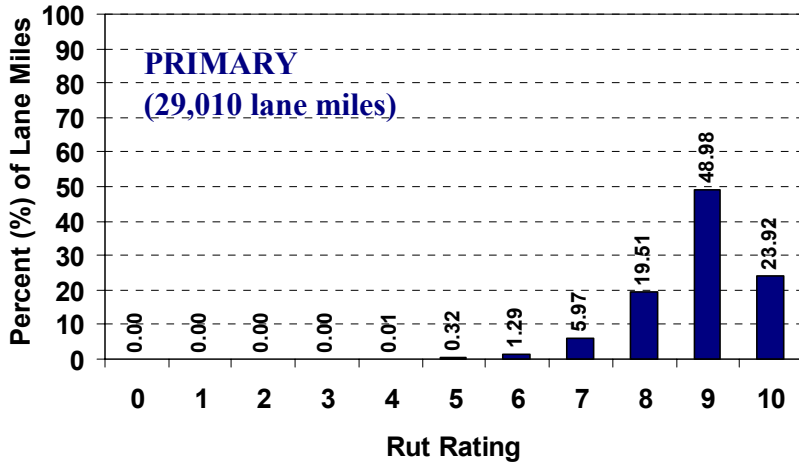
The Profiler has three sensors (to measure ride and rut), combined with two accelerometers and a data acquisition system (computer) that monitors the pavement's longitudinal and transverse profiles while in motion.

Rut Ratings by System and District

2002 Flexible Pavement Condition Survey

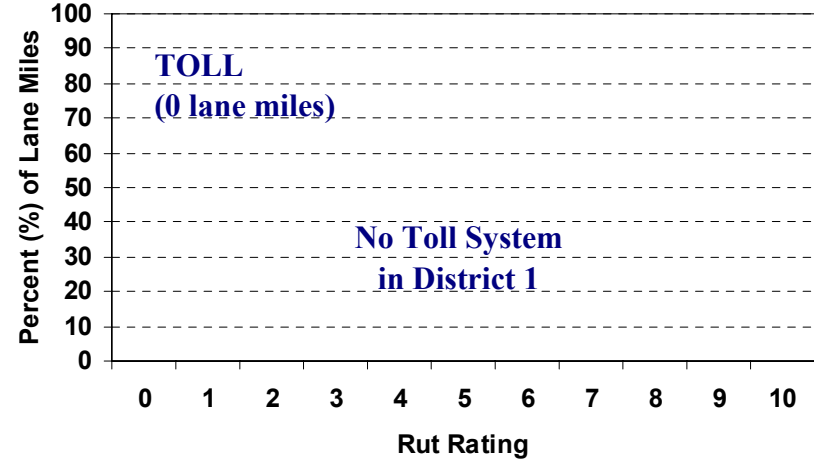
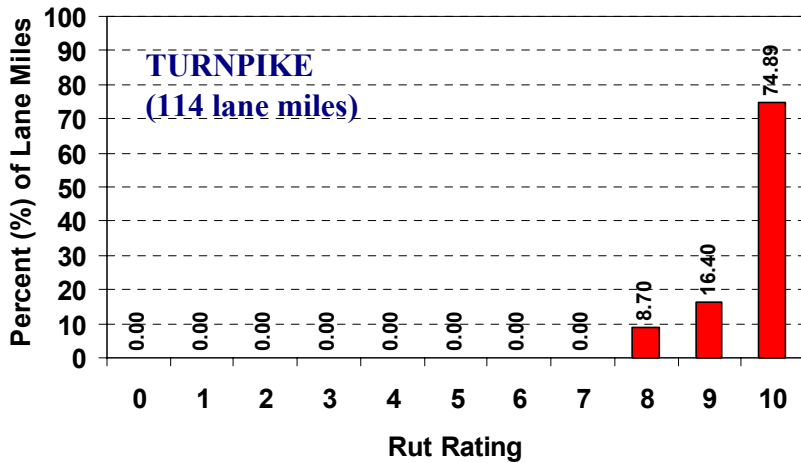
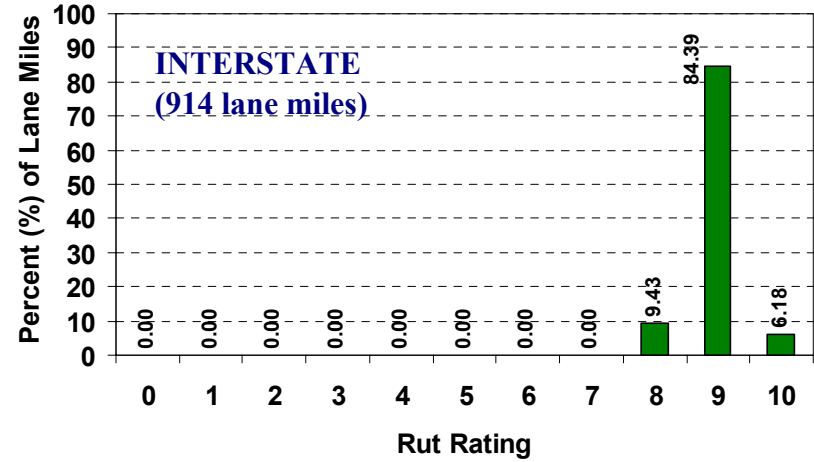
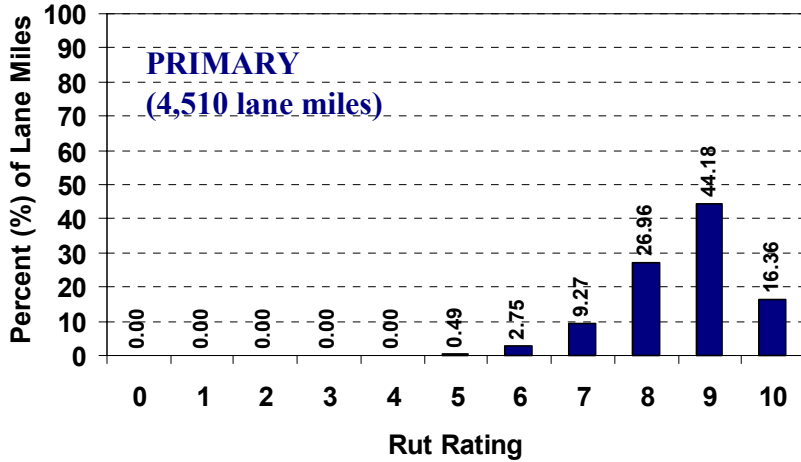


2002 Rut Distribution by System Statewide



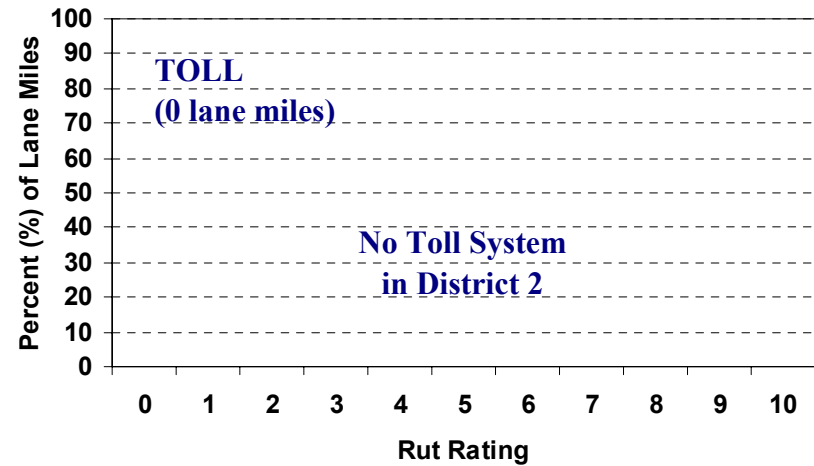
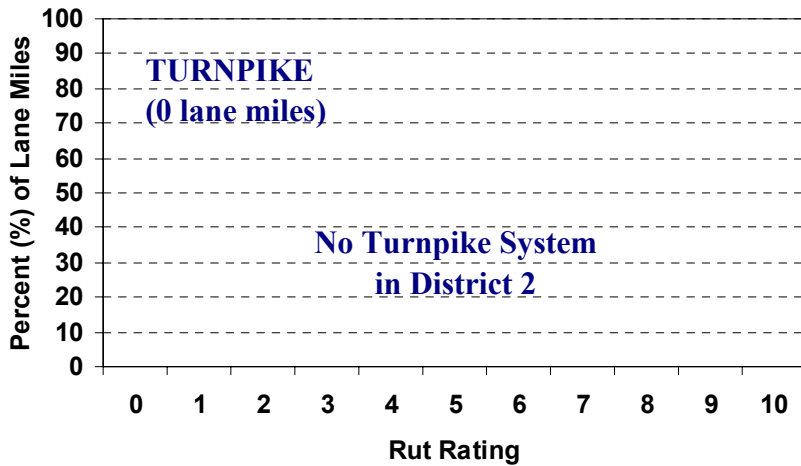
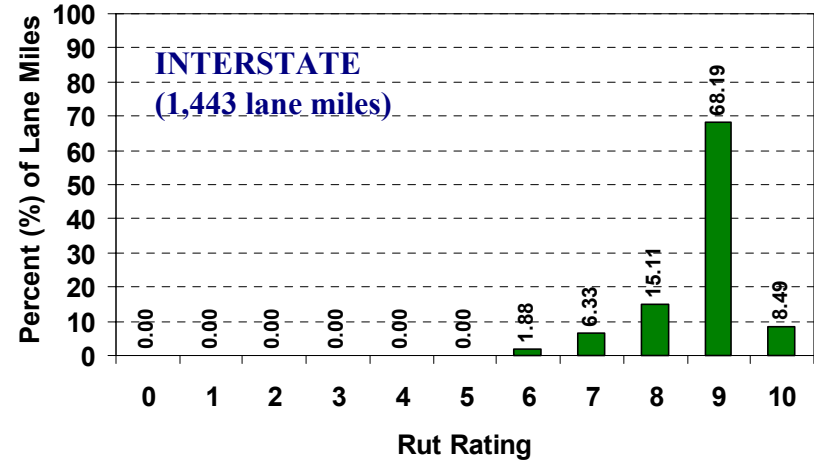
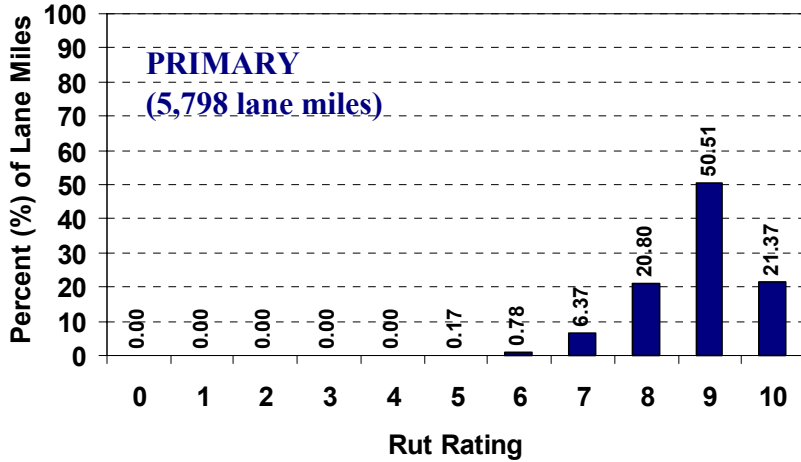
2002 Rut Distribution by System

District 1



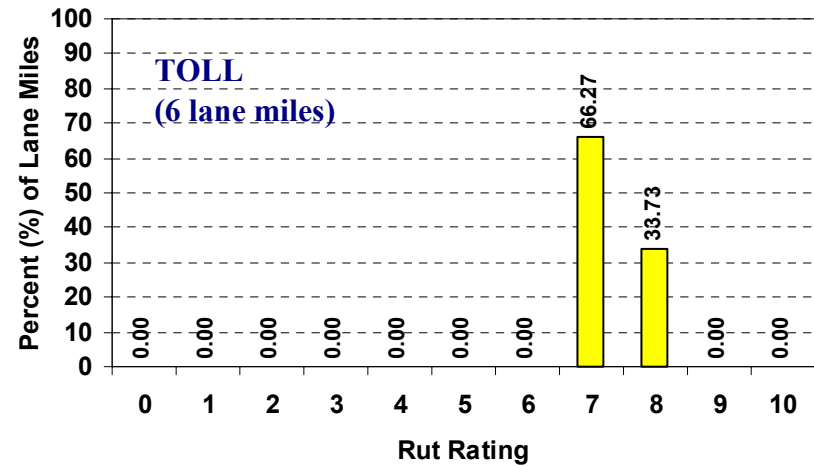
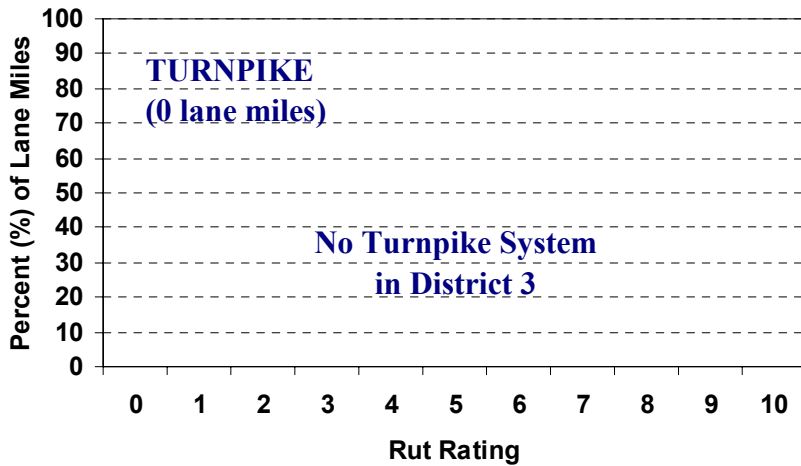
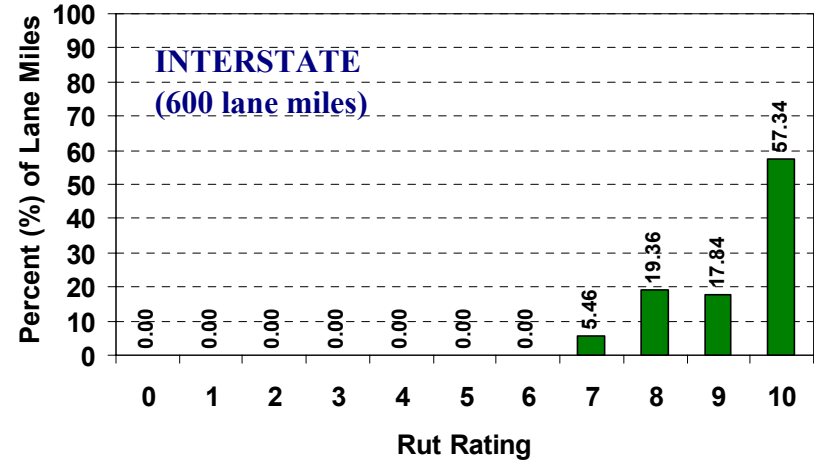
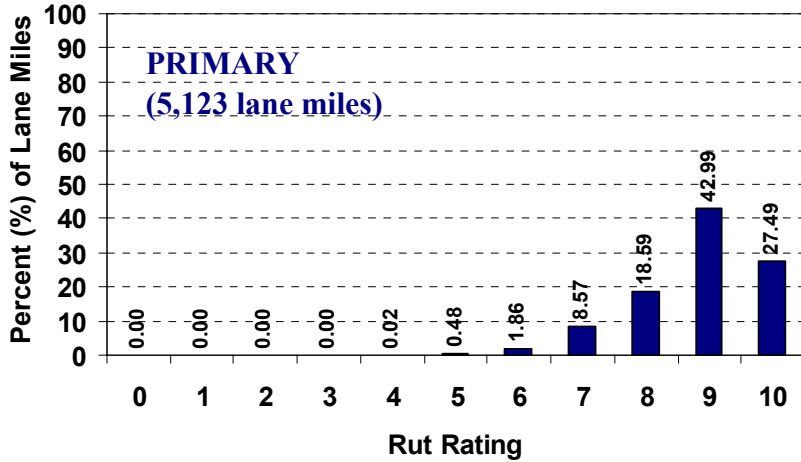
2002 Rut Distribution by System

District 2



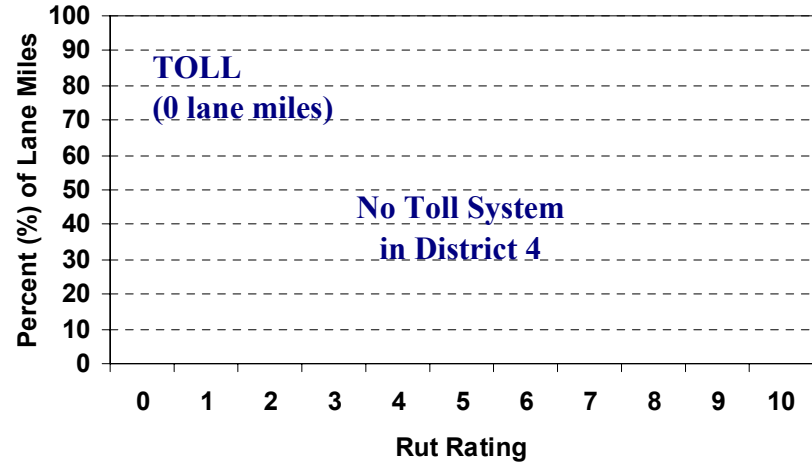
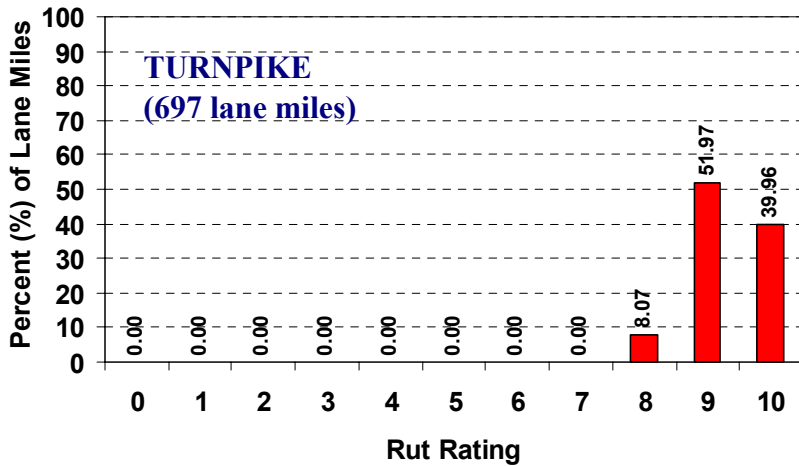
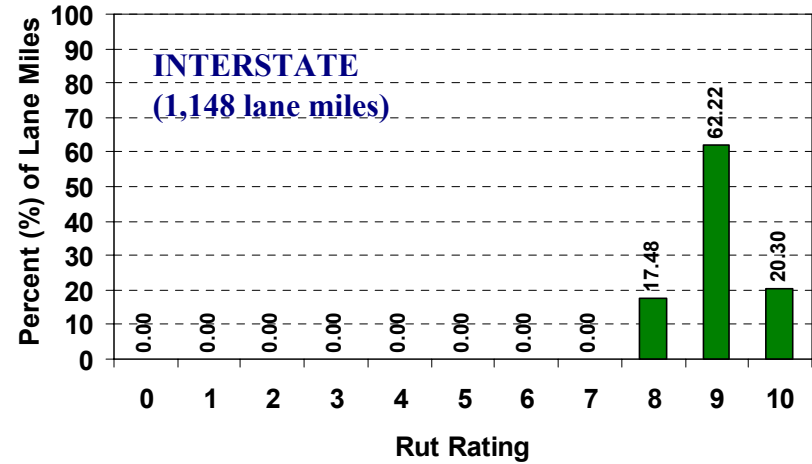
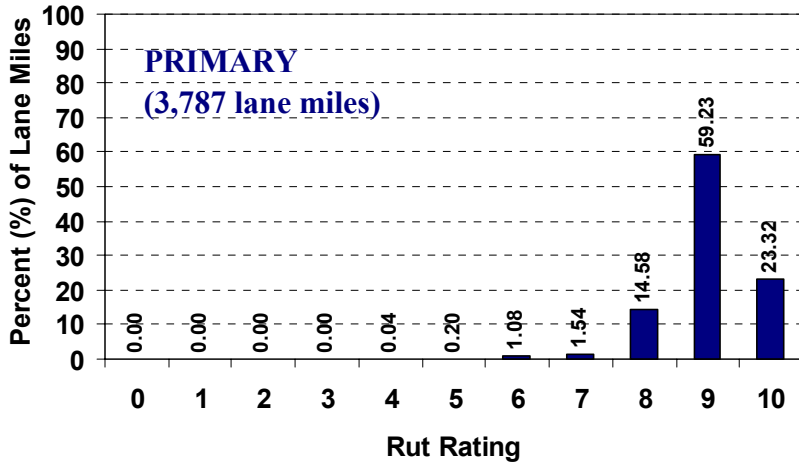
2002 Rut Distribution by System

District 3



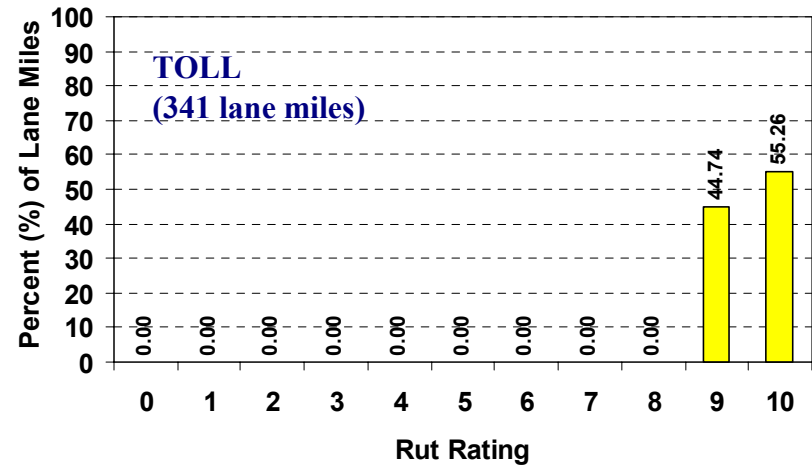
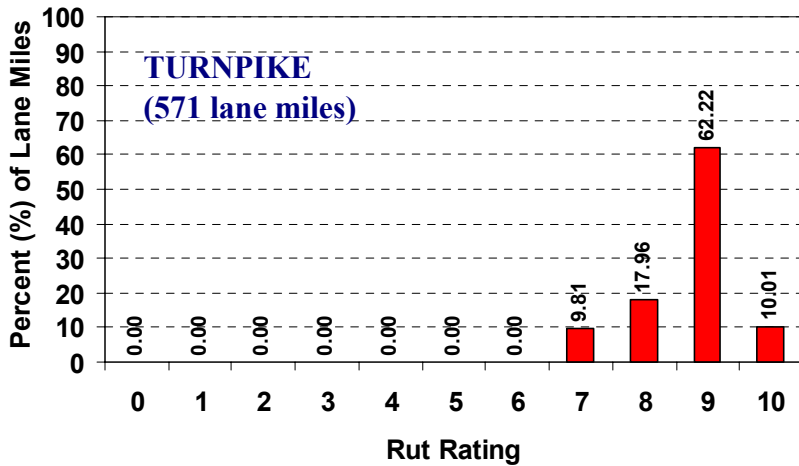
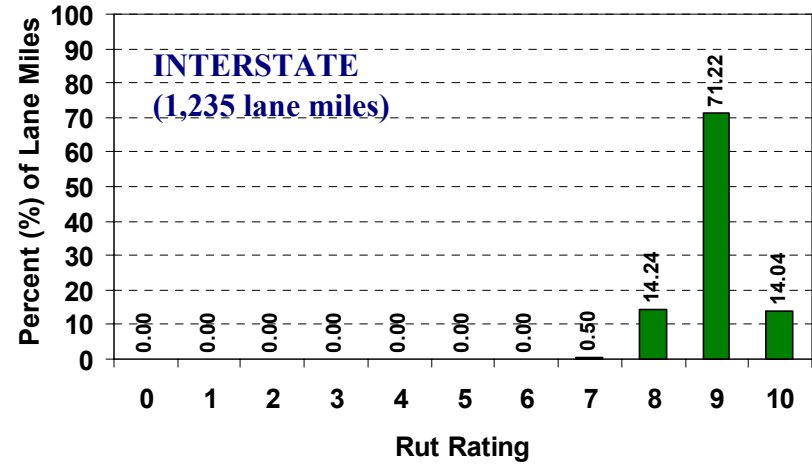
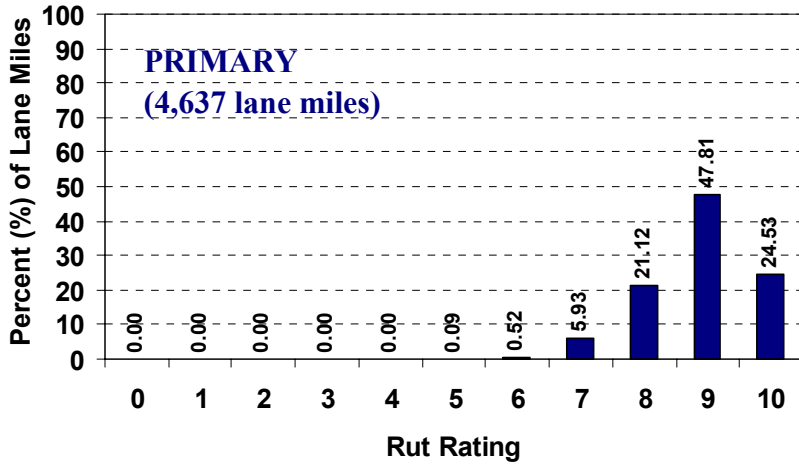
2002 Rut Distribution by System

District 4



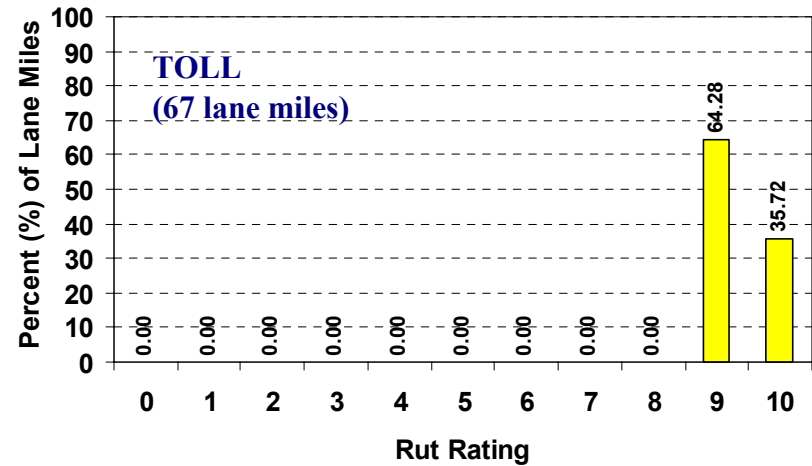
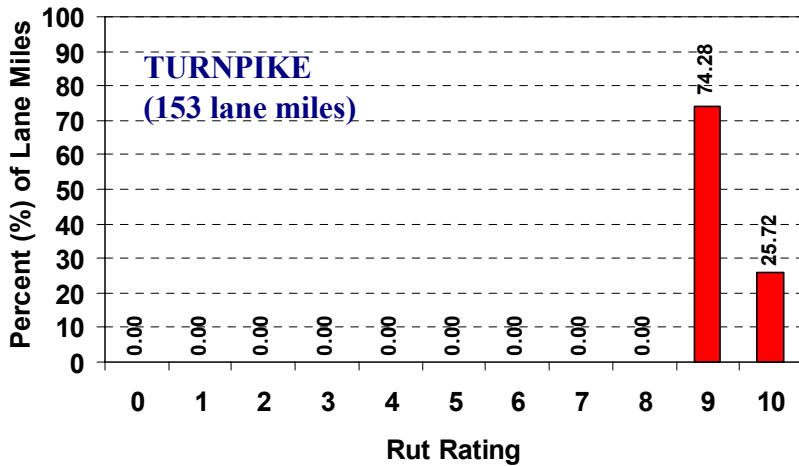
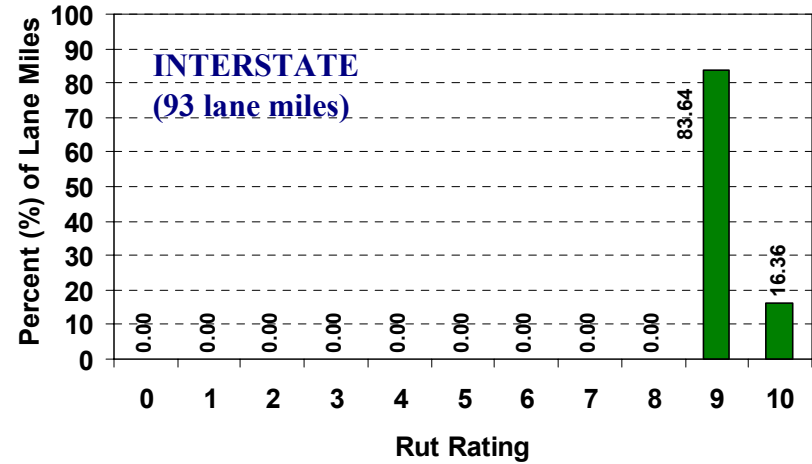
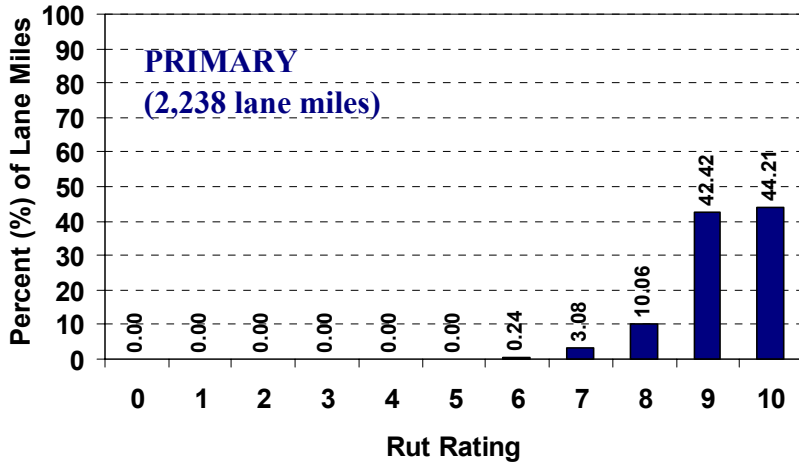
2002 Rut Distribution by System

District 5



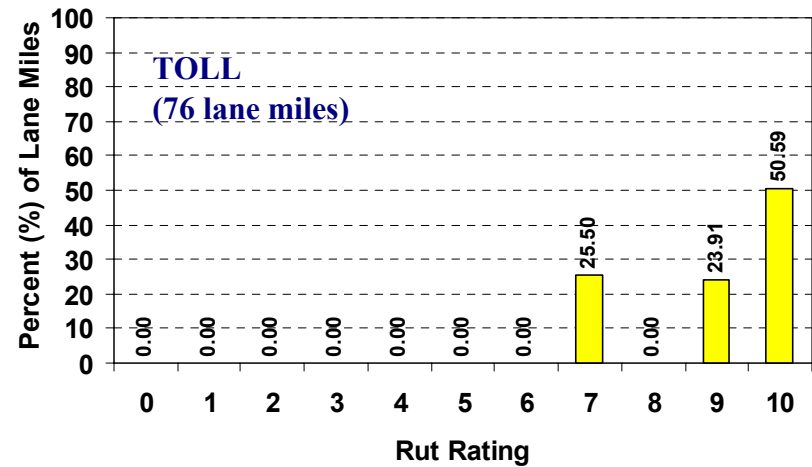
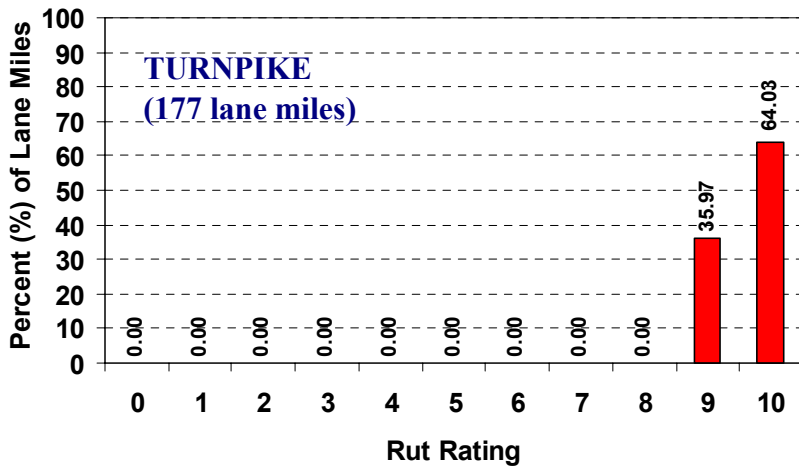
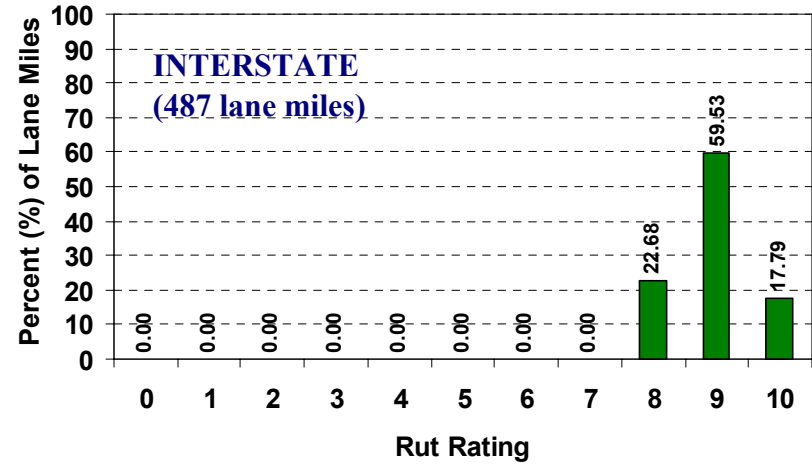
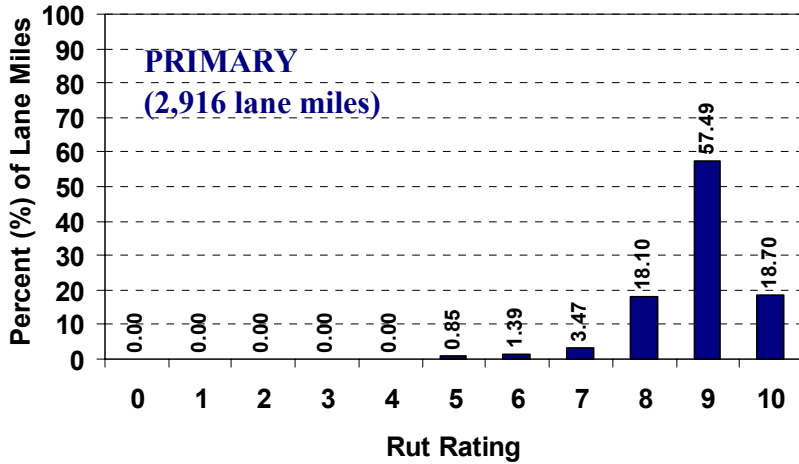
2002 Rut Distribution by System

District 6



2002 Rut Distribution by System

District 7



SECTION IV

RIDE RATING

BY

SYSTEM AND DISTRICT



SECTION IV

Ride Rating by System and District

Ride Rating Criteria

- Ride Ratings measure the ride quality of a pavement section. It is an indication of the degree of smoothness or roughness of the wearing surface.
- Ride Ratings are calculated from Ride Number (ASTM E-1489).

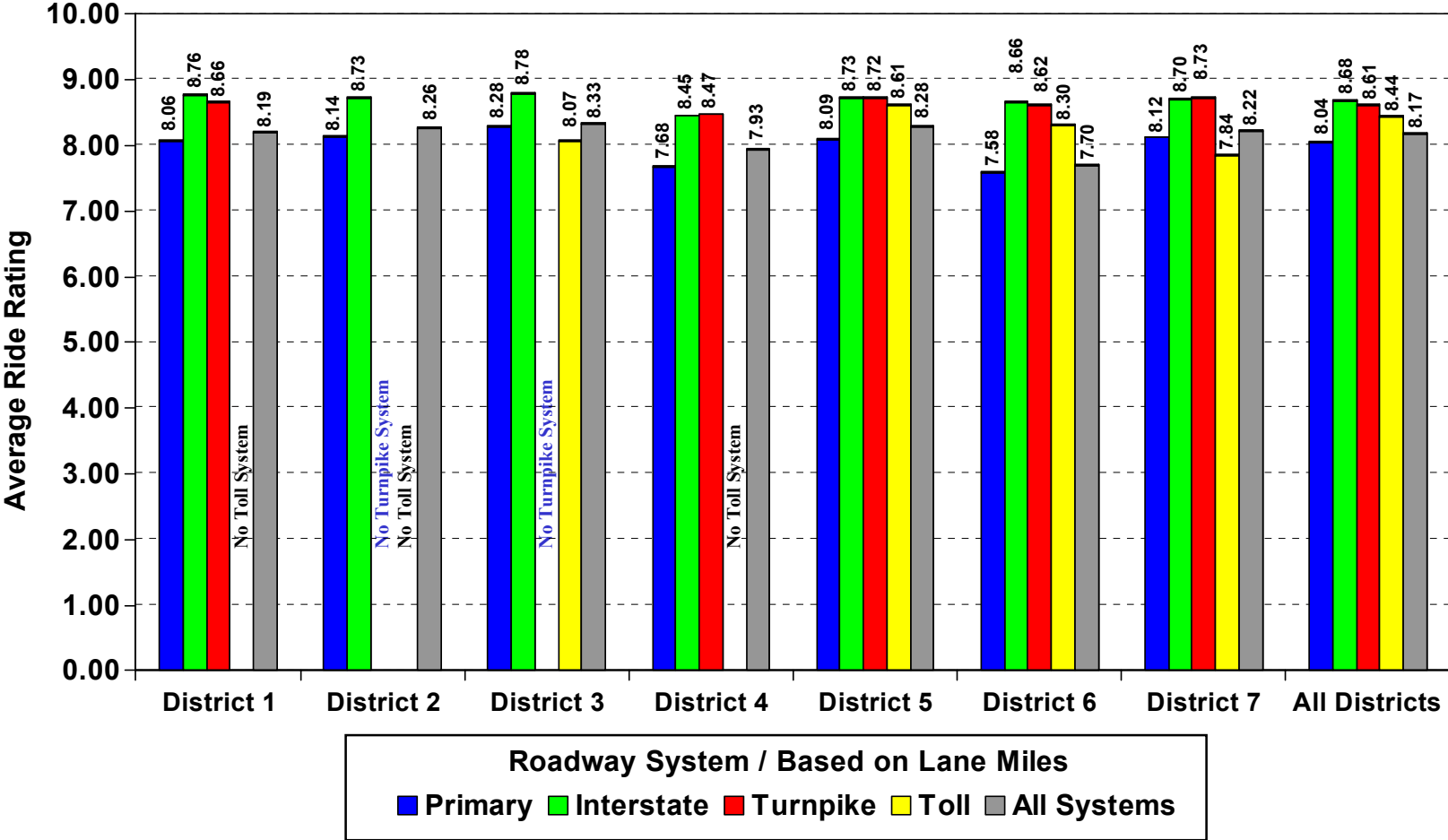
Ride Number x 2 = Ride Rating

Ride Number is a mathematical processing of longitudinal profile measurements to produce an estimate of subjective ride quality or user perception. The Ride Number is based on an algorithm published in National Cooperative Highway Research Project (NCHRP) 1-23. Ride Number is an ASTM Standard (E-1489).

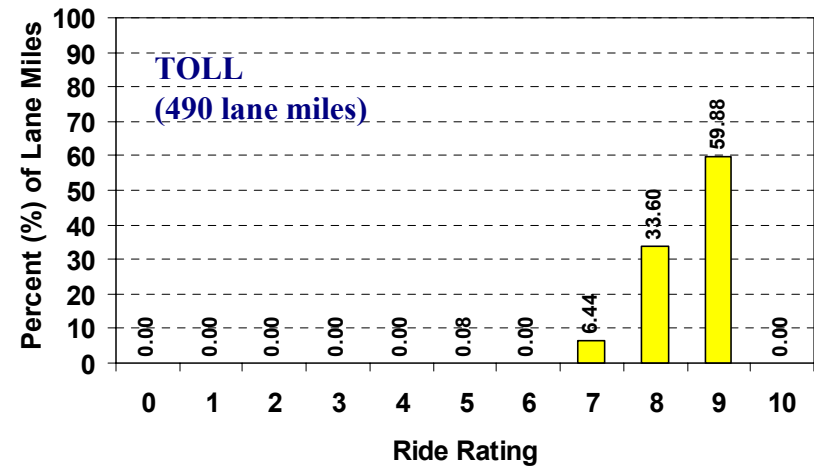
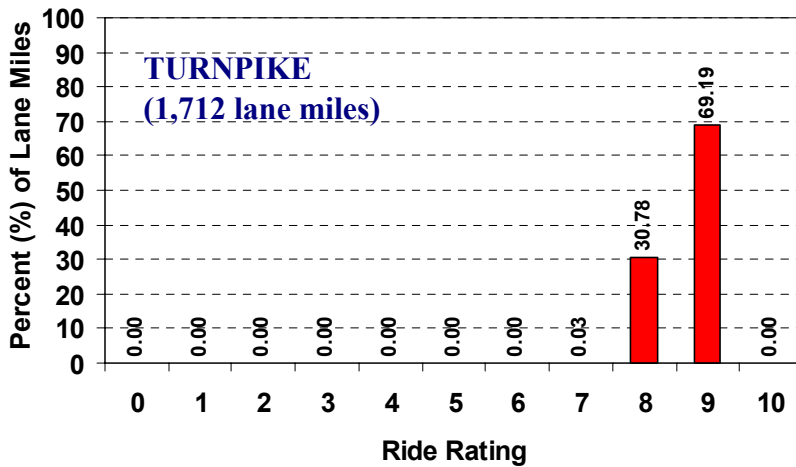
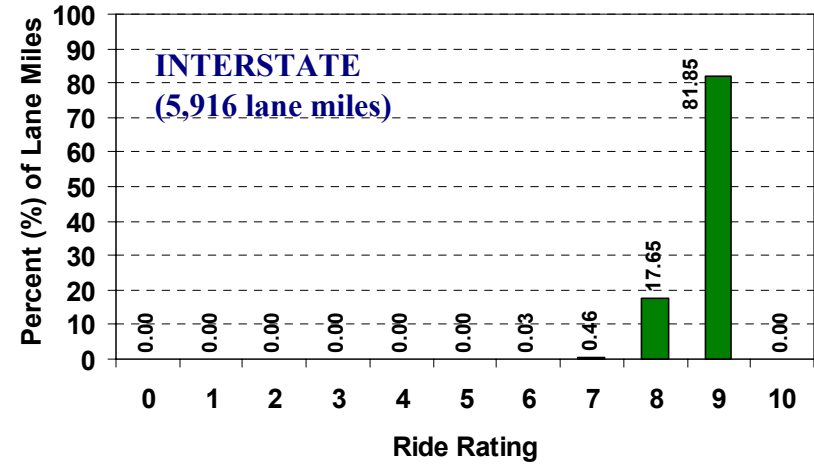
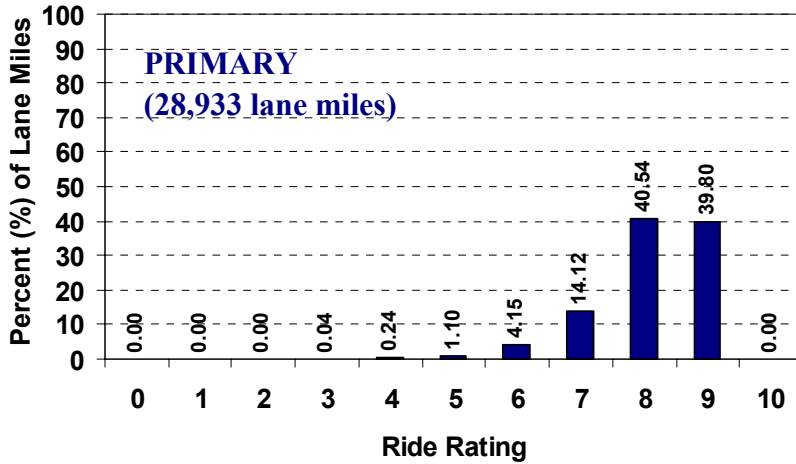
- Rideability is greatly affected by factors that include the following:
 - ▶ Original pavement profile
 - ▶ Profiles from intersecting roads
 - ▶ Utility patches and manhole covers
 - ▶ Surface and structural deterioration
- Ride deficiency is rated on a zero to ten scale, where ten is best. A ten would indicate a very smooth surface. Currently pavement sections with ratings of six or less are eligible for rehabilitation.

Ride Ratings by System and District

2002 Flexible Pavement Condition Survey

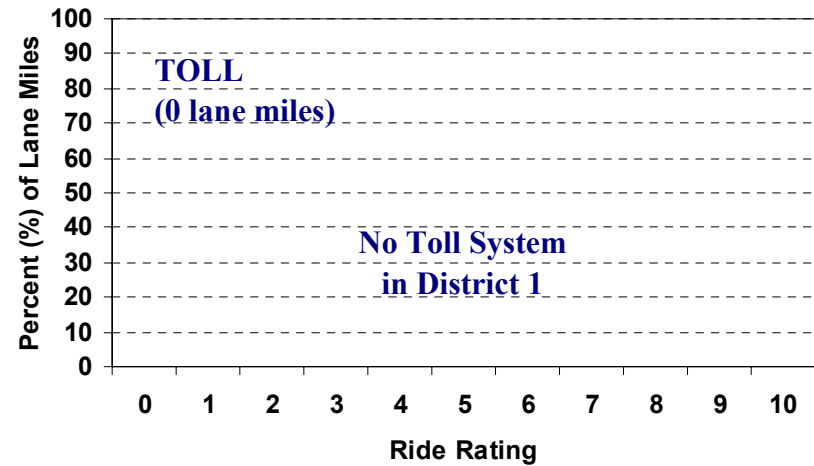
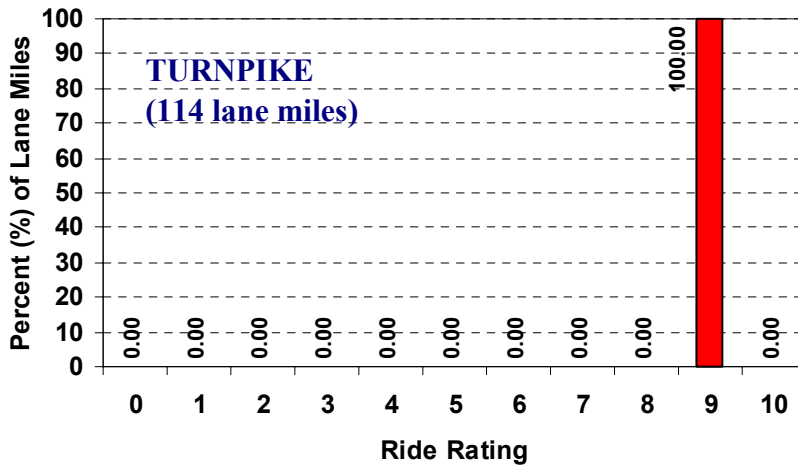
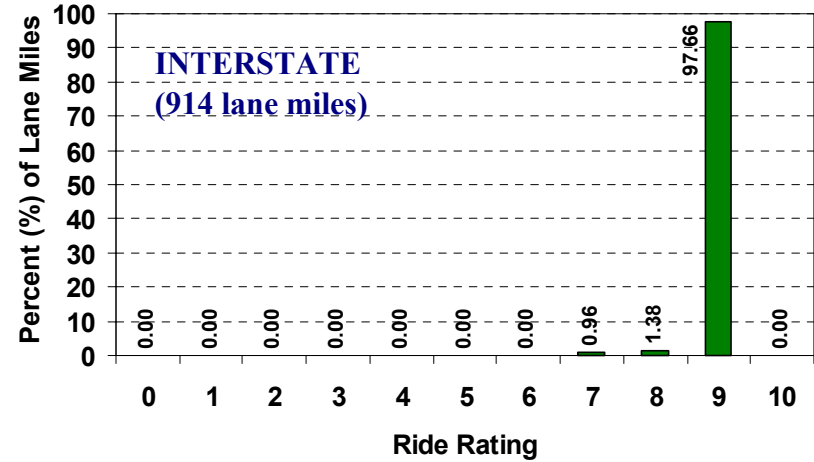
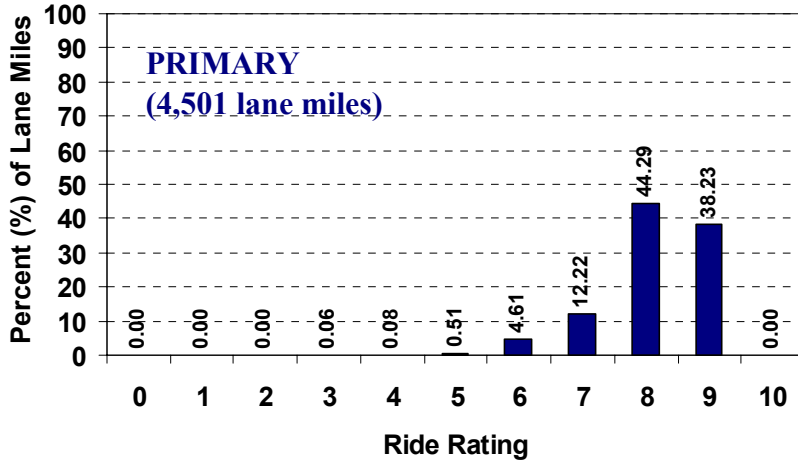


2002 Ride Distribution by System Statewide



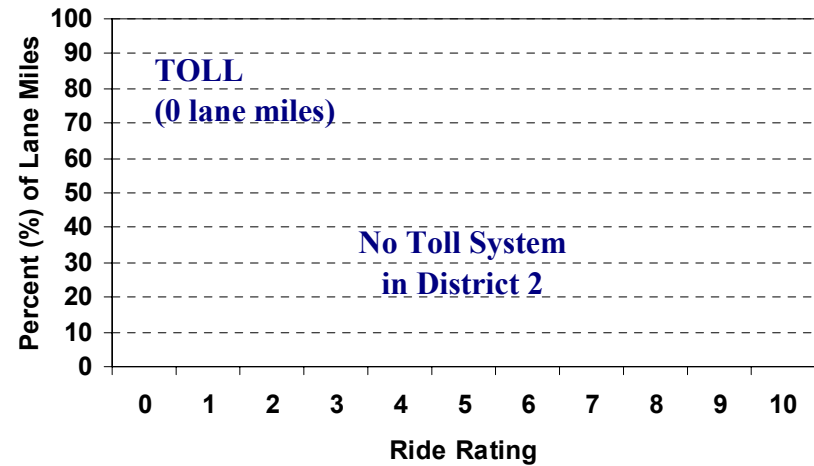
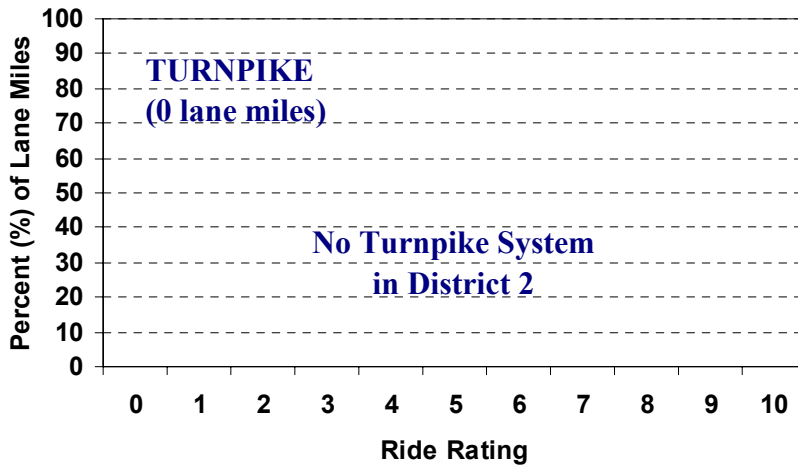
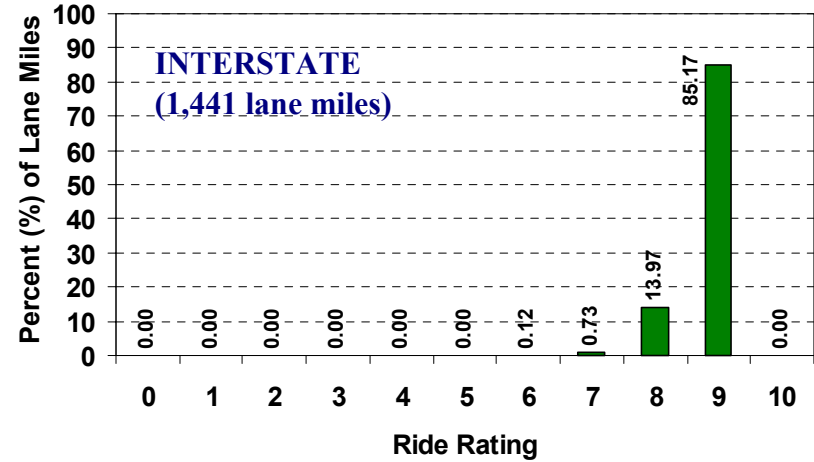
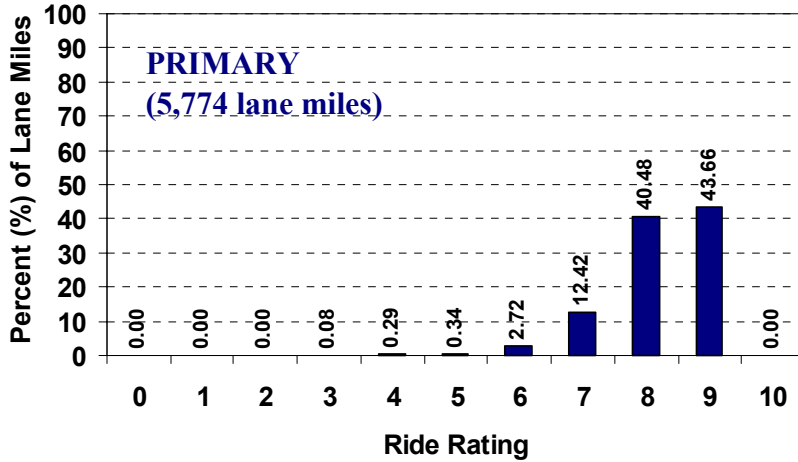
2002 Ride Distribution by System

District 1



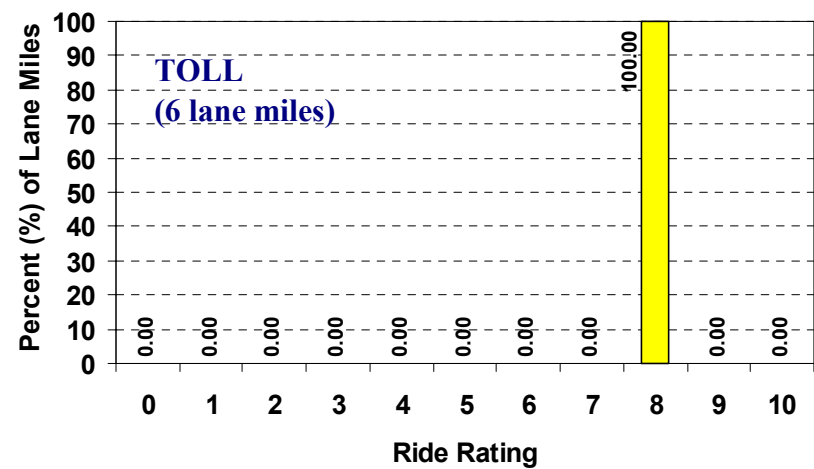
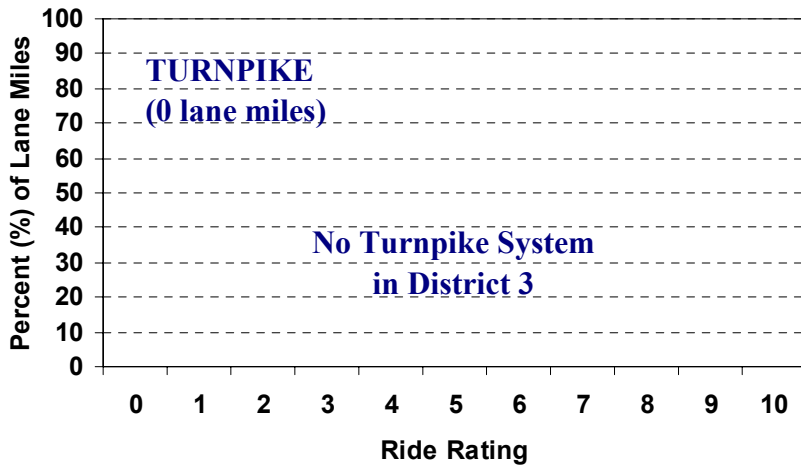
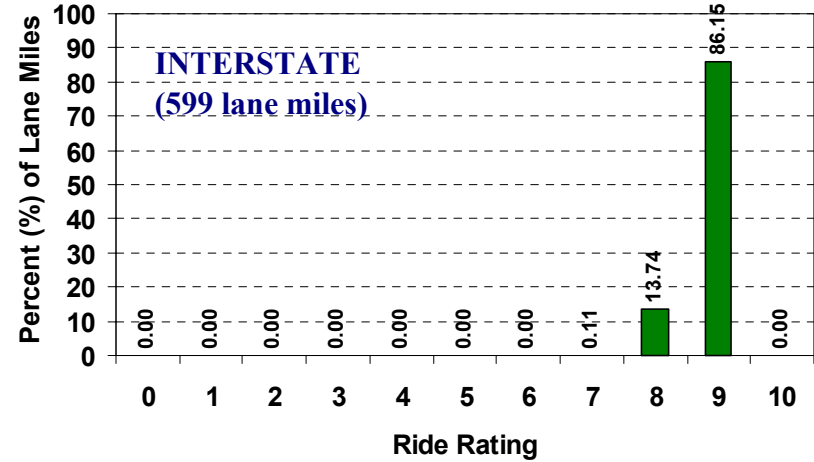
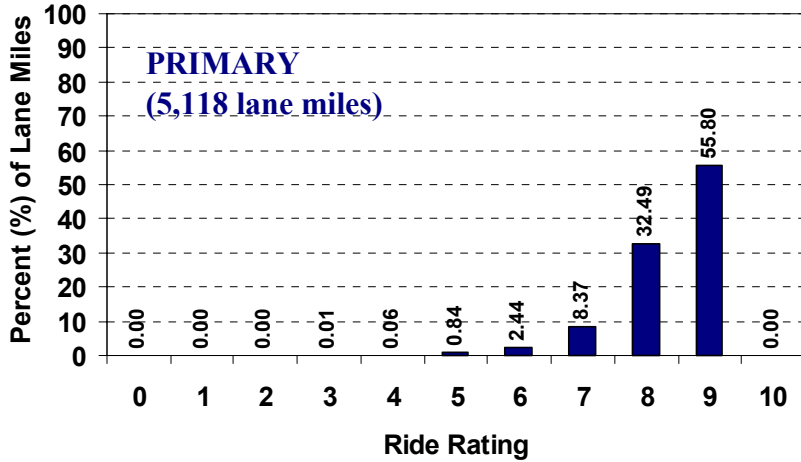
2002 Ride Distribution by System

District 2



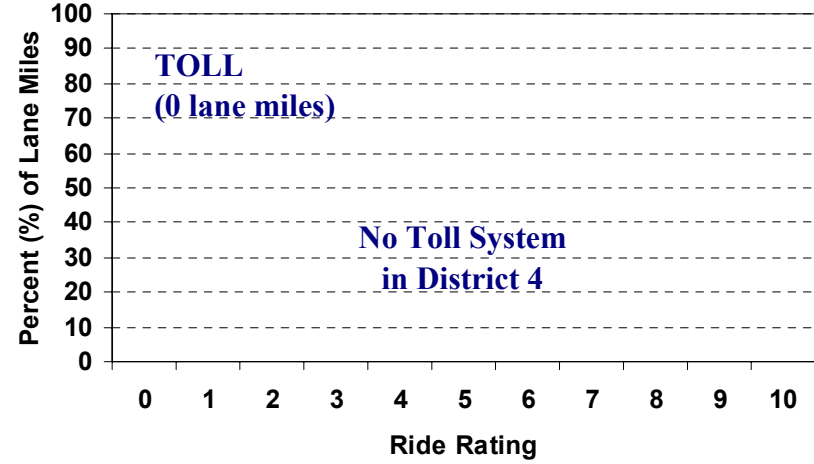
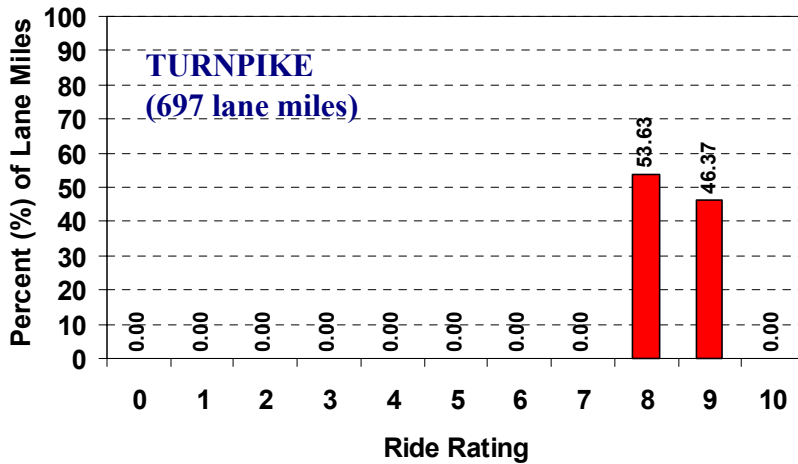
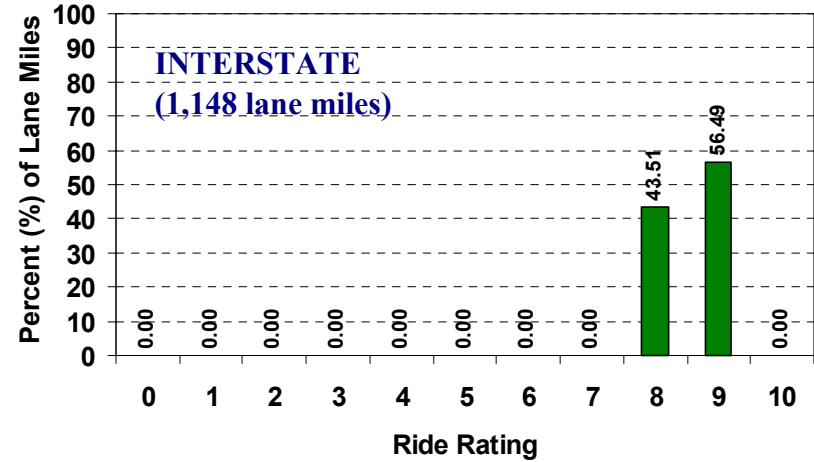
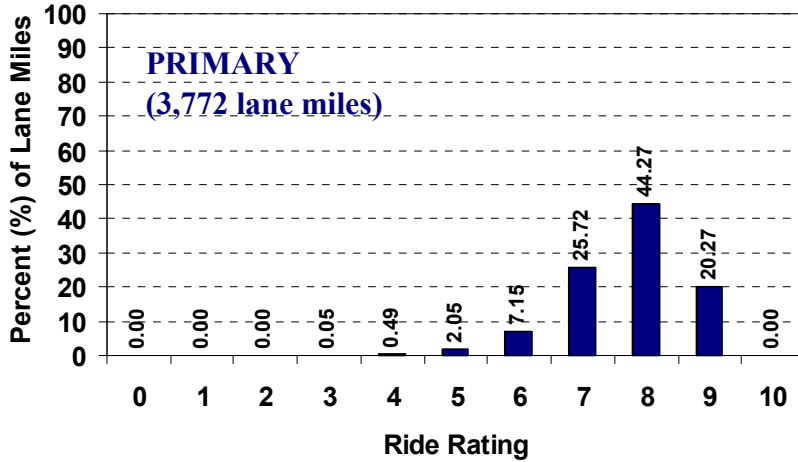
2002 Ride Distribution by System

District 3



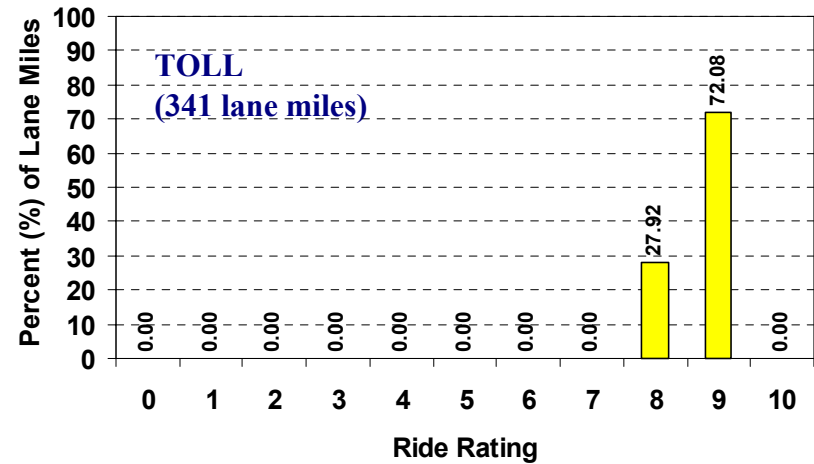
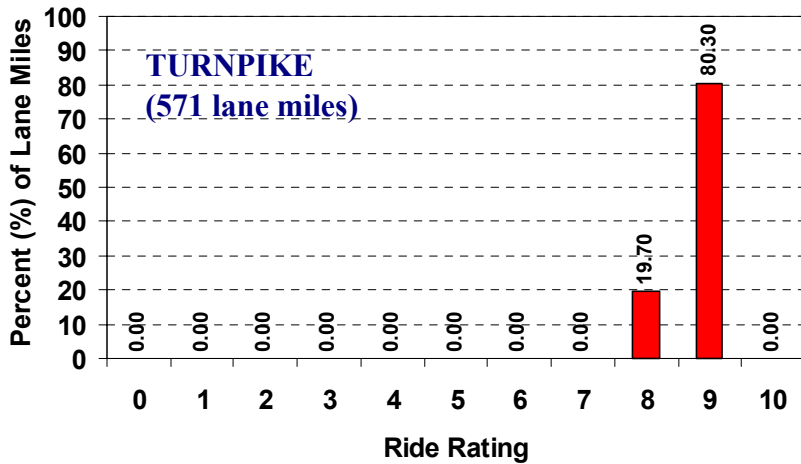
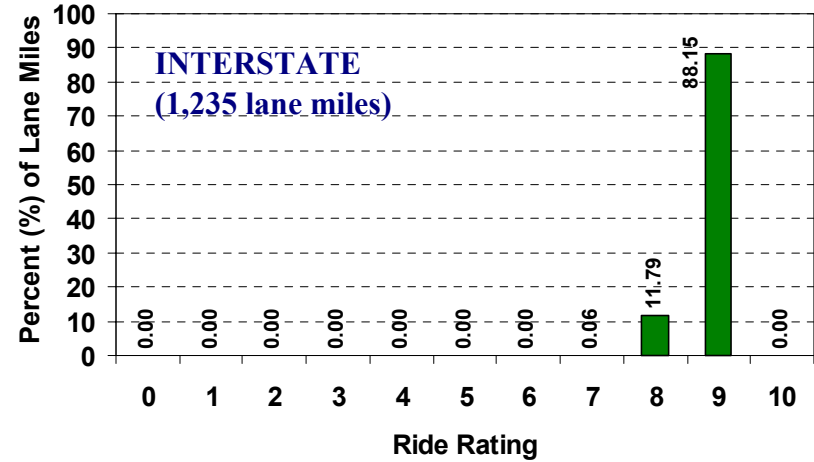
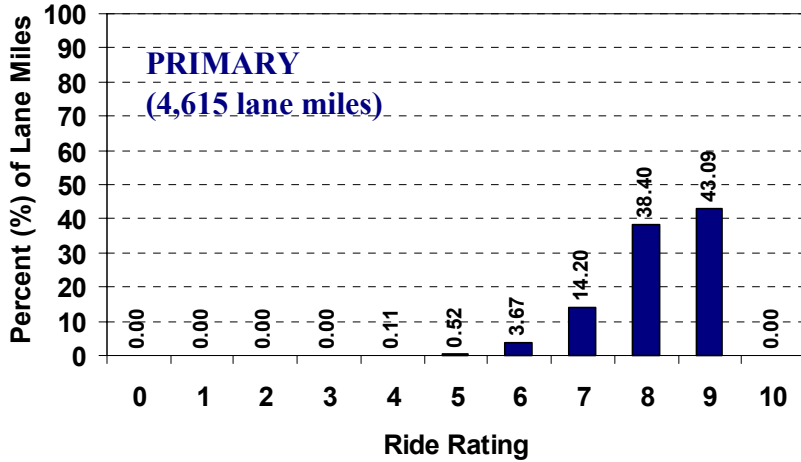
2002 Ride Distribution by System

District 4



2002 Ride Distribution by System

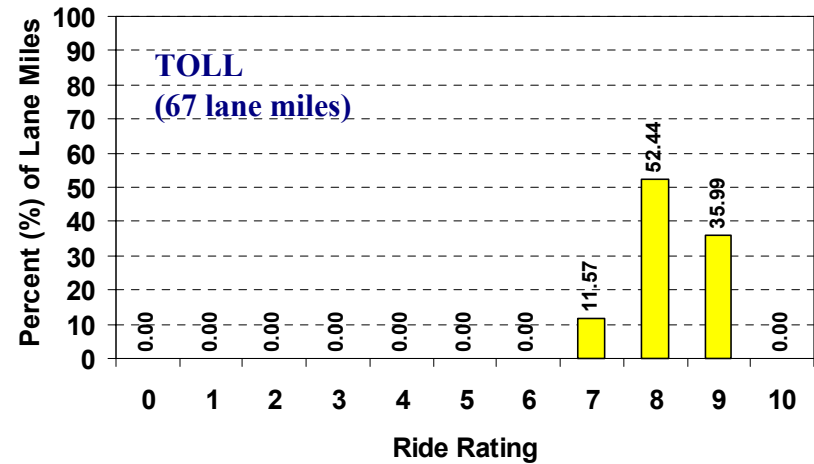
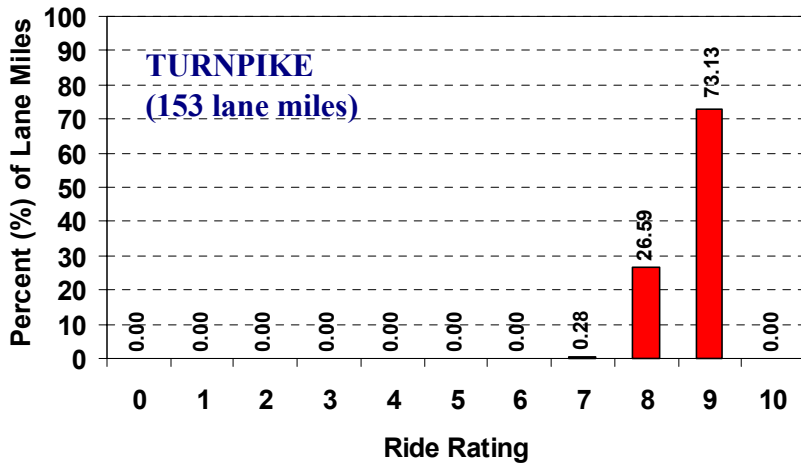
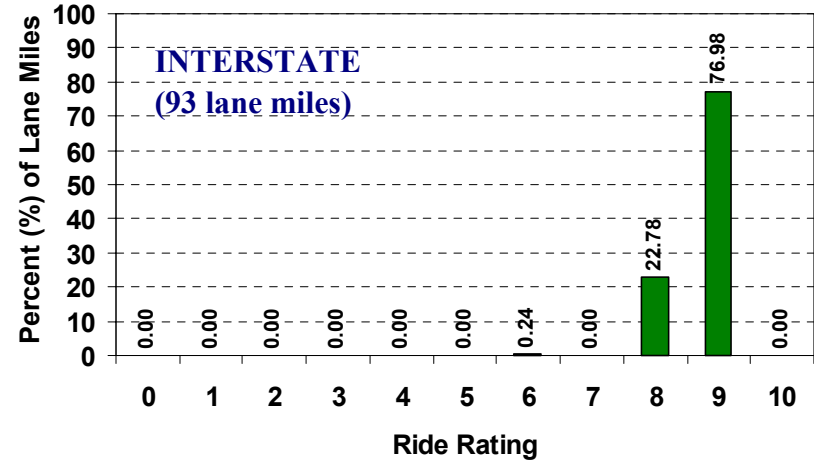
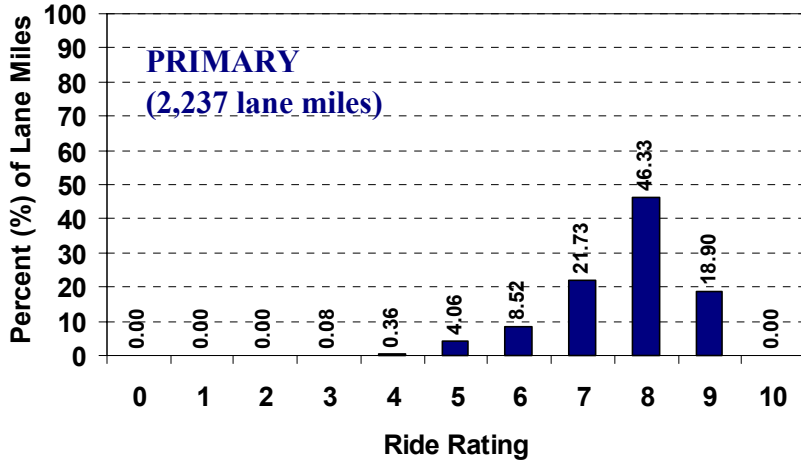
District 5



2002 Ride Distribution by System

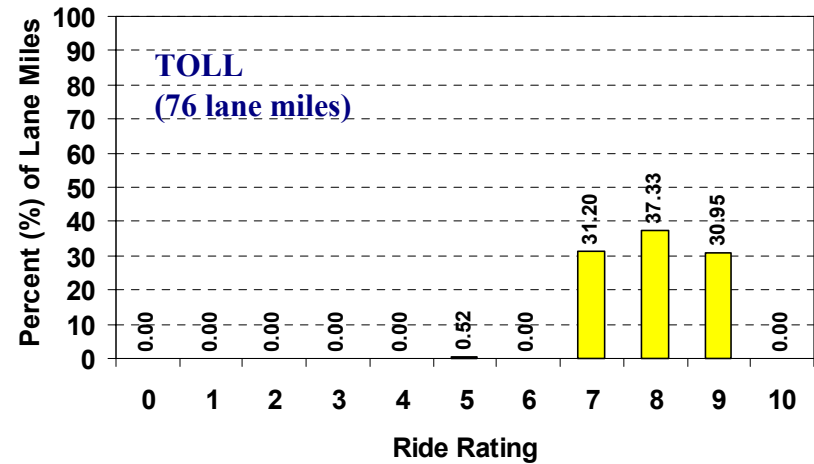
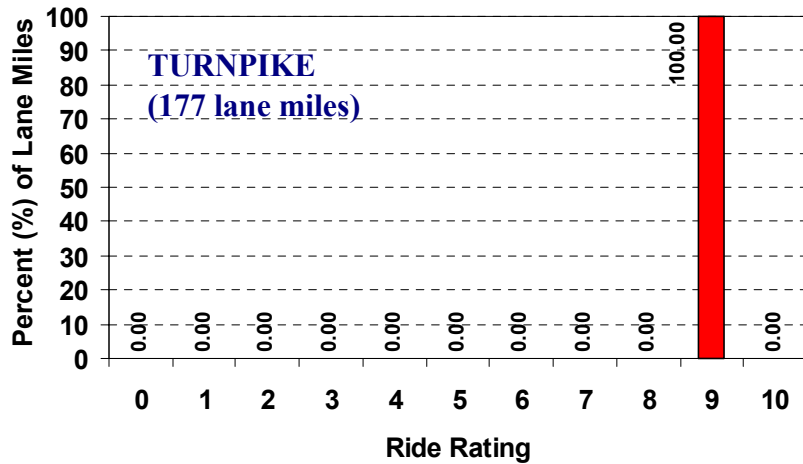
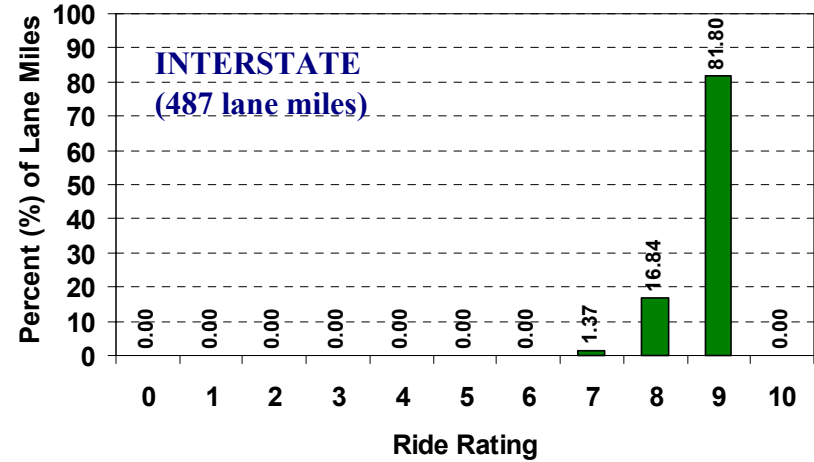
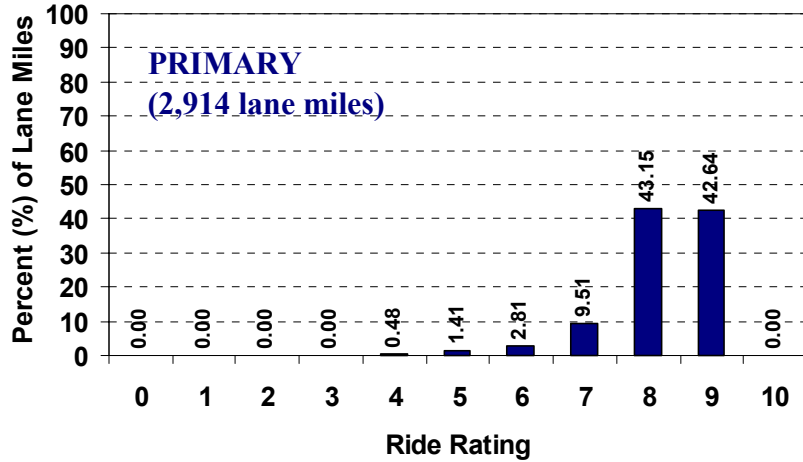
District 6

39



2002 Ride Distribution by System

District 7



SECTION V

CRACK, RUT AND RIDE

DISTRIBUTIONS

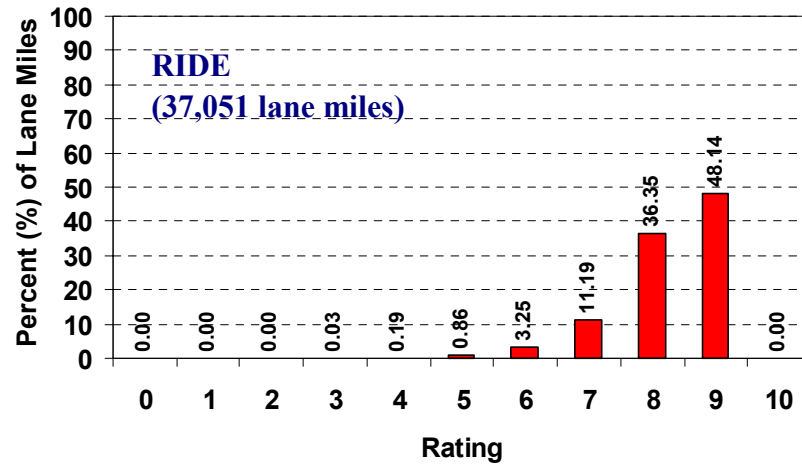
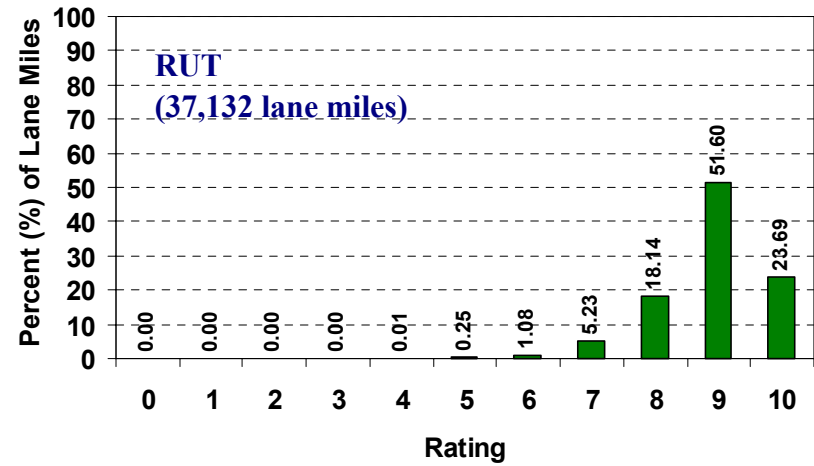
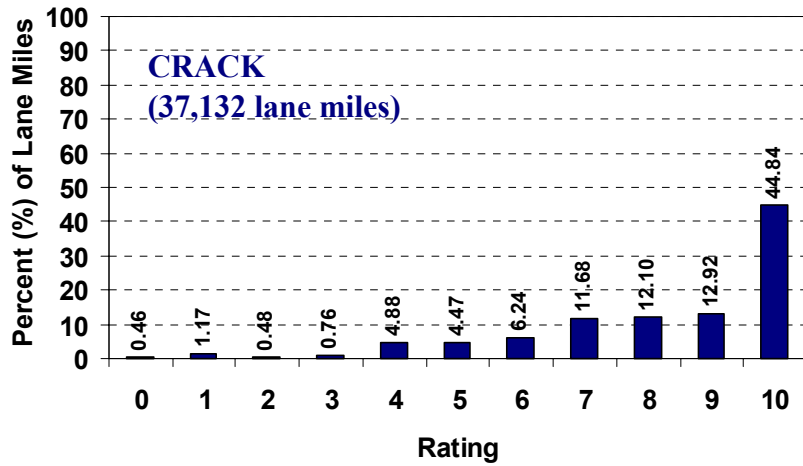
BY

DISTRICT

(ALL SYSTEMS COMBINED)

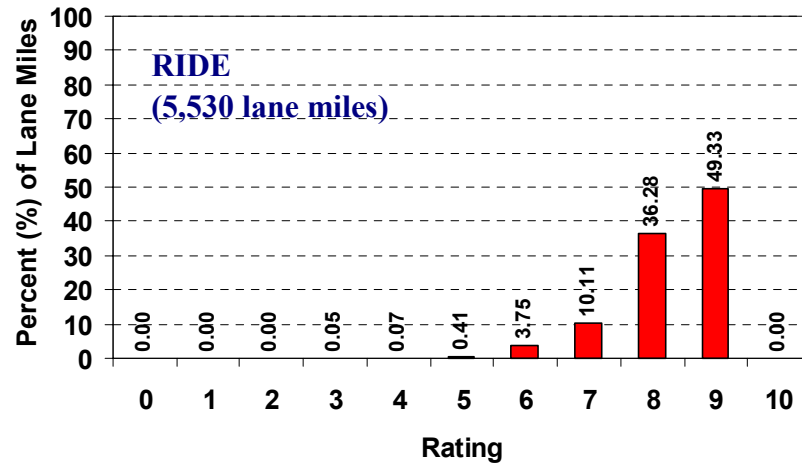
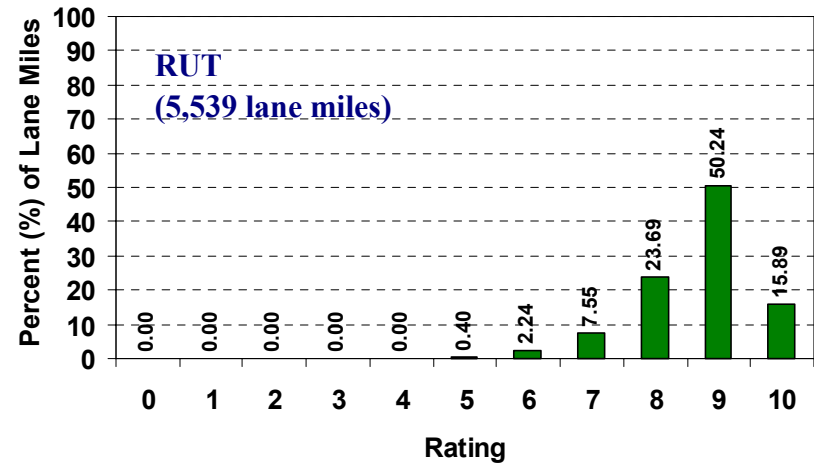
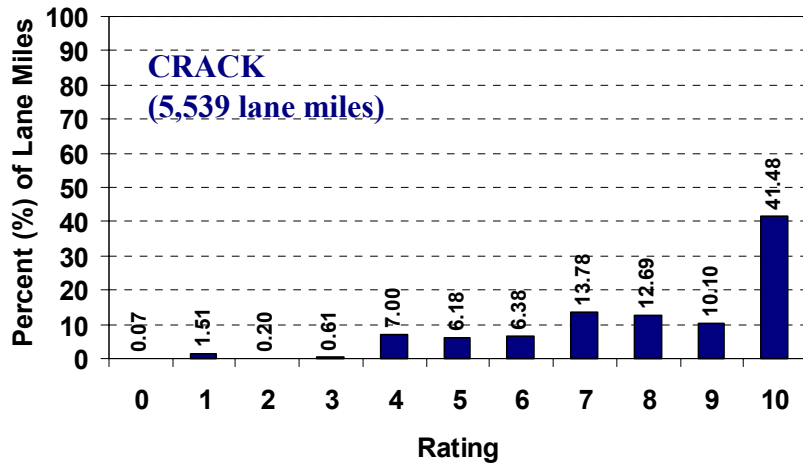


2002 Crack, Rut and Ride Distribution Statewide (All Systems)



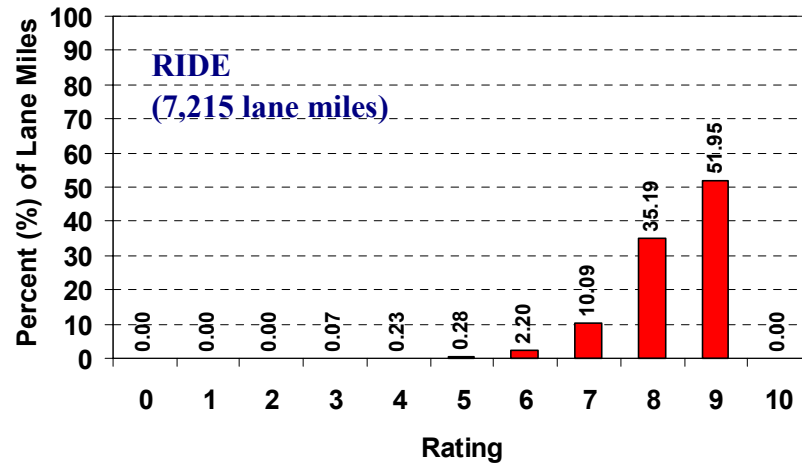
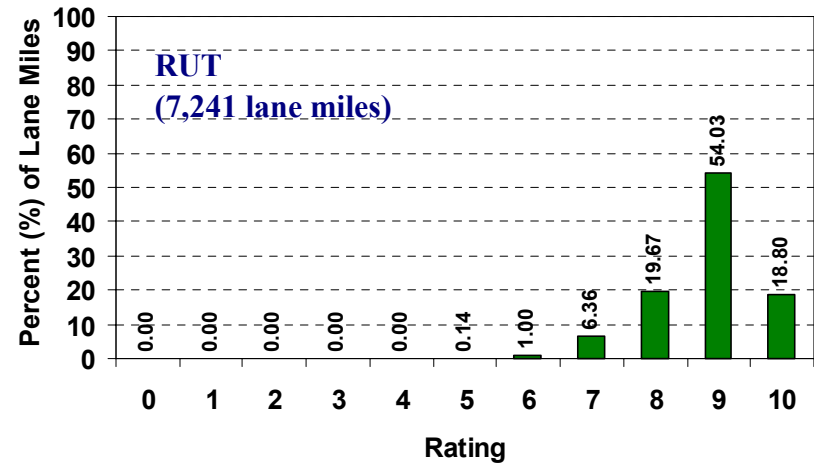
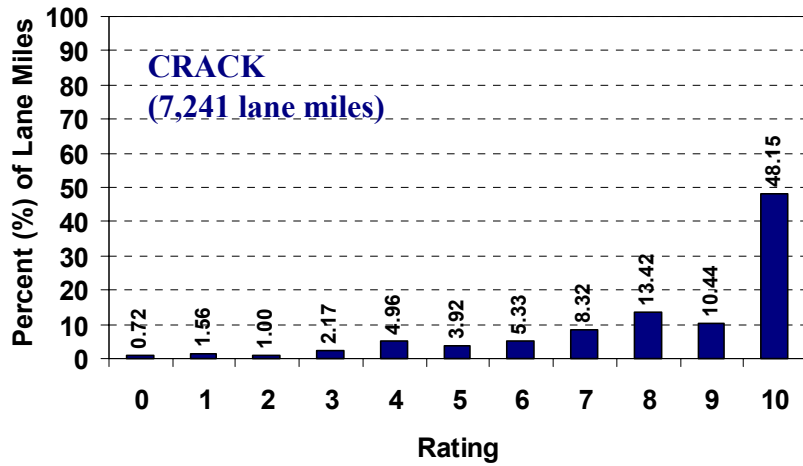
2002 Crack, Rut and Ride Distribution

District 1 (All Systems)



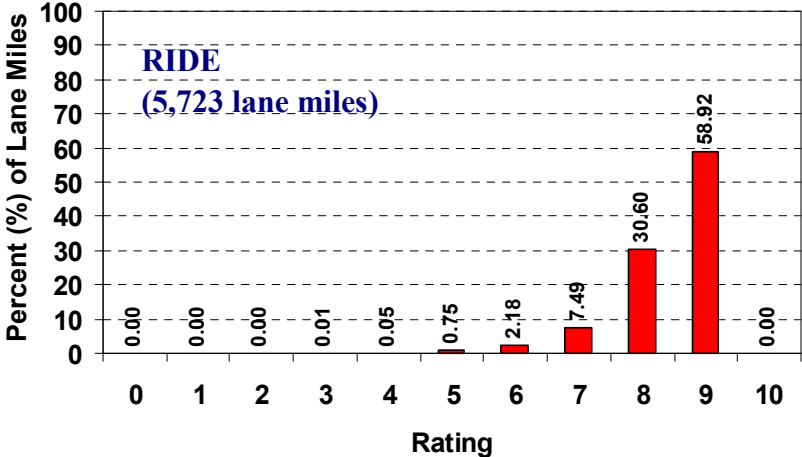
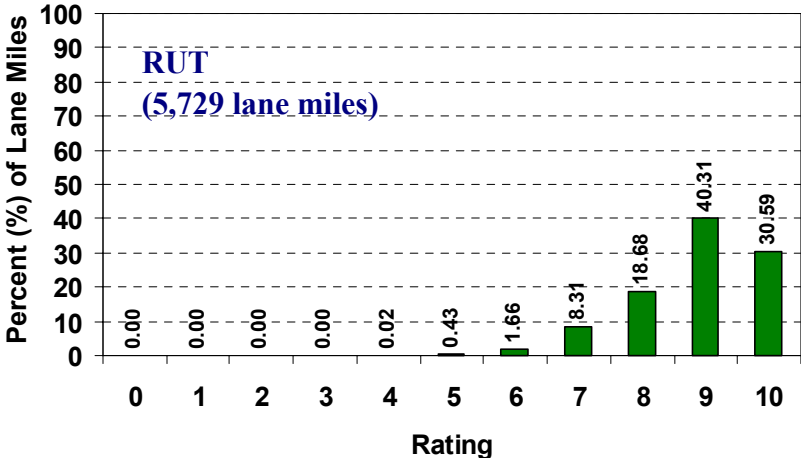
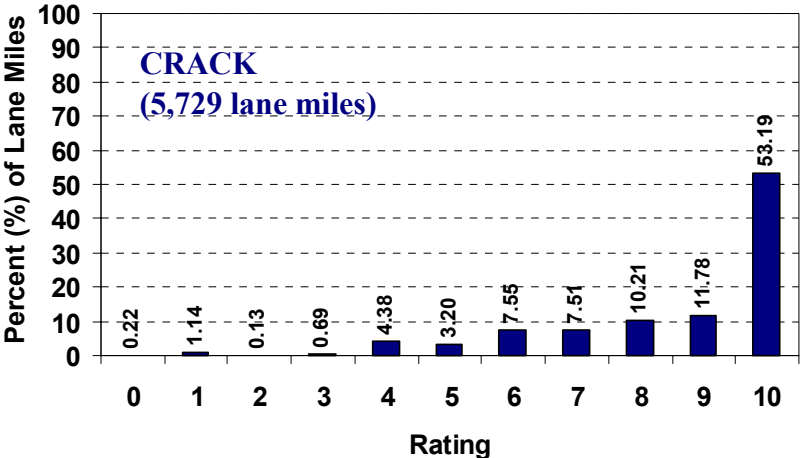
2002 Crack, Rut and Ride Distribution

District 2 (All Systems)



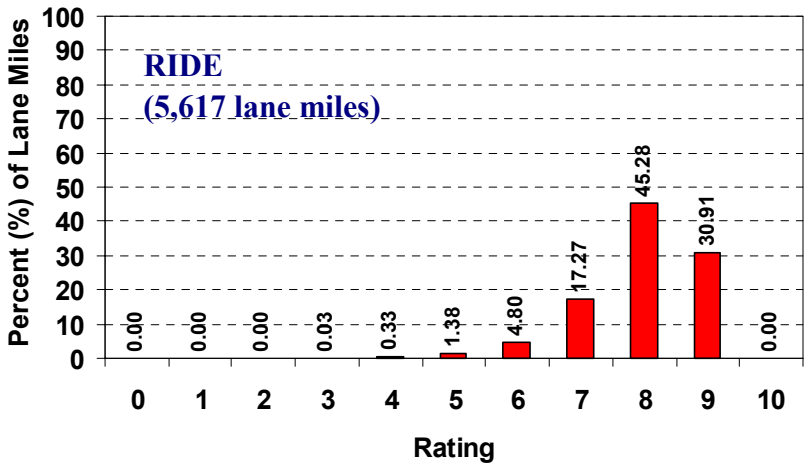
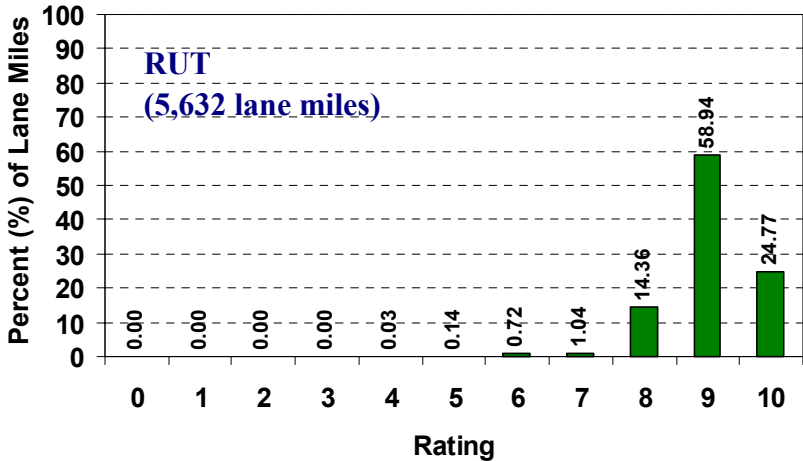
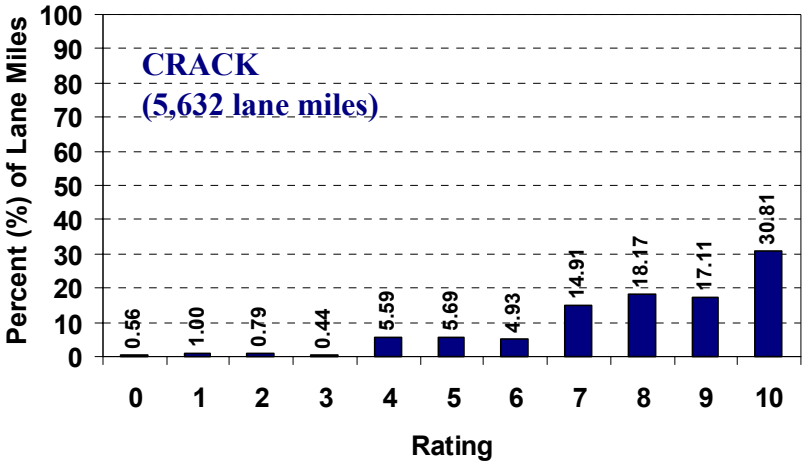
2002 Crack, Rut and Ride Distribution

District 3 (All Systems)



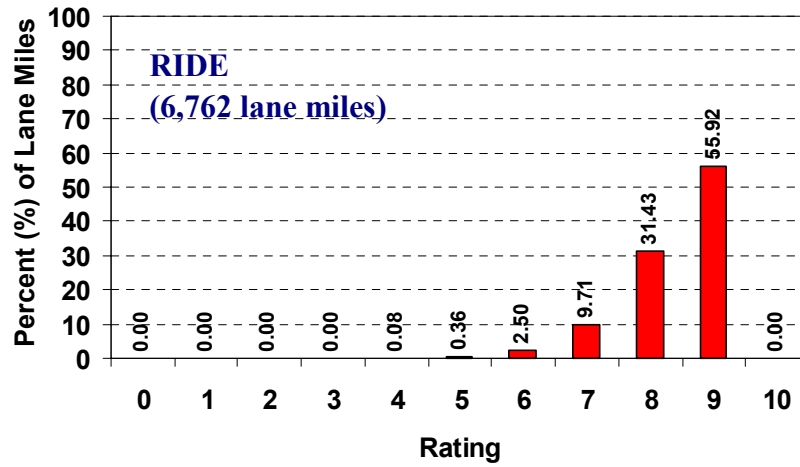
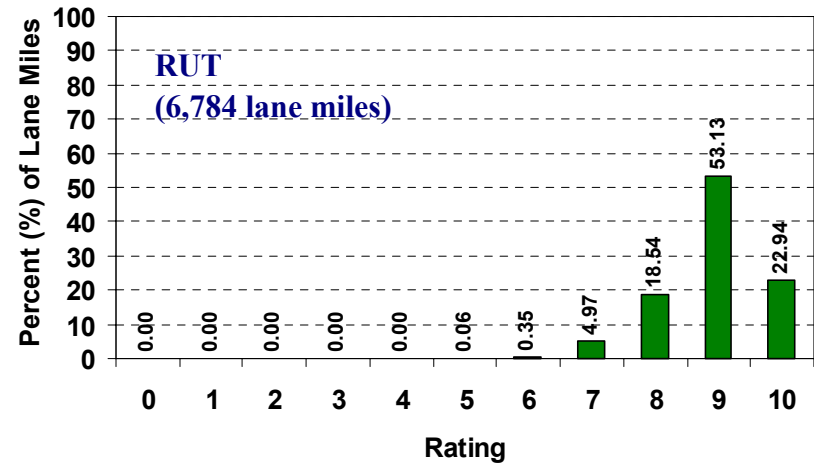
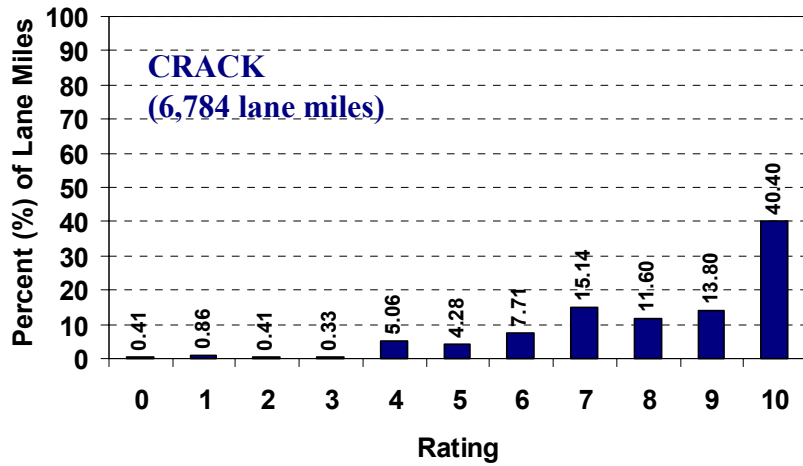
2002 Crack, Rut and Ride Distribution

District 4 (All Systems)



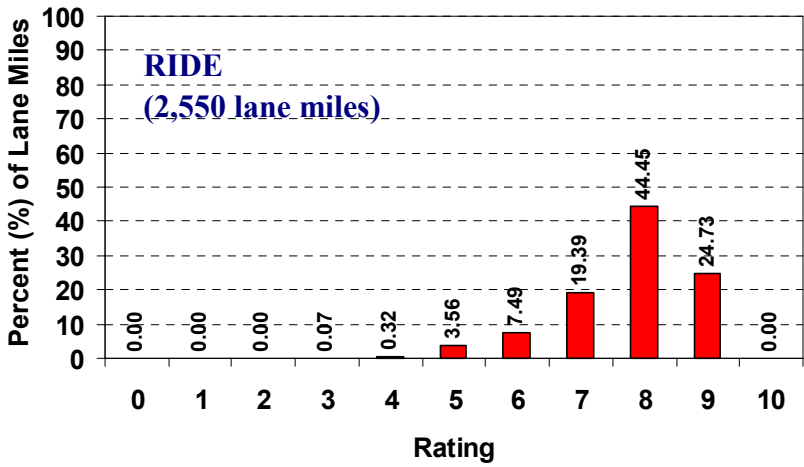
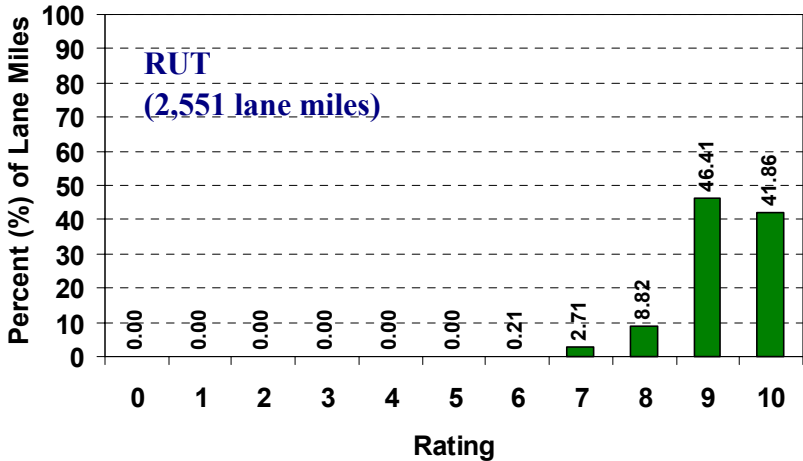
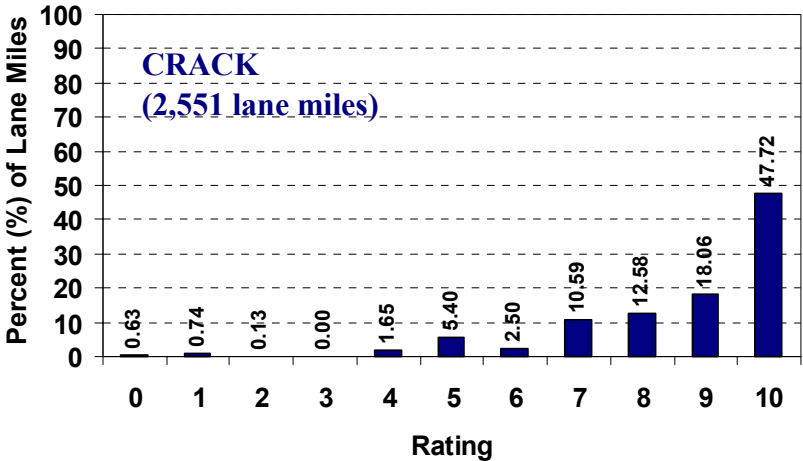
2002 Crack, Rut and Ride Distribution

District 5 (All Systems)



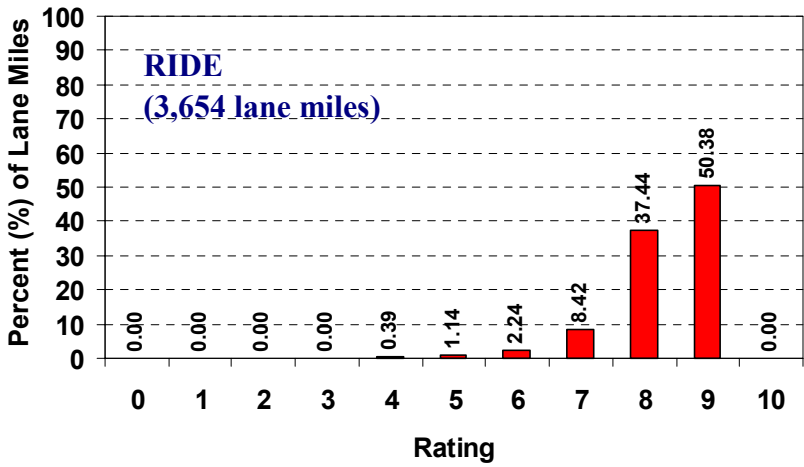
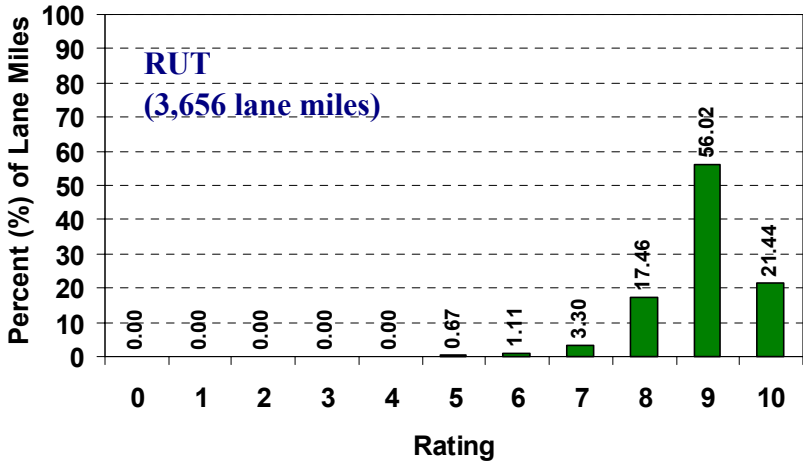
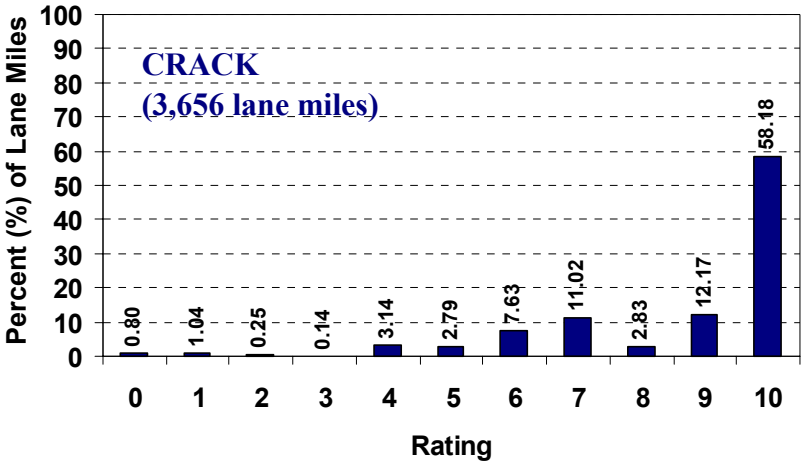
2002 Crack, Rut and Ride Distribution

District 6 (All Systems)



2002 Crack, Rut and Ride Distribution

District 7 (All Systems)



SECTION VI

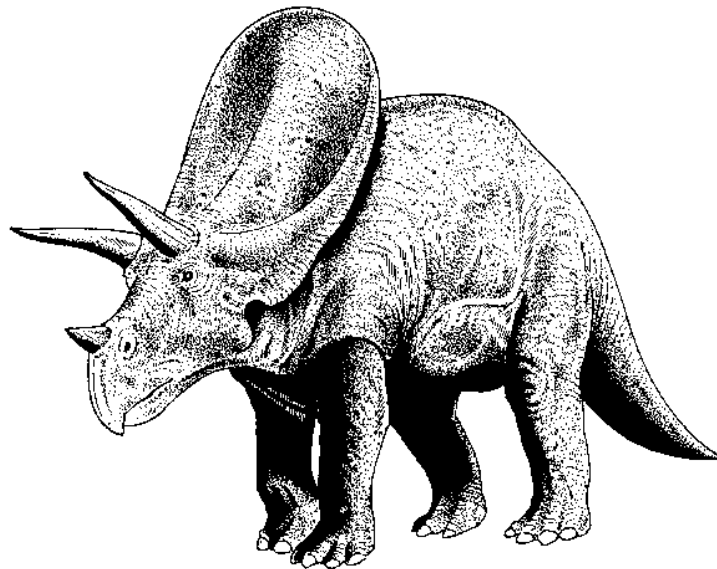
HISTORICAL

INFORMATION

BY

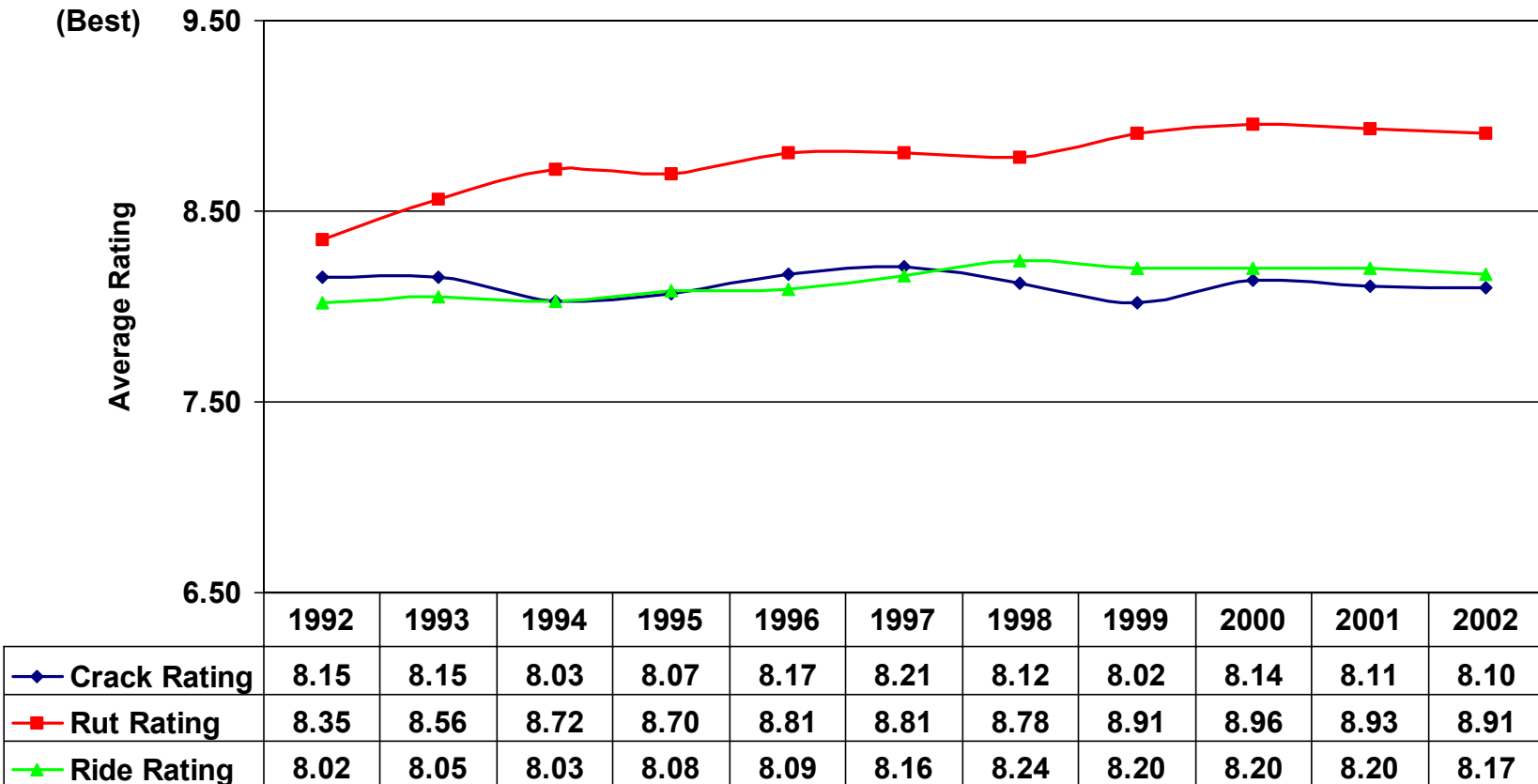
DISTRICT

(ALL SYSTEMS COMBINED)



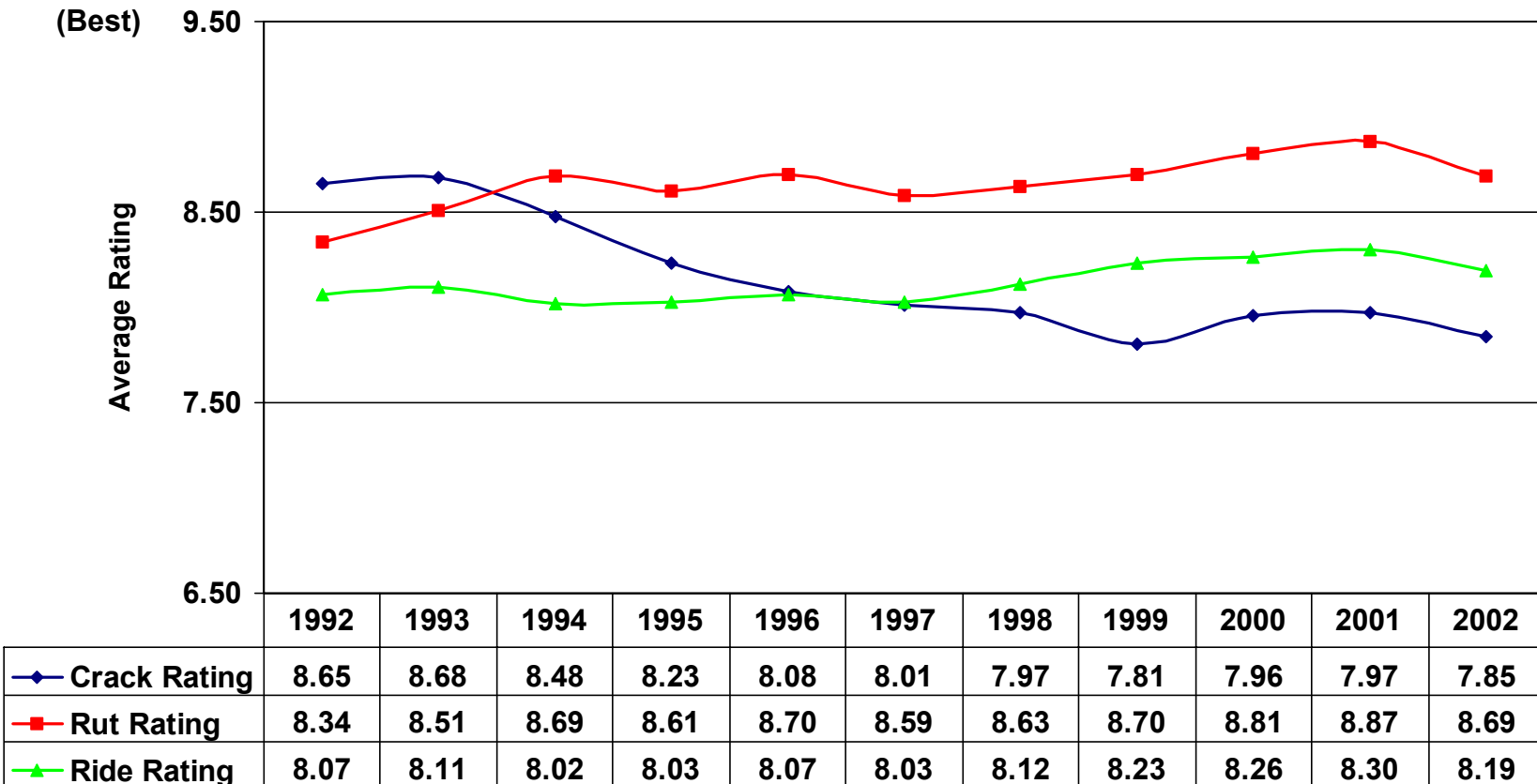
Historical Information

Statewide (All Systems)



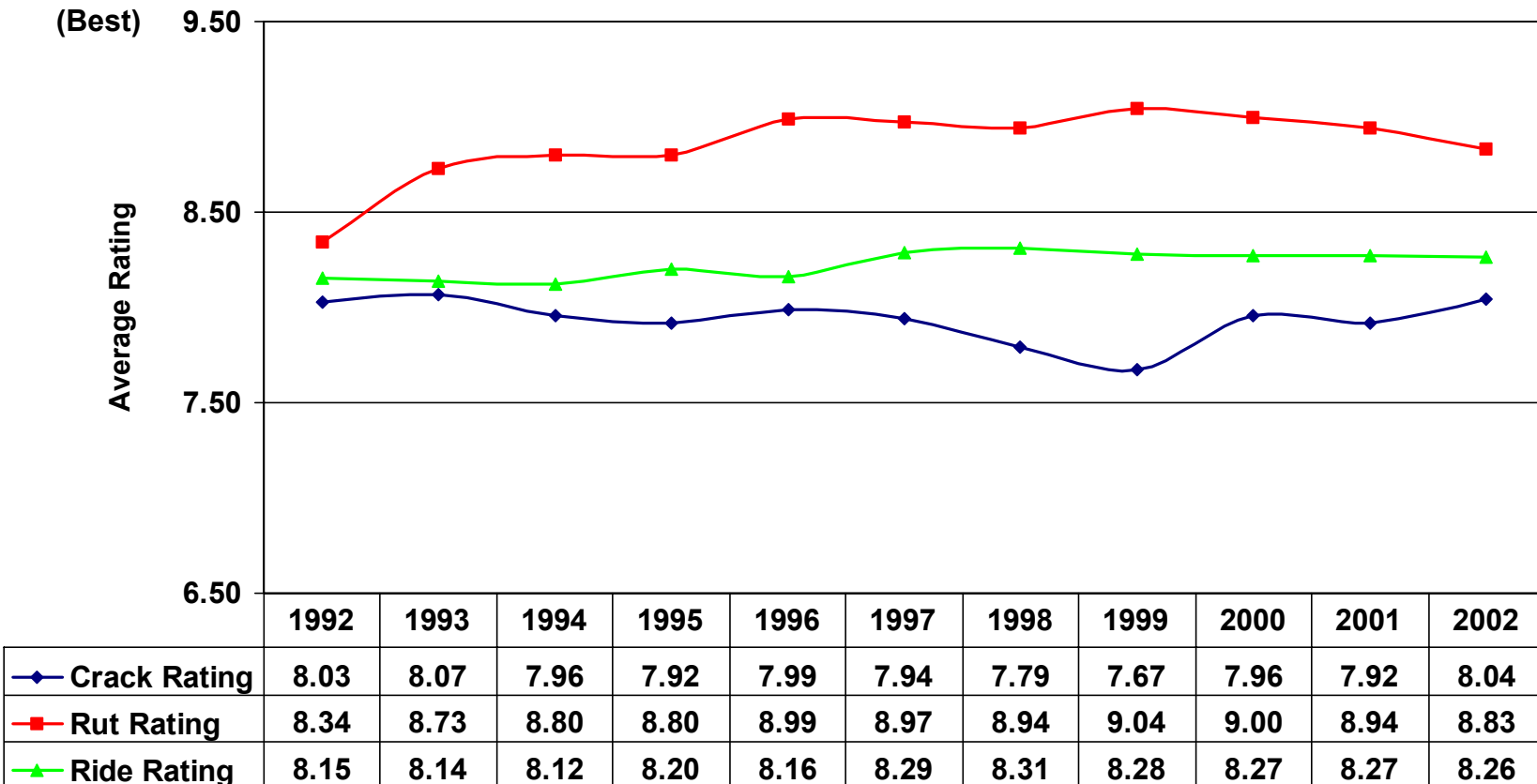
Historical Information

District 1 (All Systems)



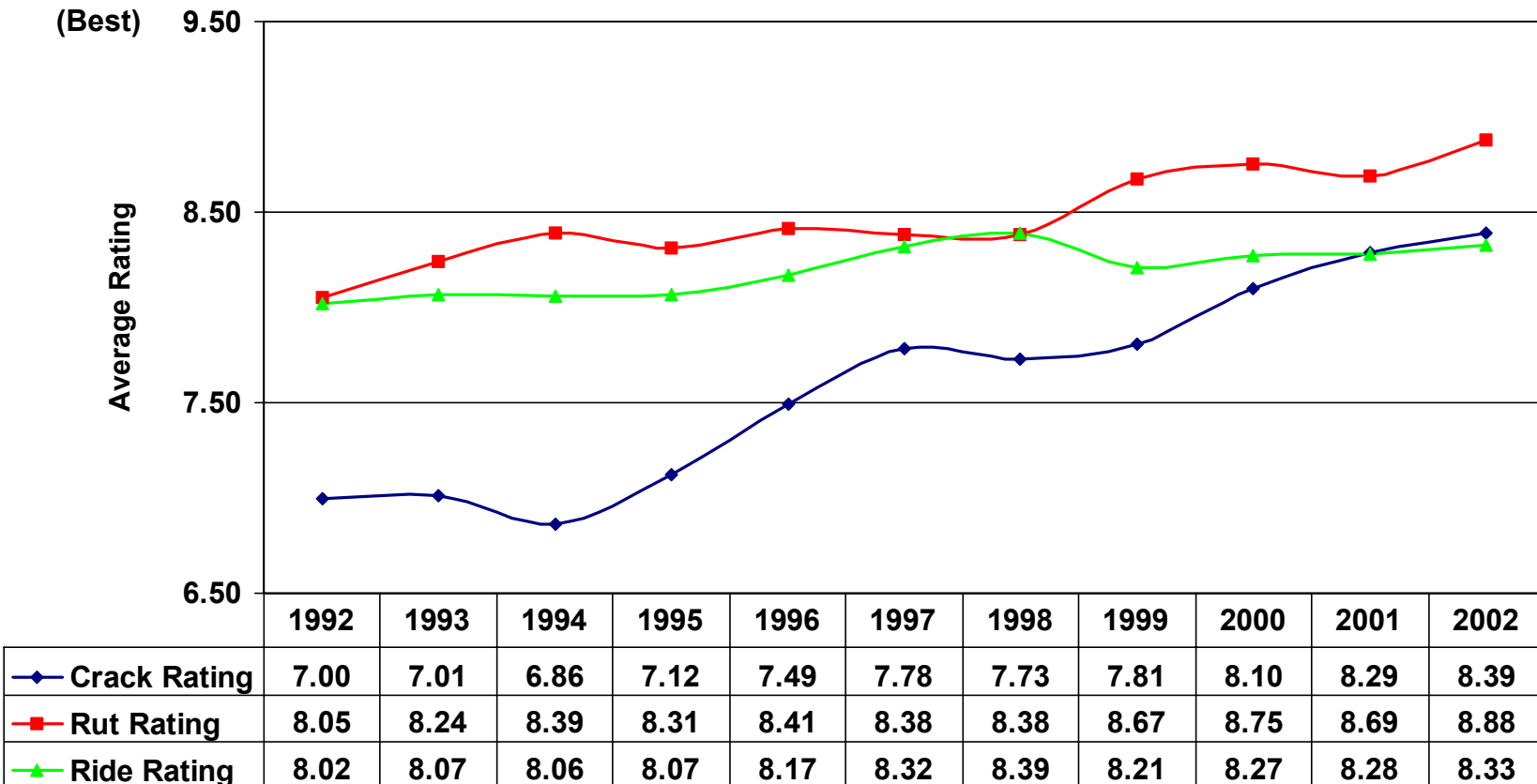
Historical Information

District 2 (All Systems)



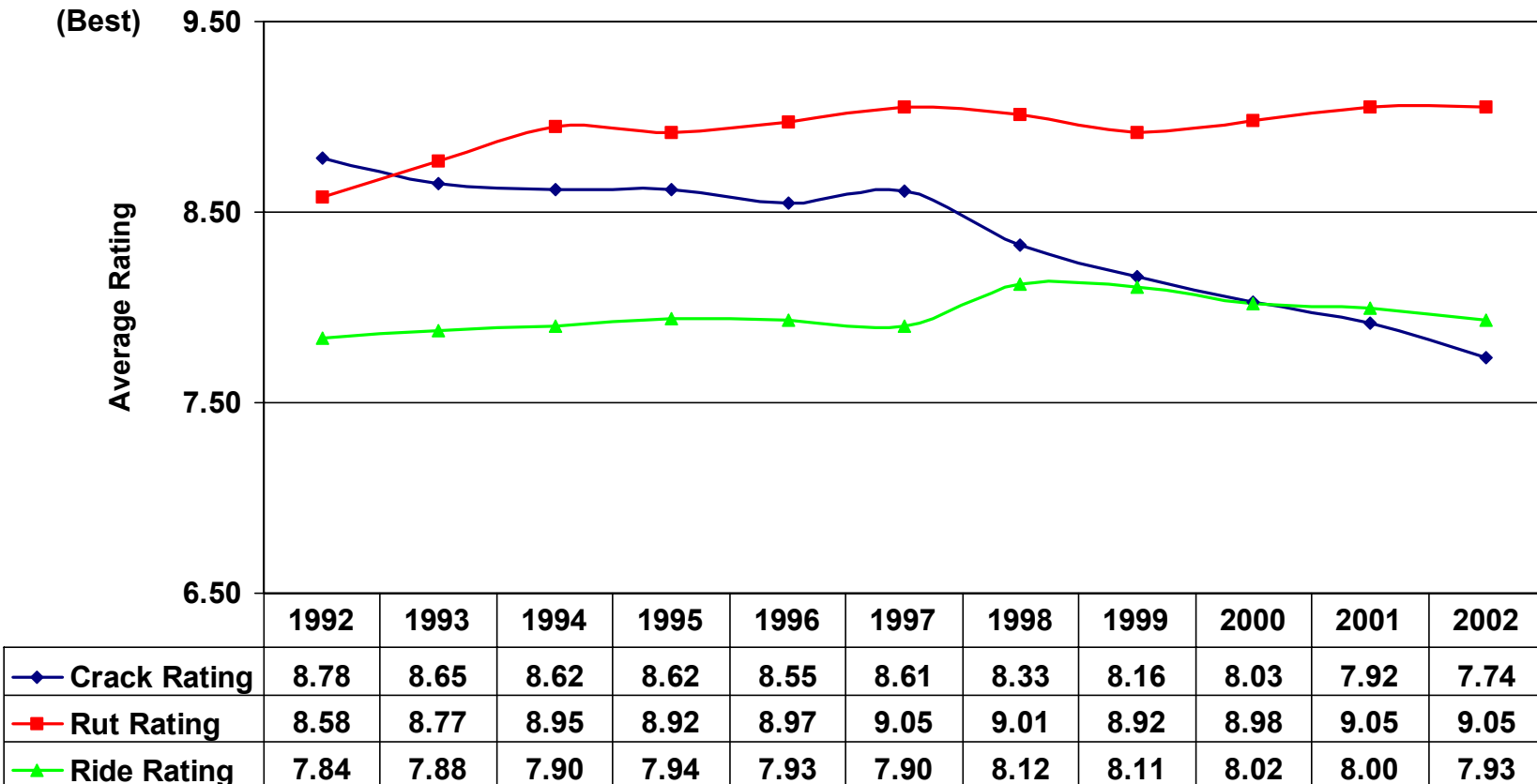
Historical Information

District 3 (All Systems)



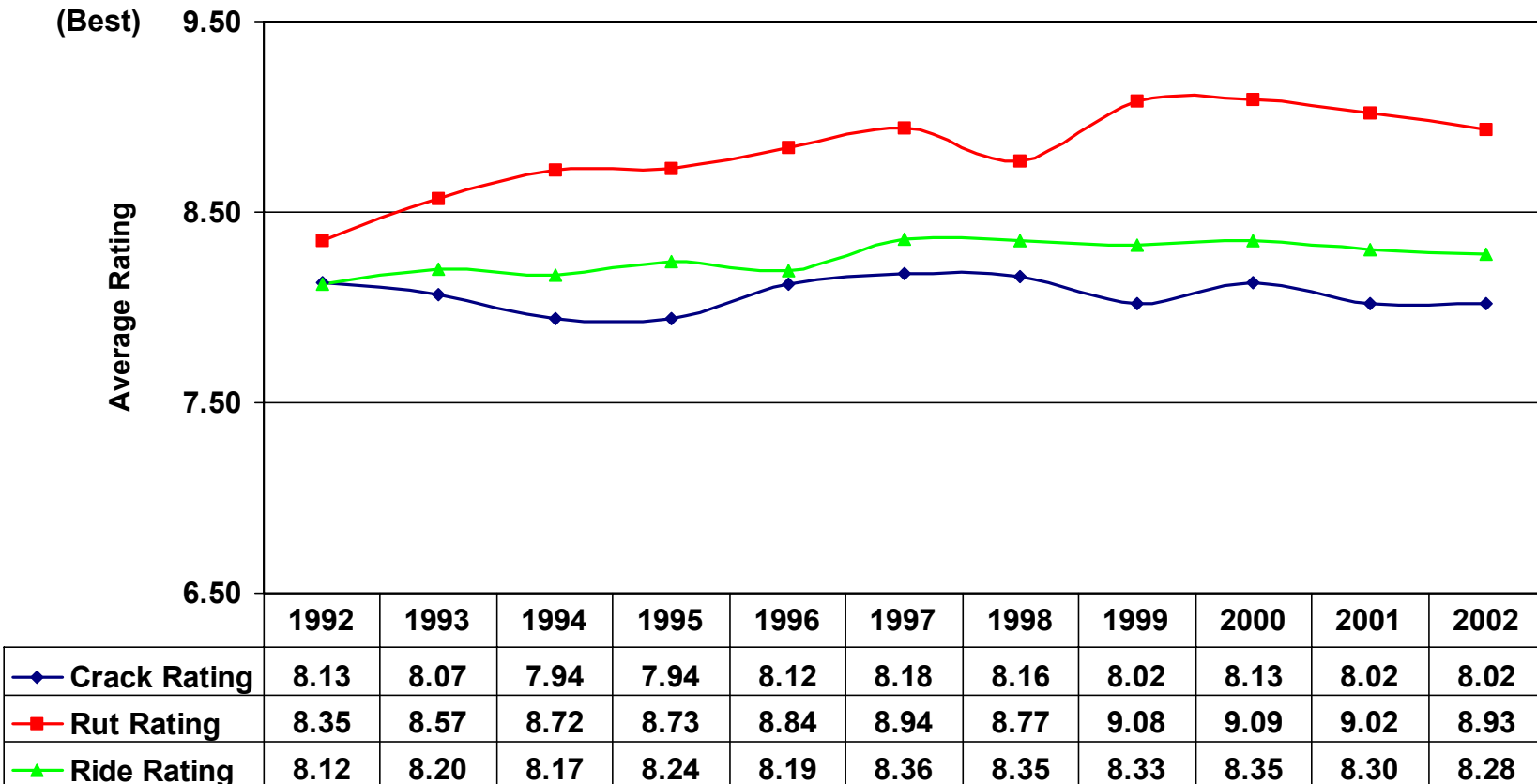
Historical Information

District 4 (All Systems)



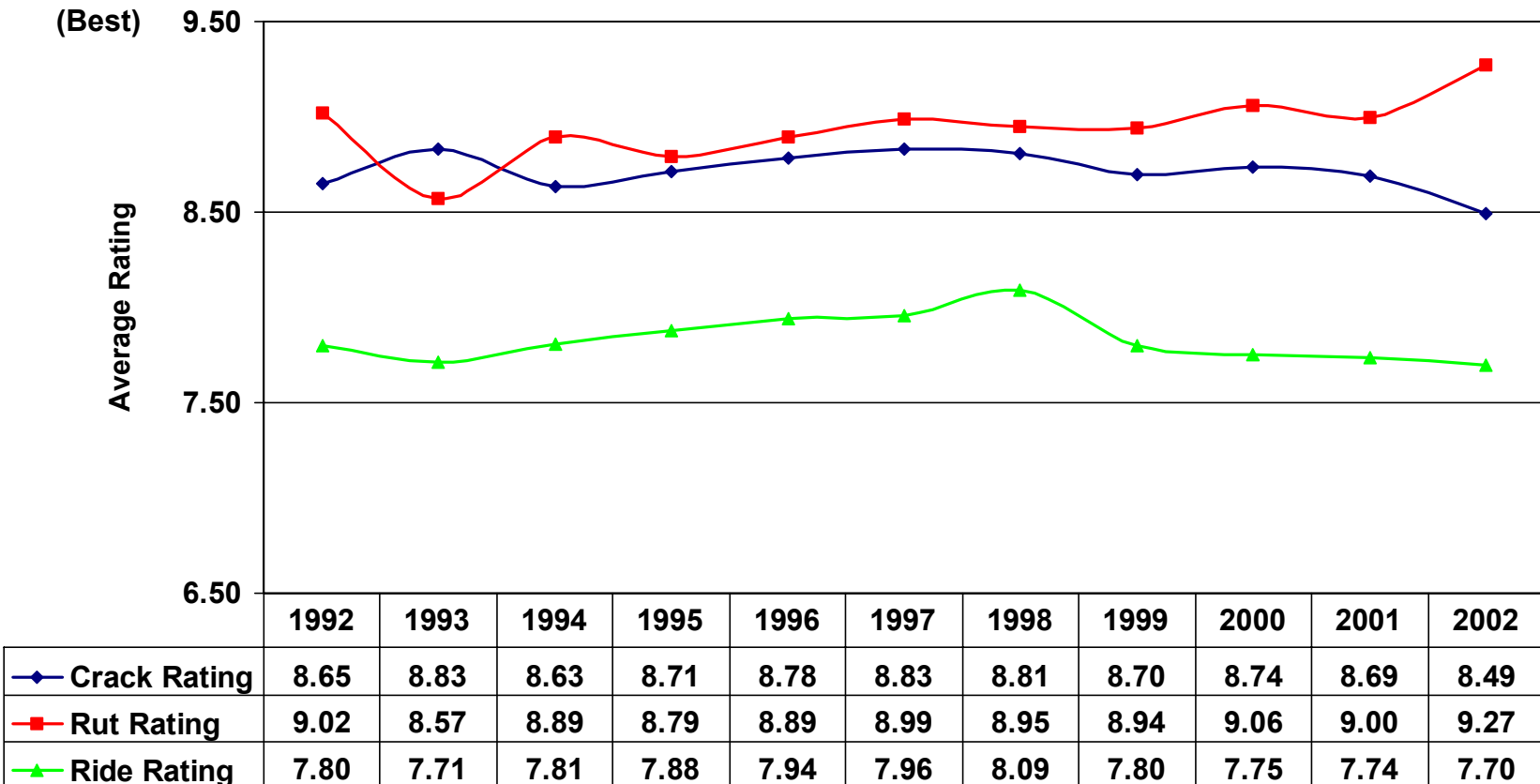
Historical Information

District 5 (All Systems)



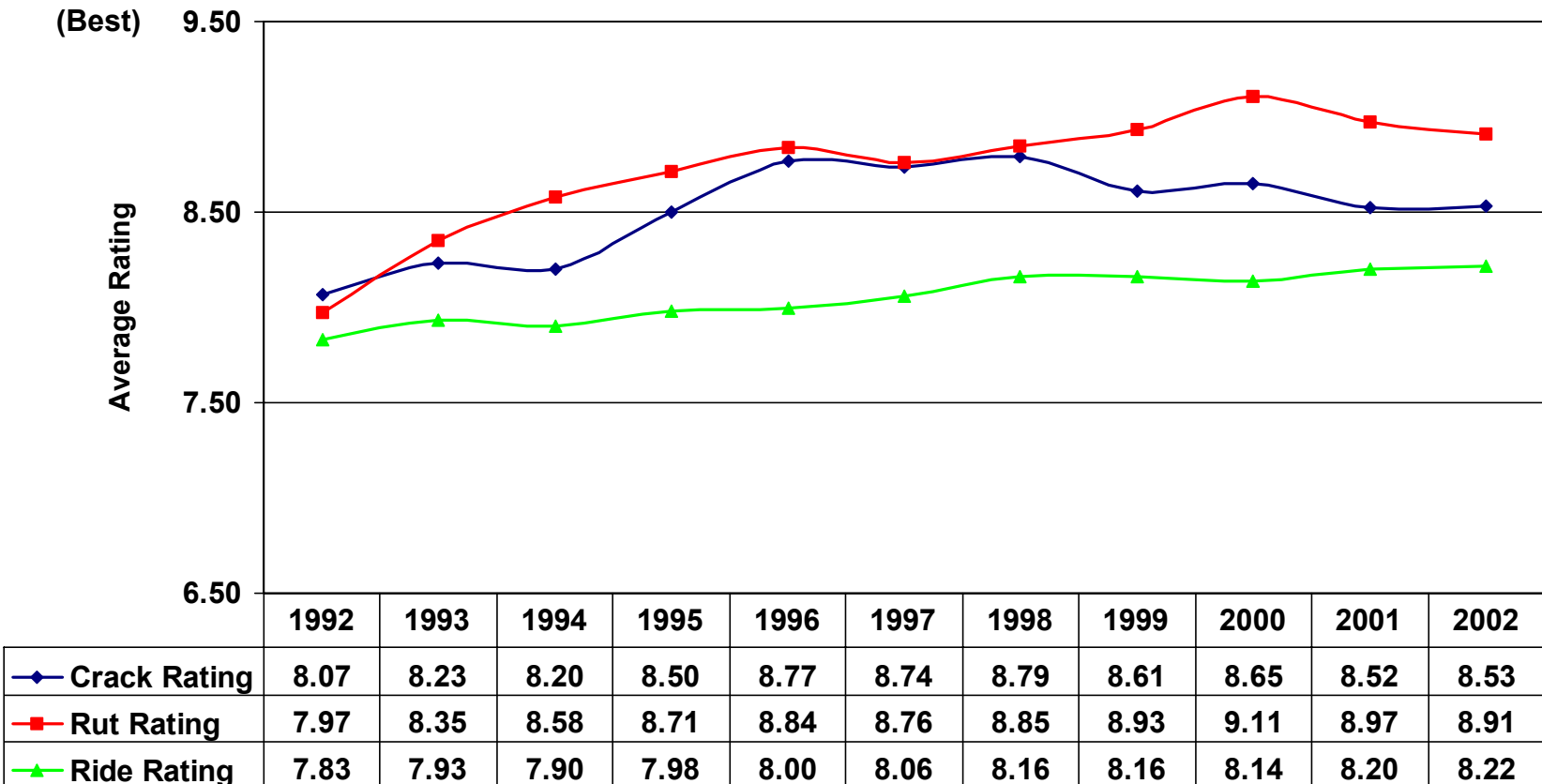
Historical Information

District 6 (All Systems)



Historical Information

District 7 (All Systems)



SECTION VII

**HISTORICAL
INFORMATION**

BY

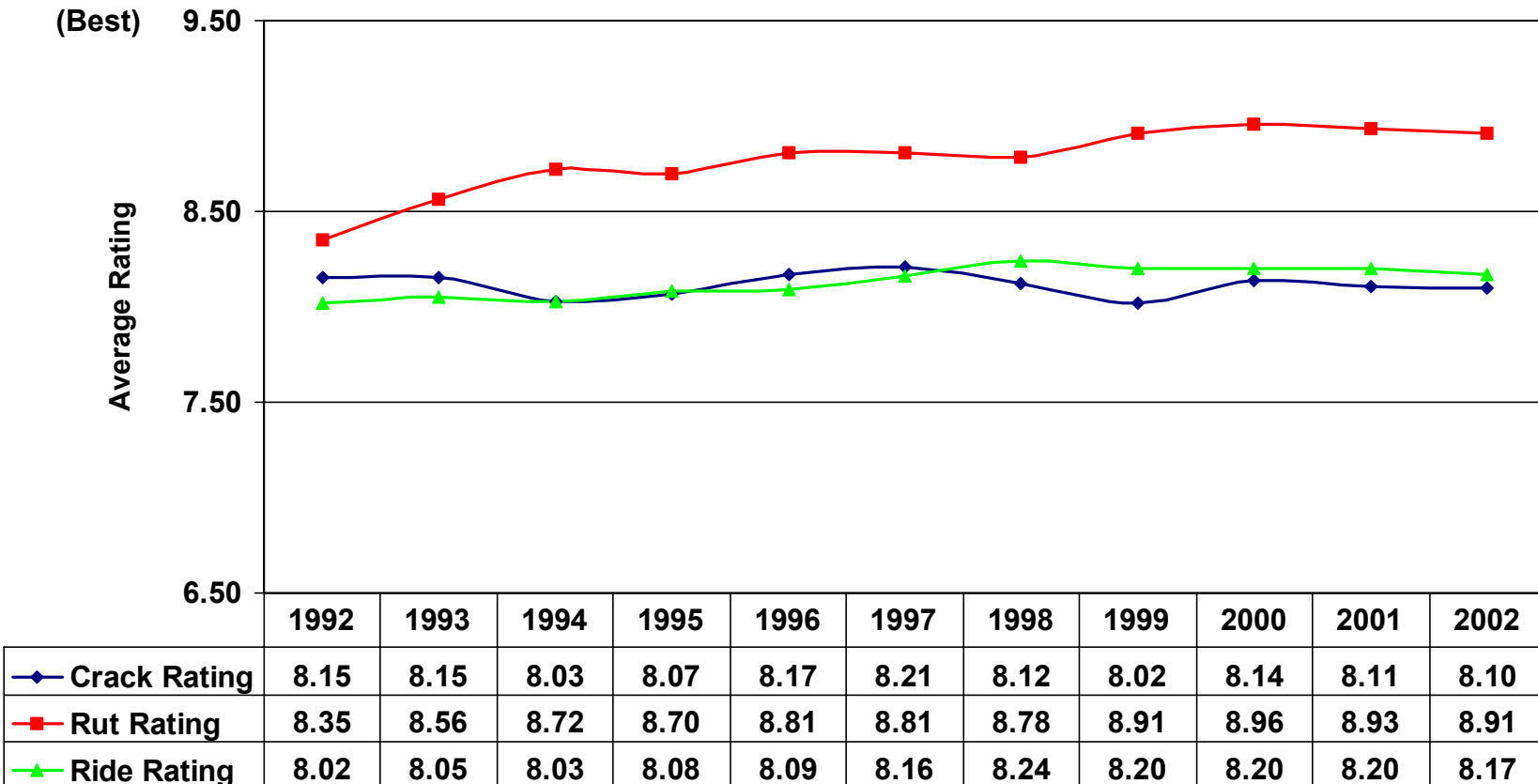
SYSTEM

(ALL DISTRICTS COMBINED)



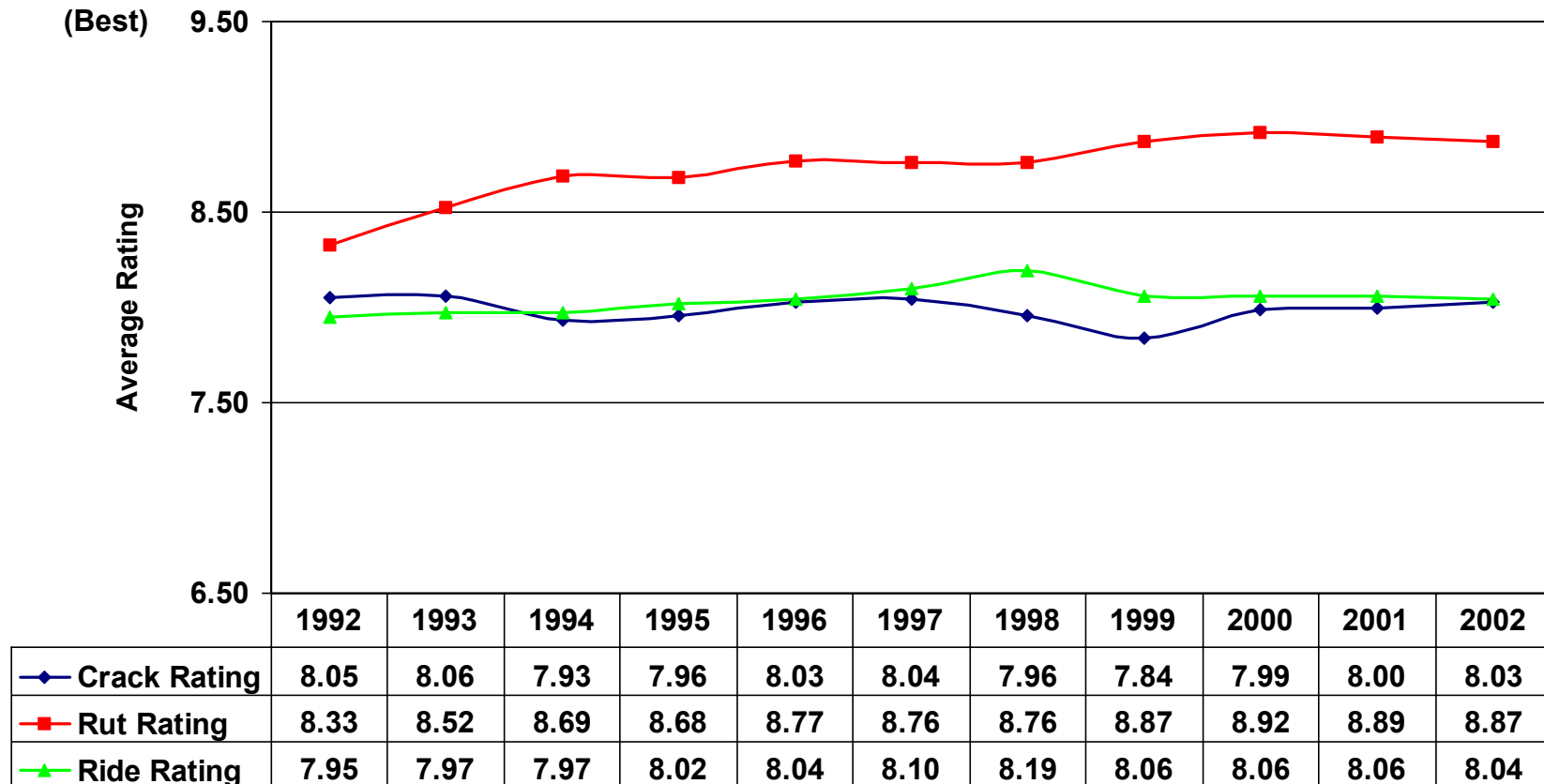
Historical Information

All Systems (All Districts)



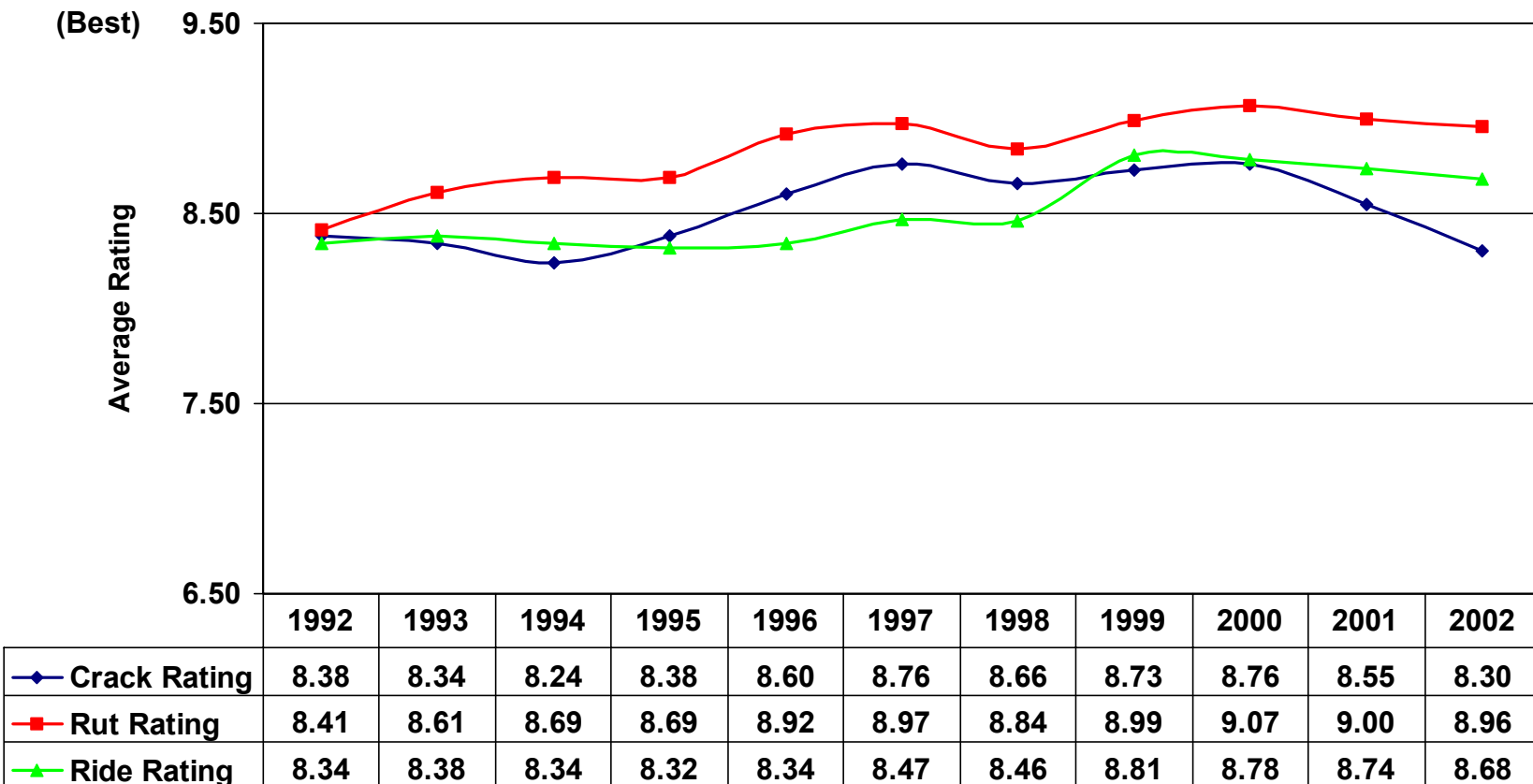
Historical Information

Primary System (All Districts)



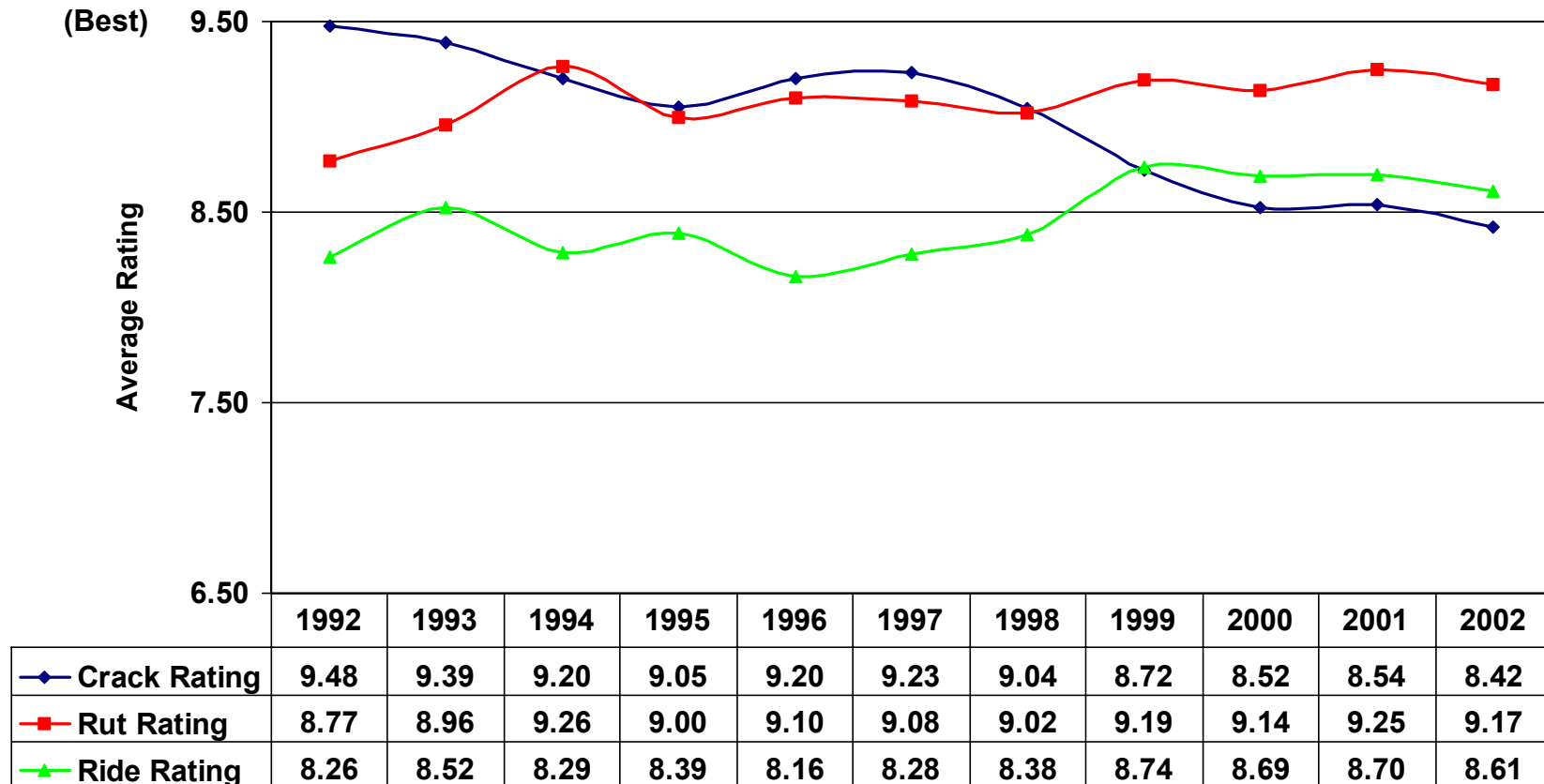
Historical Information

Interstate System (All Districts)



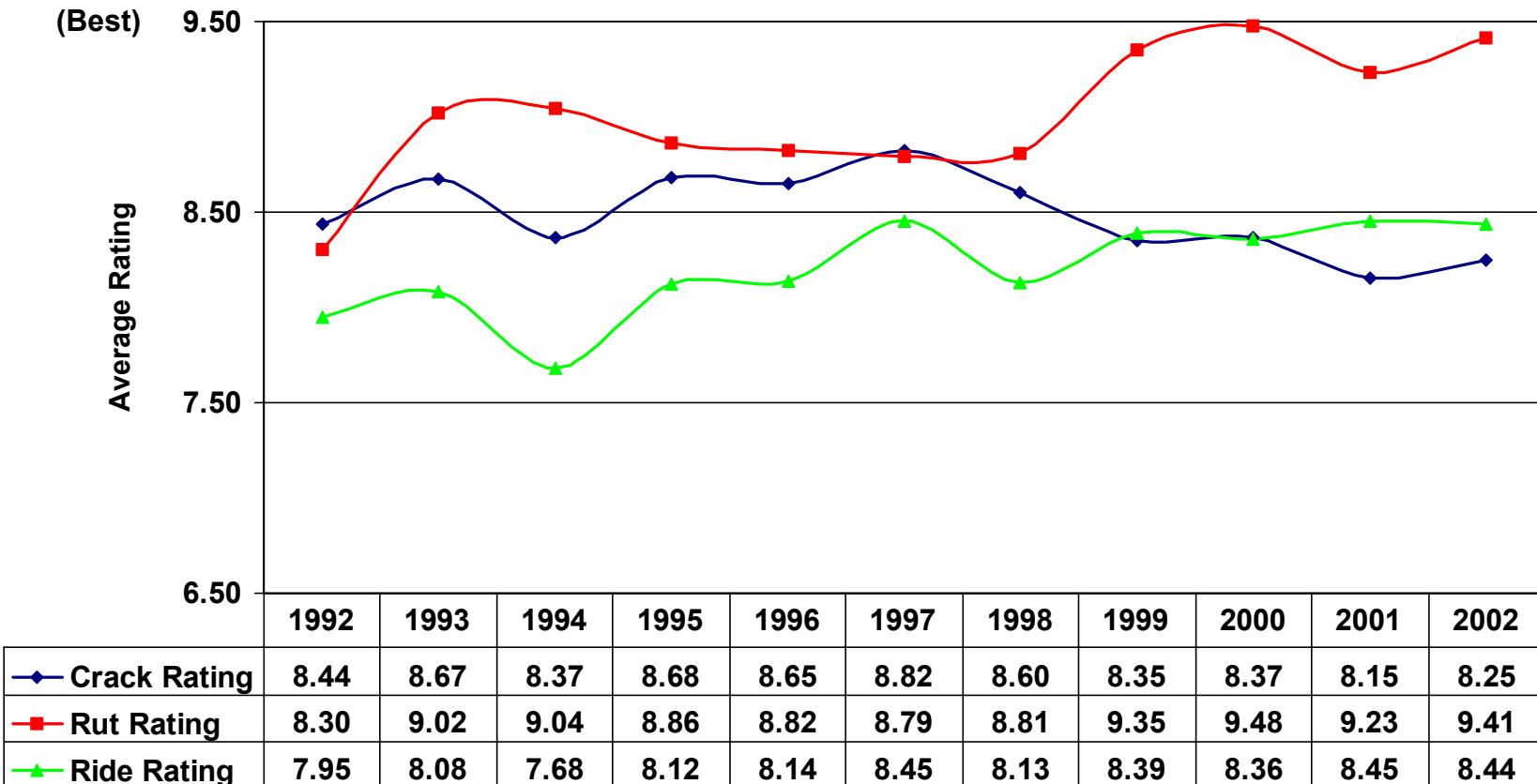
Historical Information

Turnpike System (All Districts)



Historical Information

Toll System (All Districts)



SECTION VIII

RAVELING INFORMATION



SECTION VIII

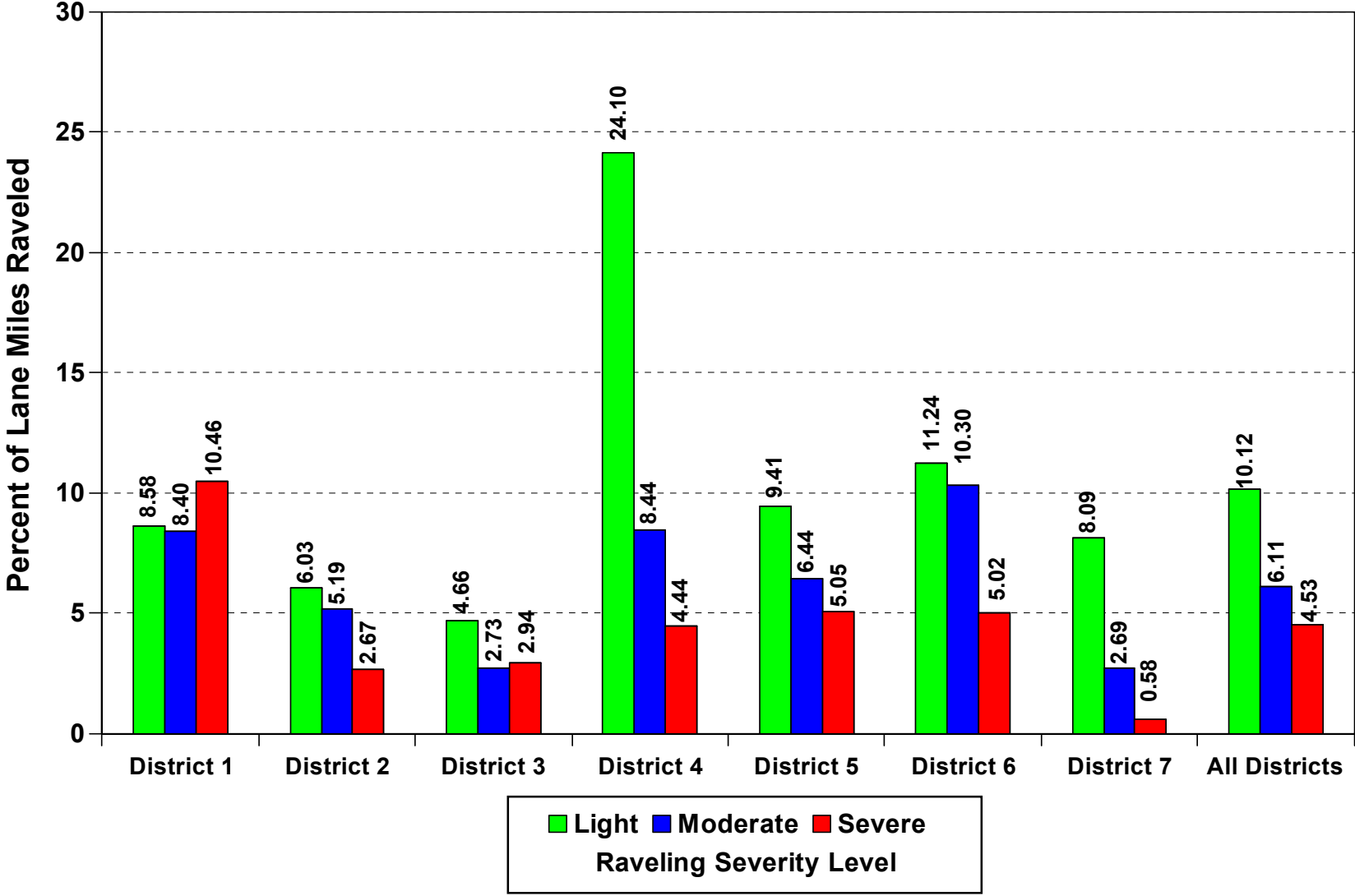
Raveling

Raveling Rating Criteria

- Raveling is the wearing away of the pavement surface caused by the dislodging of aggregate particles and the loss of asphalt binder due to weathering.
- Raveling for the rated section is accumulated in the crack ratings.
- Raveling and weathering may be caused by:
 - ▶ Hardening of the asphalt binder
 - ▶ Low adhesion of the asphalt binder
 - ▶ Low wear resistant aggregate in the mix or poor asphalt mix (dirty aggregate in the mix)
 - ▶ Water sensitive asphalt-aggregate mixture
 - ▶ Any combination of the above items
- Raveling became a noticeable defect by raters and was required to be listed in their comments as of 1992.
- Beginning in 1995, Raveling was rated by severity level (light, moderate, and severe) and percent of affected area, where only the predominate severity level was recorded.
 - ▶ Light Raveling occurs when the aggregate and/or binder has begun to wear away but has not progressed significantly. Some loss of fine aggregate is present.
 - ▶ Moderate Raveling occurs when the aggregate and/or binder has worn away and the surface texture is becoming rough and pitted; loose particles generally exist; loss of fine aggregate and some loss of coarse aggregate exists.
 - ▶ Severe Raveling occurs when the aggregate and/or binder has worn away and the surface texture is very rough and pitted; loss of coarse aggregate is very noticeable.

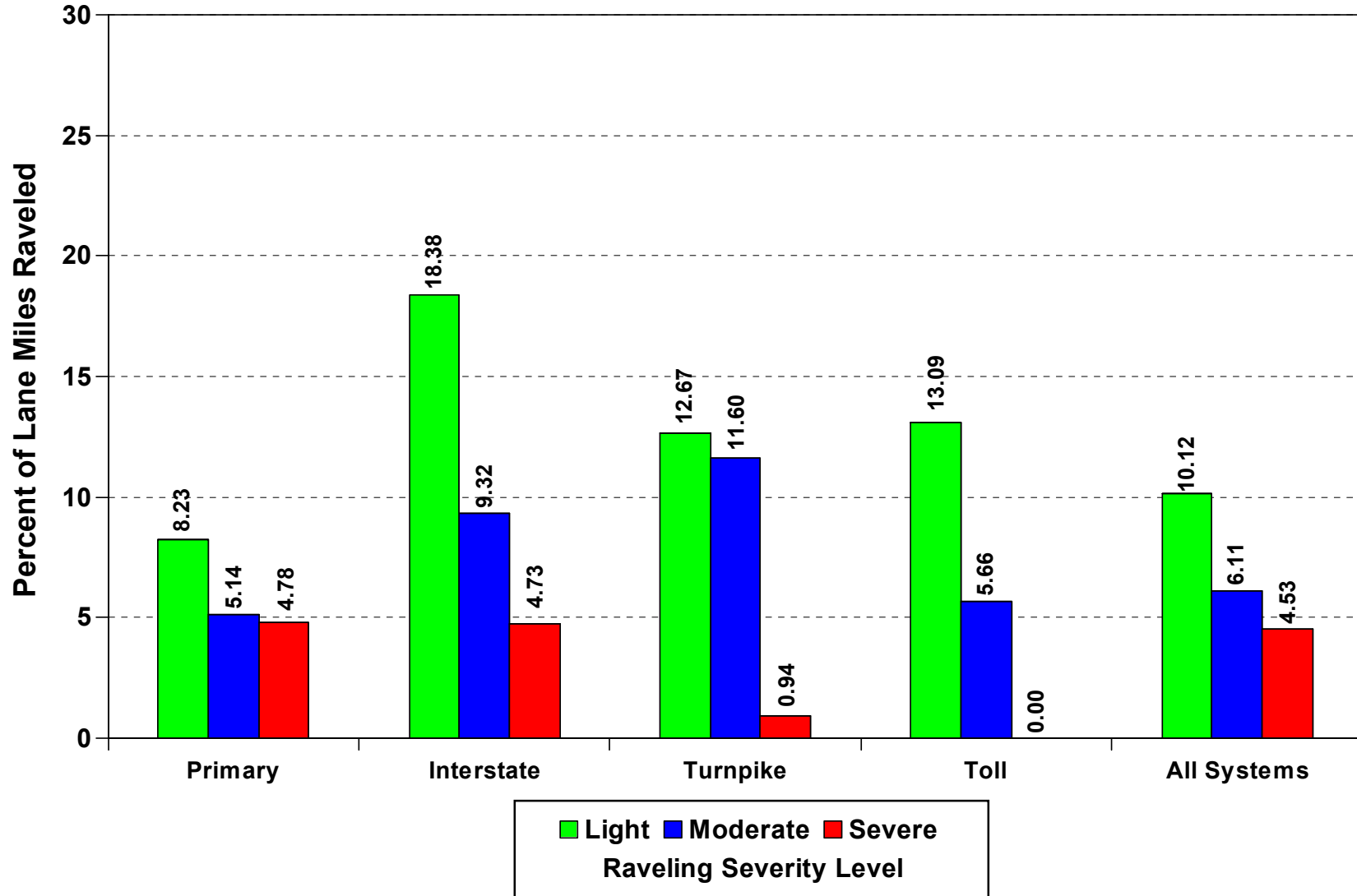
2002 Raveling Survey by District

All Systems



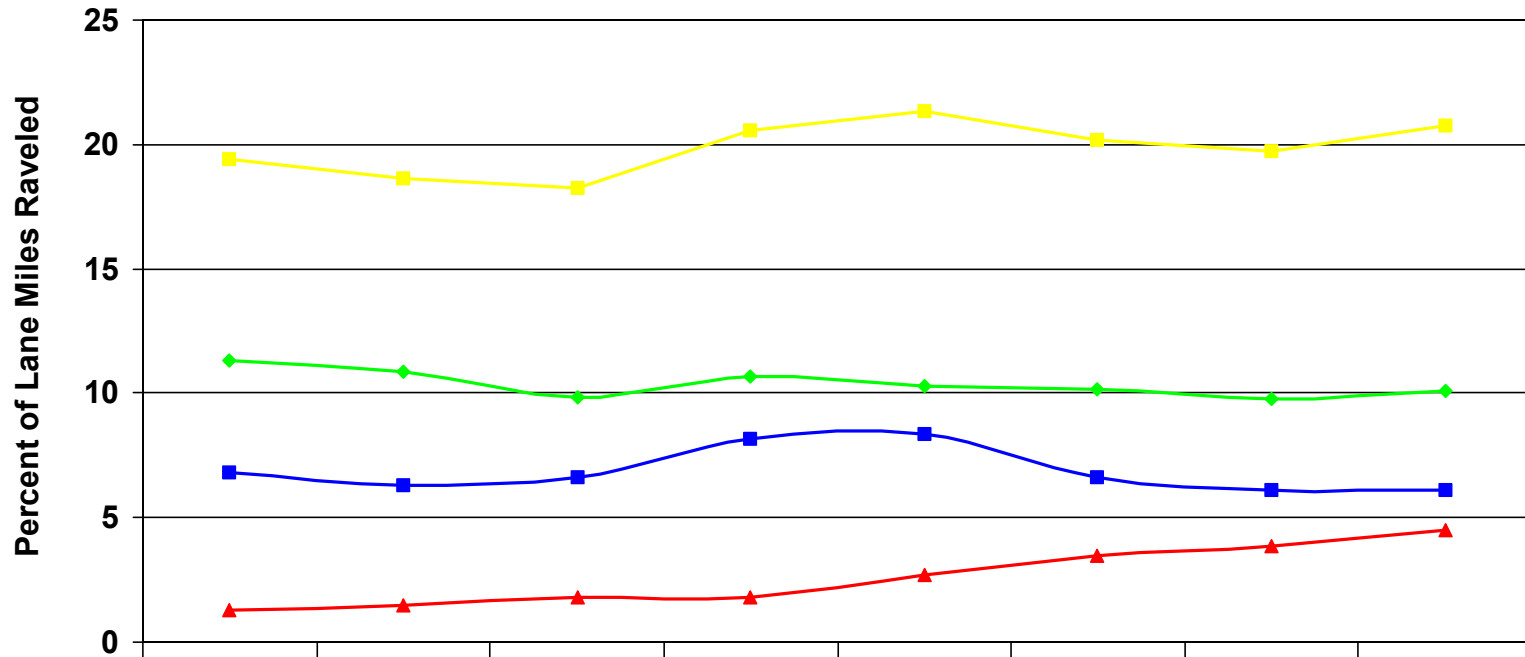
2002 Raveling Survey by System

All Districts



Raveling Survey History

All Systems Combined (All Districts)



	1995	1996	1997	1998	1999	2000	2001	2002
Combined	19.42	18.62	18.22	20.59	21.33	20.21	19.74	20.76
Light	11.34	10.89	9.85	10.65	10.26	10.17	9.78	10.12
Moderate	6.79	6.28	6.59	8.14	8.34	6.60	6.08	6.11
Severe	1.29	1.45	1.78	1.80	2.73	3.44	3.88	4.53

SECTION IX

CRACK, RUT AND RIDE RATINGS COMPARISON BETWEEN 2002 AND 2001



SECTION IX

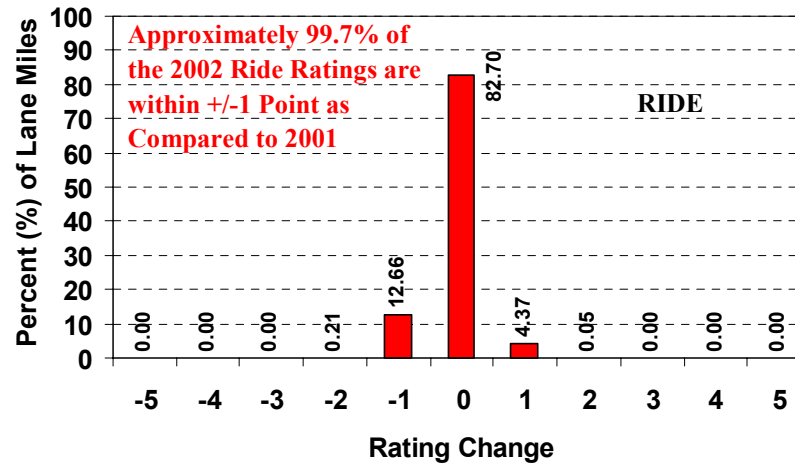
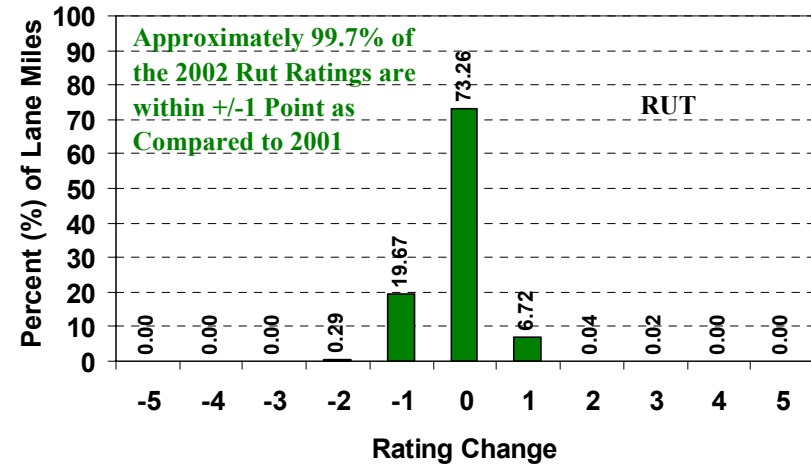
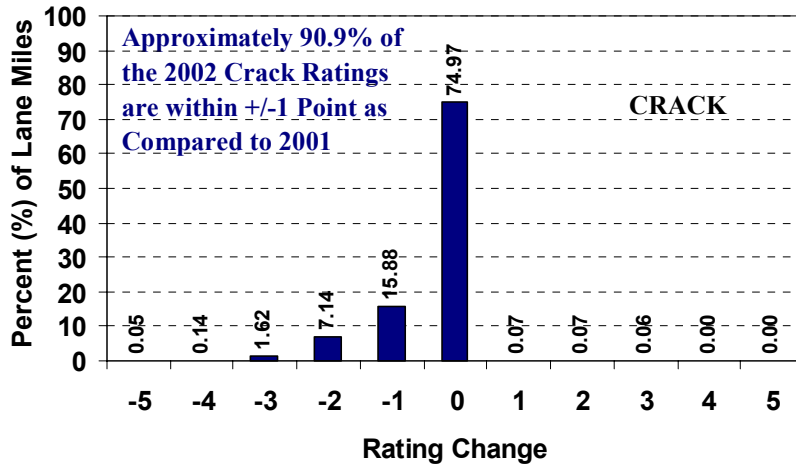
Crack, Rut, and Ride Ratings Comparison

Rating Comparison Criteria

The following pavement types have been omitted because they exhibit known changes to the pavement surface as indicated below:

- Type 0 - Pavement sections not State-maintained, duplicated under another county section number, or added under the rigid pavement condition survey.
- Type 2 - Surface Treatment or pavement improvement without new construction, such as intersection improvements, wheel path leveling, bridge approach or area resurfacing.
- Type 4 - Rigid Pavements
- Type 5 - New Construction
- Type 6 - No Ride taken for this section (normally because of length constraint)
- Type 7 - New Pavement (Overlays)
- Type 8 - Under Construction
- Type 9 - Structures or exceptions that are State-maintained

Crack, Rut and Ride Changes 2002 as Compared to 2001



NEGATIVE VALUES COULD INDICATE DETERIORATION IN THE PAVEMENT AND/OR VARIABILITY IN THE DATA COLLECTION PROCESS

POSITIVE VALUES COULD INDICATE VARIABILITY IN THE DATA COLLECTION PROCESS