

STATE OF FLORIDA



1999 FLEXIBLE PAVEMENT CONDITION SURVEY FACTS & FIGURES

FL/DOT/SMO/99-428

April 1999

STATE MATERIALS OFFICE

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Executive Summary

Since 1985, the Pavement Systems Evaluation Section of the State Materials Office has been responsible for the Department's Annual Pavement Condition Survey. The Survey is conducted on 100% of the State-maintained Highway System. Since the mileage of flexible pavements represents approximately 96% of the entire System, the facts and figures contained in this report are for flexible pavements only.

The purpose of the Survey is to provide the Department with a means for determining the present condition of the State Roadway System and for comparing present and past conditions in order to predict deterioration rates. In addition, the Survey can be used to predict rehabilitation funding needs and to provide justification for annual rehabilitation and distribution of budgets.

The worst lane in each direction is tested, and pavement sections are determined by construction limits or uniform conditions. Ride rating and Rut rating data are collected with four road profilers, while Cracking is subjective and collected visually. Cracking is rated by severity levels and quantities for both the wheel path area and the remaining area of the lane.

The 1999 Survey was completed using Laser equipped profilers. The Lasers fire at 32,000 times per second or approximately 30.3 readings per inch while traveling at 60 mph. Ride Number is the statistic used to produce Ride Rating. Ride Number is an ASTM Standard (E 1489) and is a mathematical processing of longitudinal profile measurements to produce an estimate of subjective ride quality or user perception.

After the Survey is completed, the data collected are reviewed by the Pavement Systems Evaluation Section of the State Materials Office and then are sent to the Central Pavement Management Office for additional review and editing. After this, the Central Program Development Office becomes responsible for reporting the condition of the State-maintained Highway System for Pavement Management purposes.

☞ Note: The information contained and presented in this report is based on the Pavement Condition Survey, and are not the Department's final figures.

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 100% of the State-maintained Highway System. Since the mileage of flexible pavements represents approximately 96% of the entire System, the facts and figures contained in this report are for flexible pavements only unless otherwise noted.

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. Although the number of survey engineers has decreased, the number of miles surveyed since 1986 has increased by 19% (refer to chart on page 5). The purpose of the Survey is to provide the Department with a means to:

- ☞ 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
- ☞ Provide justification for distribution of rehabilitation funds to districts

The Crack, Rut and Ride deficiencies are surveyed to evaluate the condition of the pavements. For each deficiency the pavement sections are rated on a zero to ten scale, where ten indicates a section in excellent condition. Currently, any section with a rating of six or less would become eligible for rehabilitation.

Cracking is measured visually and is a subjective survey which is performed 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. This state-of-the-art equipment has to be well maintained and routinely calibrated to ensure maximum accuracy of the data collected. For detailed information about the Pavement Condition Surveys, please refer to the Rigid and Flexible Pavement Condition Survey Handbooks.

Observations

- Crack Ratings have remained stable for the past eight years.
- Rut depth values for the State-maintained System have improved.
- Ride values for the State-maintained System have remained constant.
- 89.3% of this year's Crack ratings were ± 1 point as compared to the previous year's. (*)
- 99.2% of this year's Rut ratings were ± 1 point as compared to the previous year's. (*)
- 98% of this year's Crack ratings were ± 1 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.

(*) Sections under pavement rehabilitation were excluded.

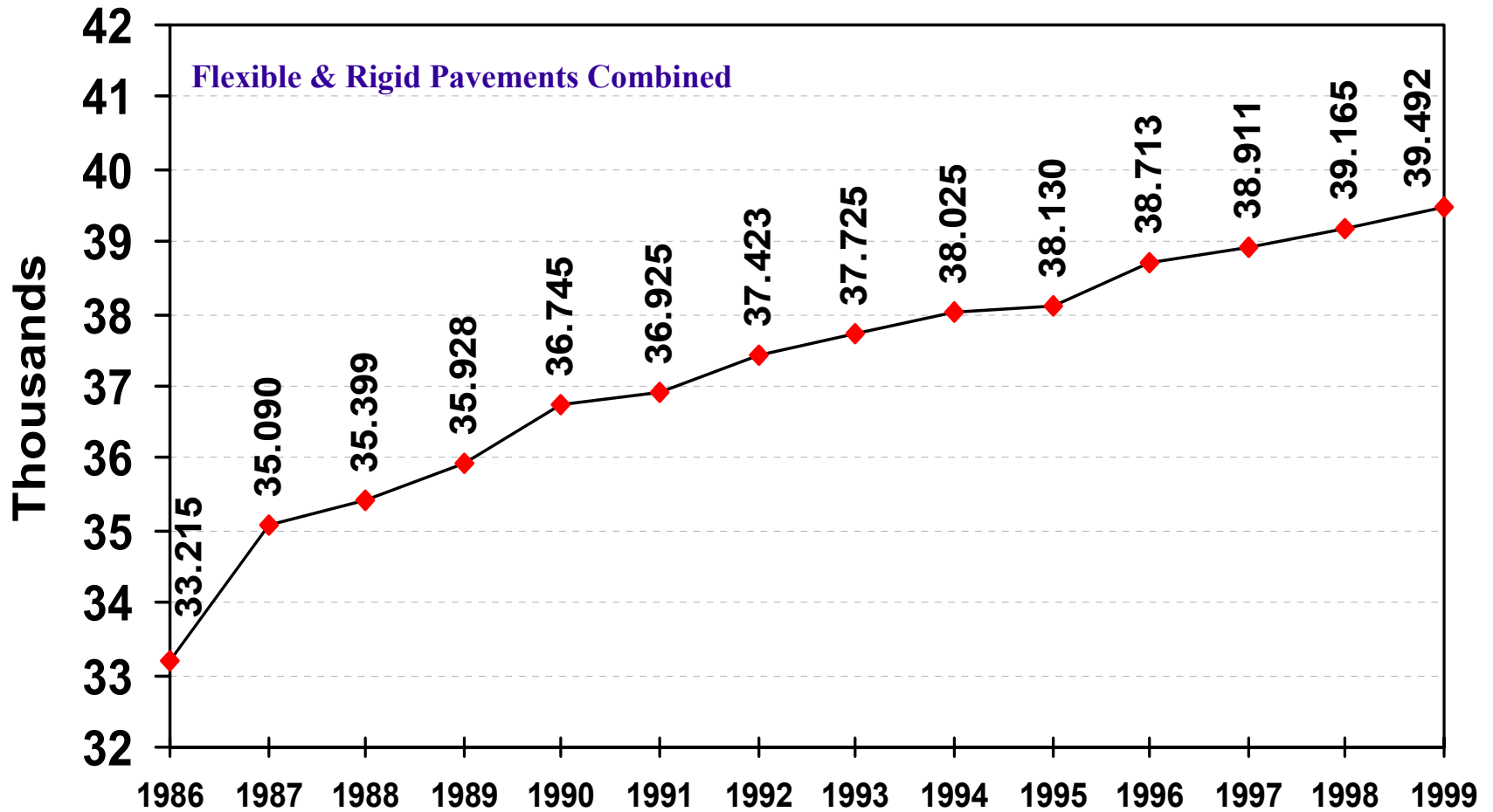
General Notes

- For multi-lane roadways: The worst lane in each direction is tested (normally that is the outermost traffic lane).
- For two-lane roadways: The worst lane is tested (normally the same lane that was 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 remaining area of the roadway.

Note: The information contained and presented in this report is based on the Pavement Condition Survey, and are not the Department's final figures.

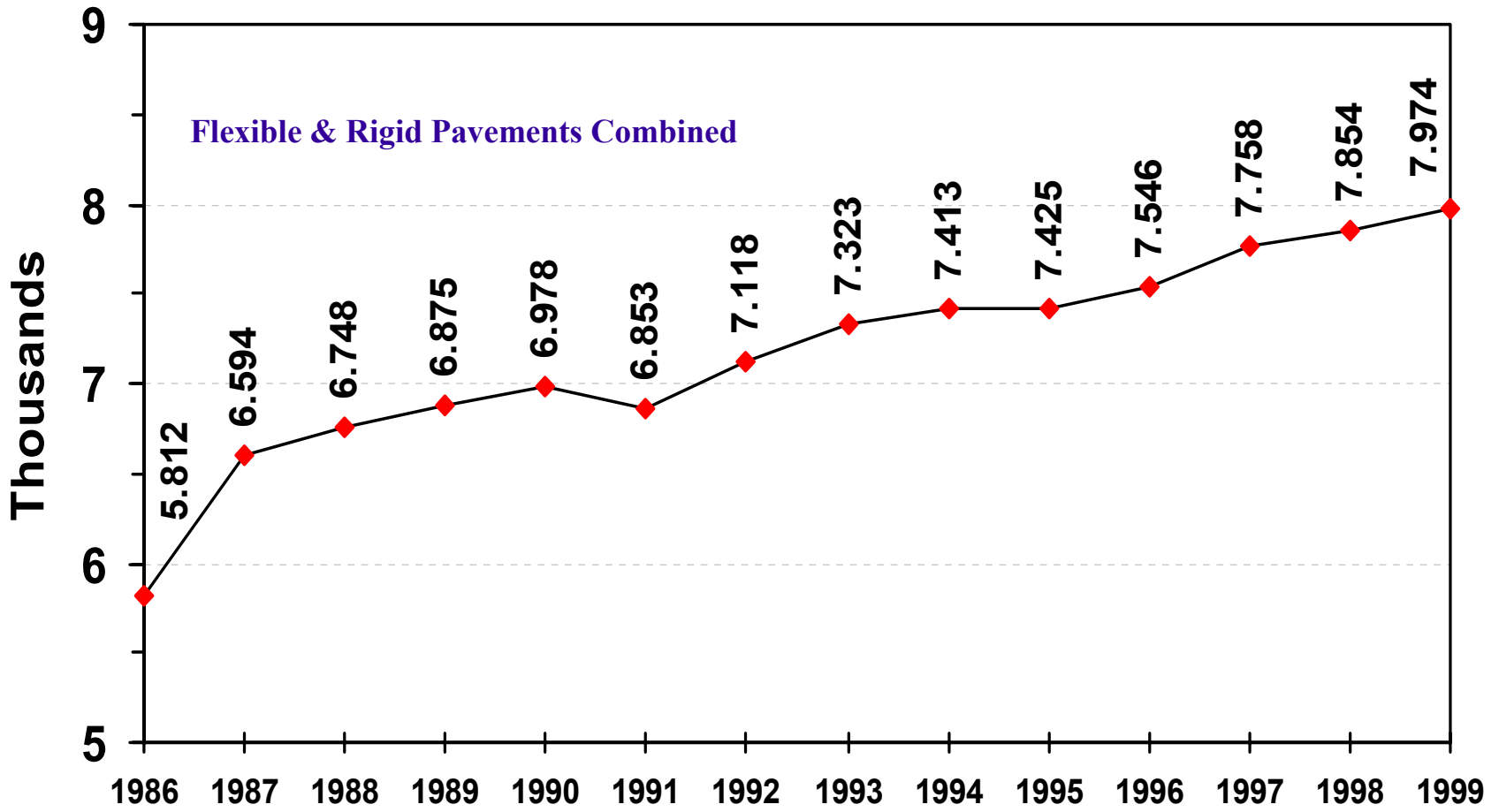
Production History

Lane Miles



Production History

Rated Sections

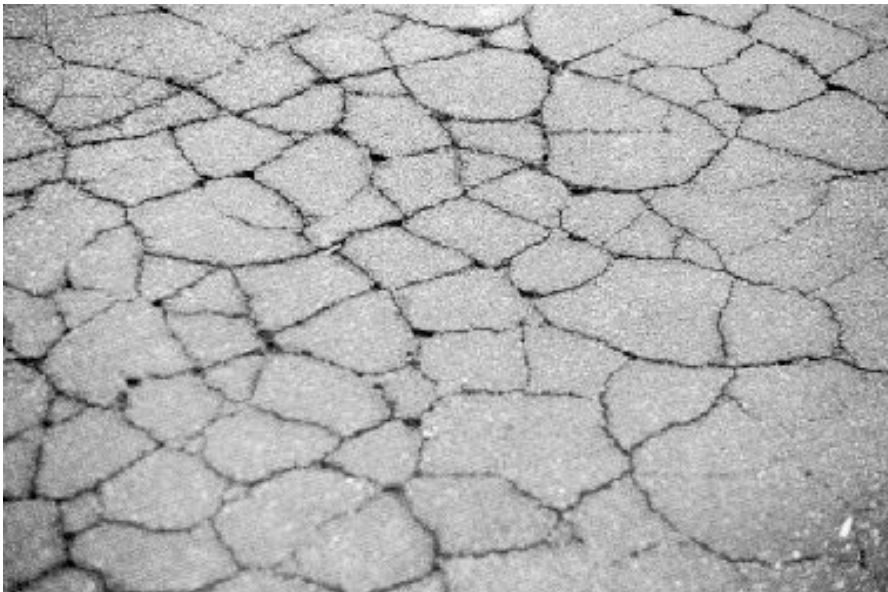


SECTION II

CRACK RATING

BY

SYSTEM AND DISTRICT



SECTION II

Crack Rating by System and District

Crack Rating Criteria

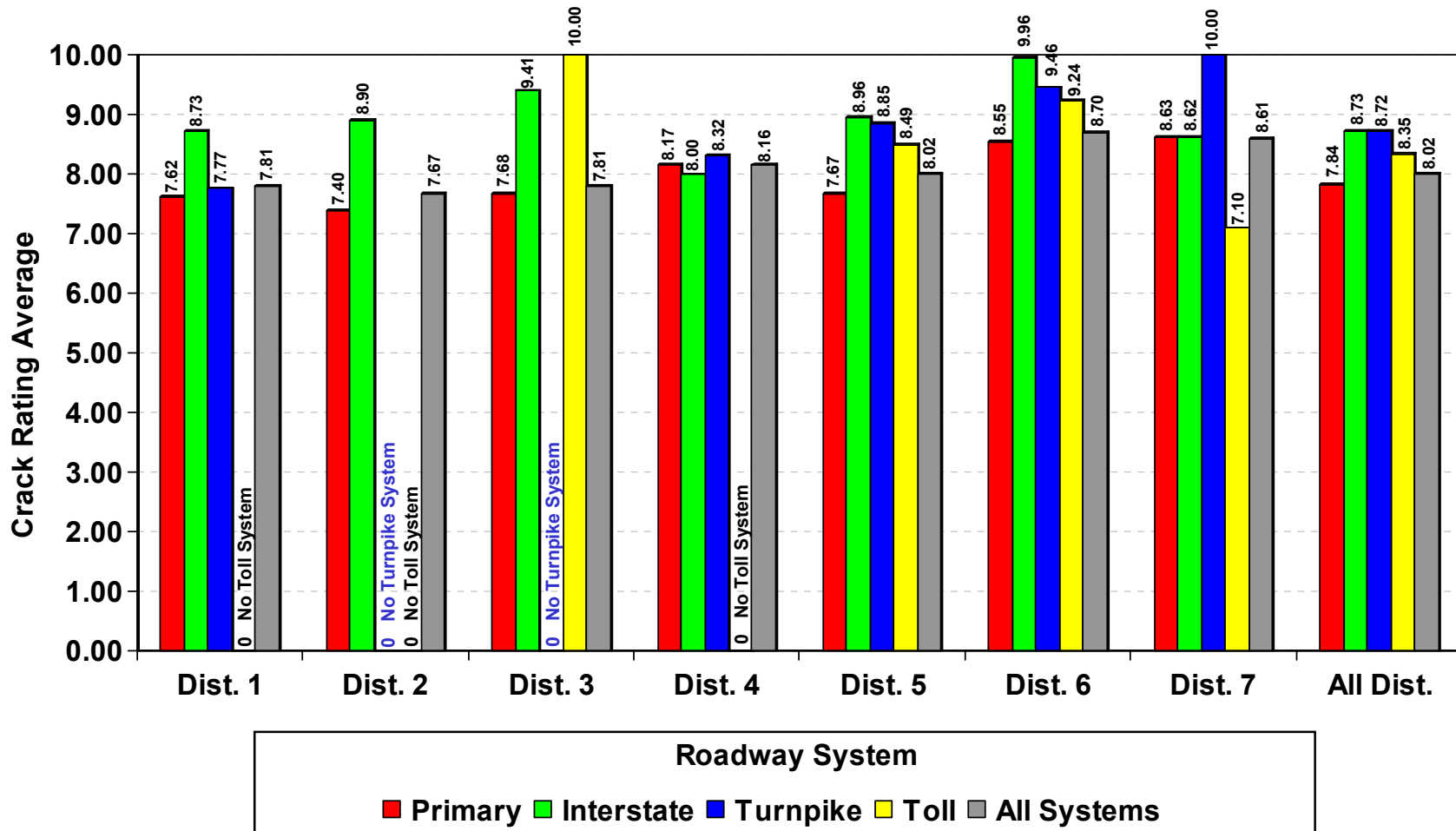
- Cracking is estimated as percentages of areas within the wheel paths (CW) and outside of the wheel paths (CO). These percentages are estimated separately for each of the two areas.
- Three types of cracking are rated depending upon severity levels.
- Only the predominate type of cracking is used to determine the deduct values. 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 10 is best. Currently, a rating of six or less makes pavement segments eligible for rehabilitation.
- The Cracking Deficiency Rating is subtracted from a perfect score of ten.

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

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

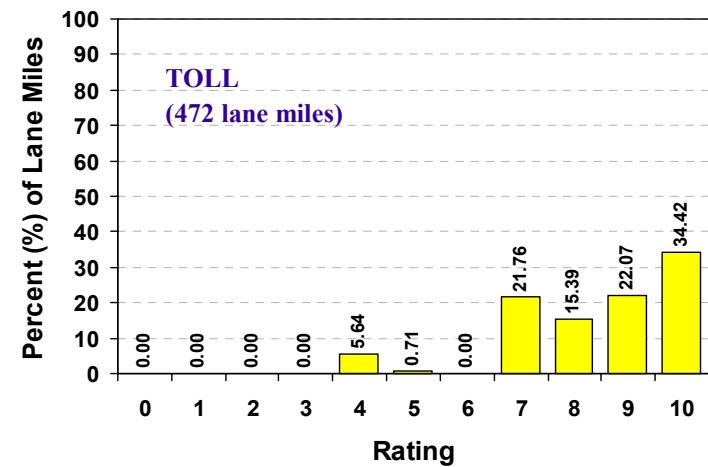
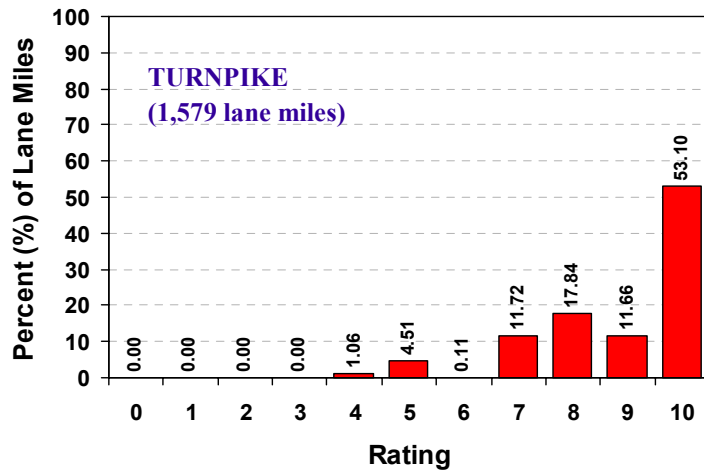
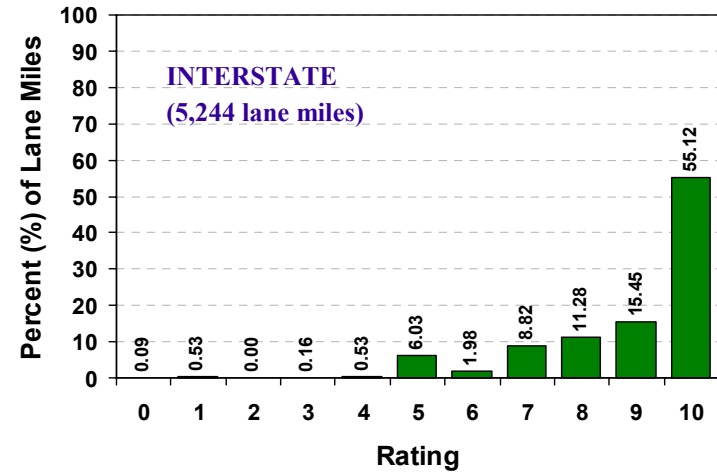
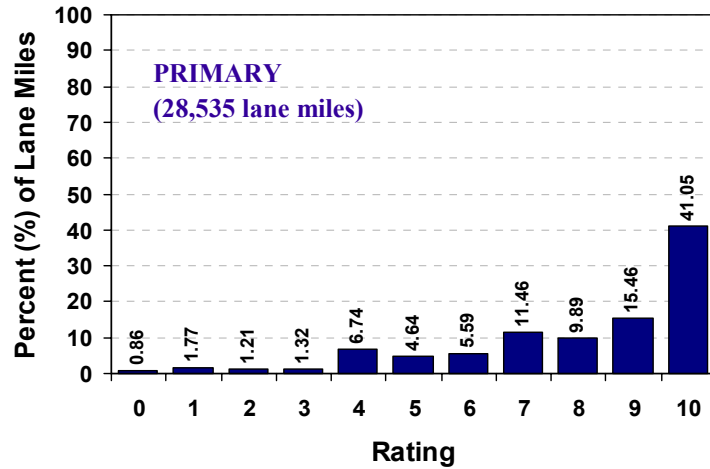
1999 Flexible Pavement Condition Survey



1999 Crack Distribution by System

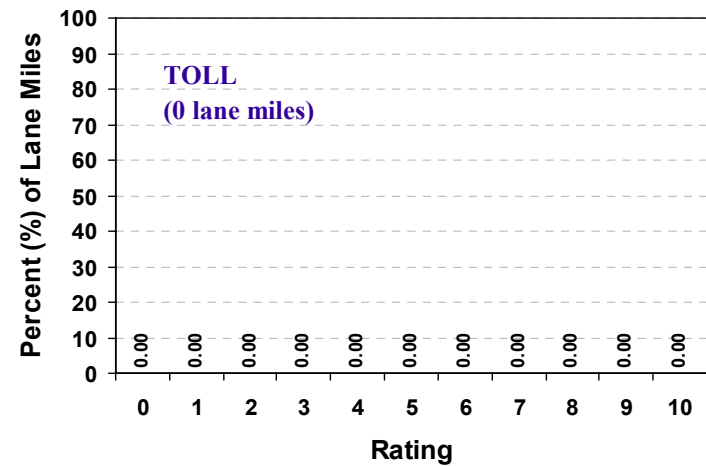
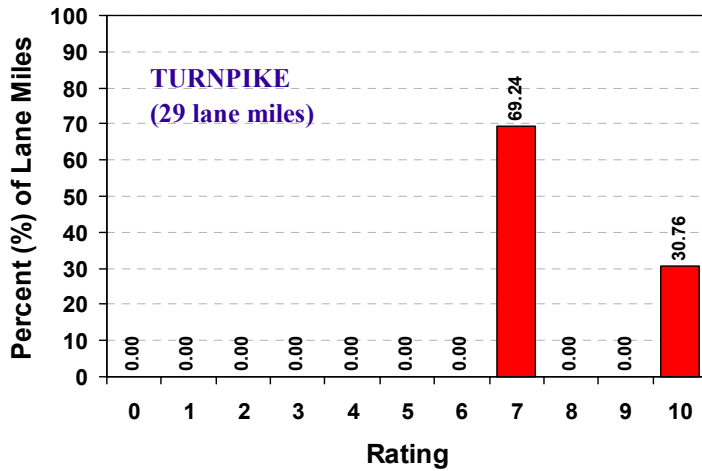
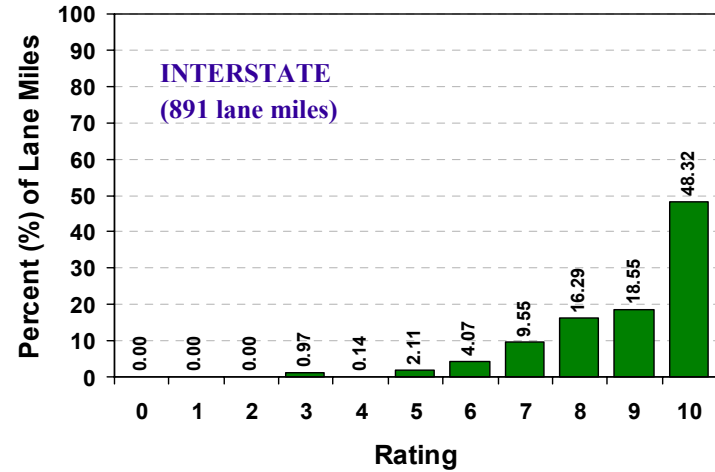
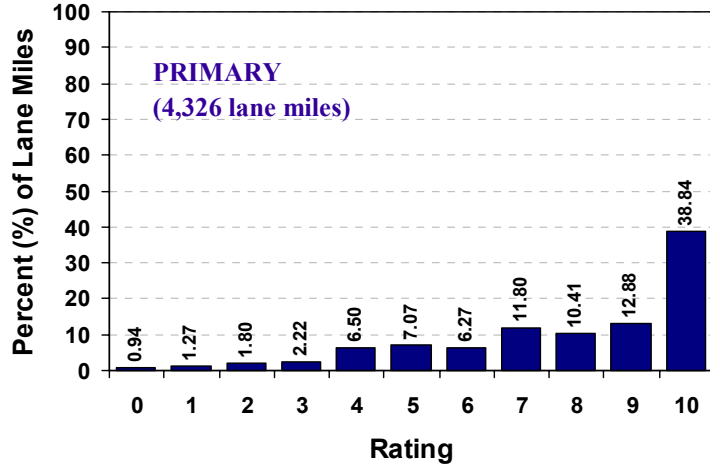
Statewide

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1999 Crack Distribution by System

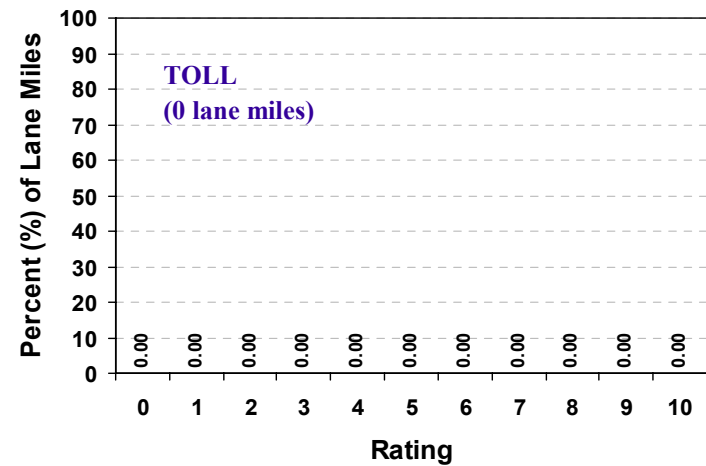
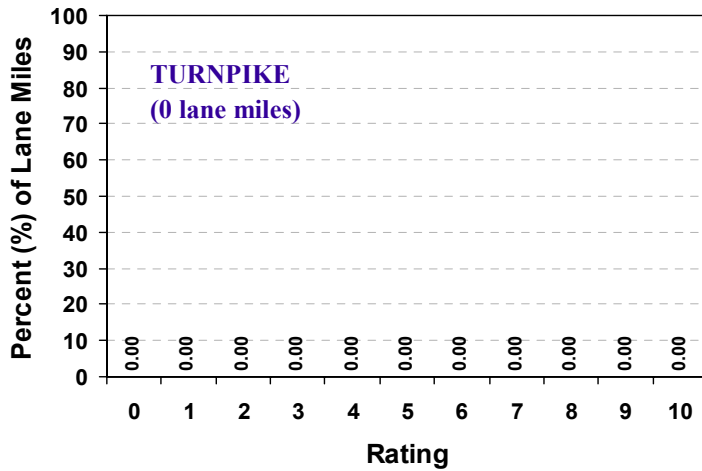
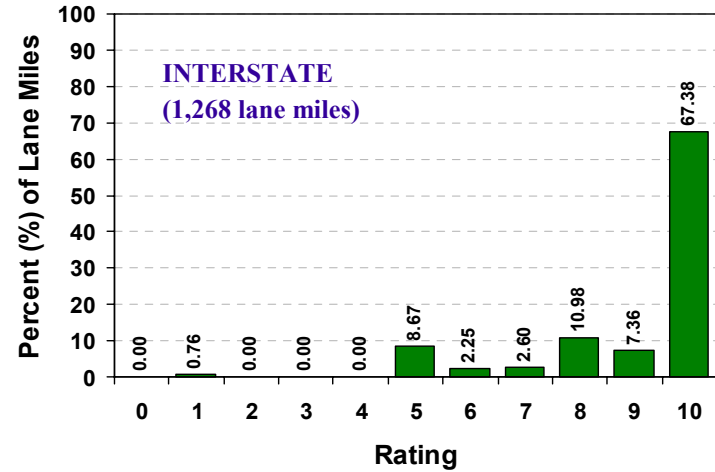
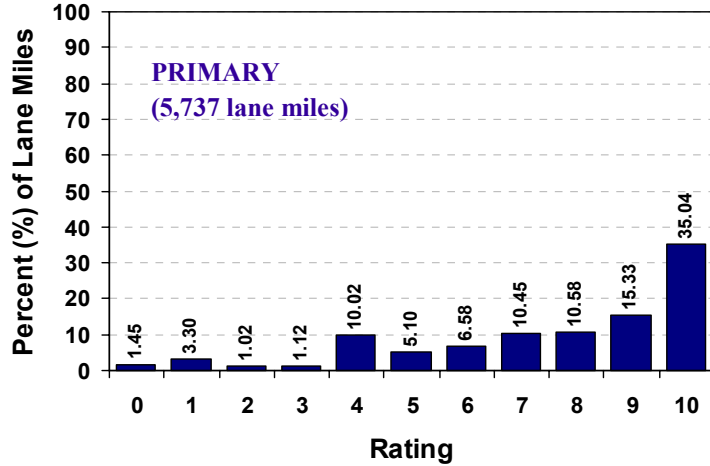
District 1



1999 Crack Distribution by System

District 2

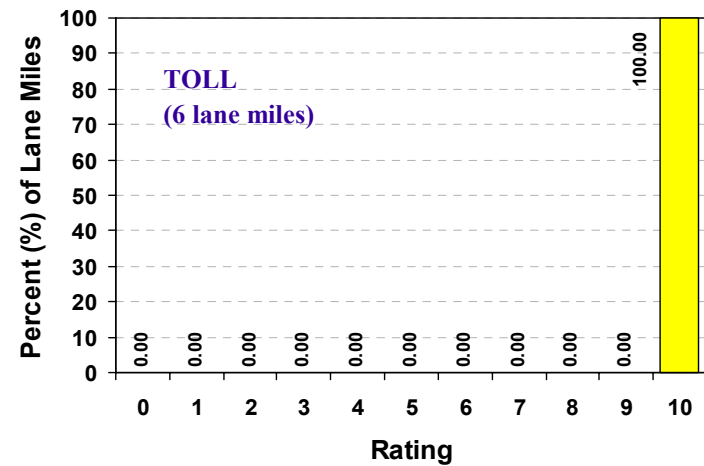
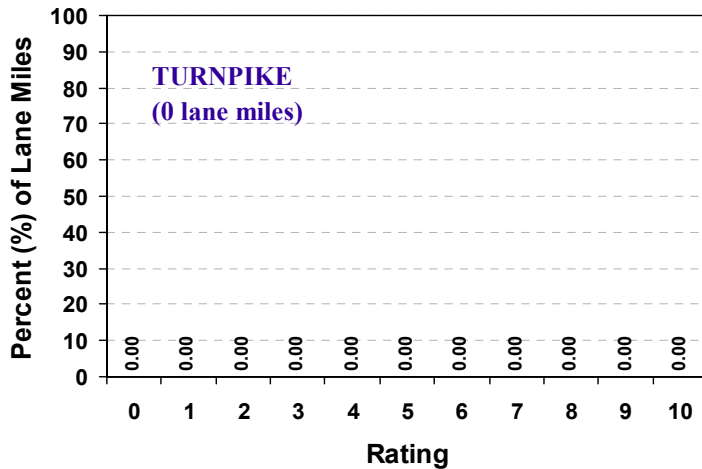
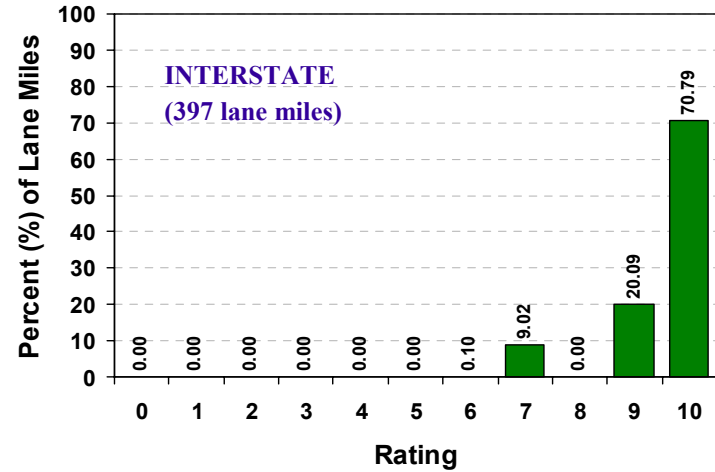
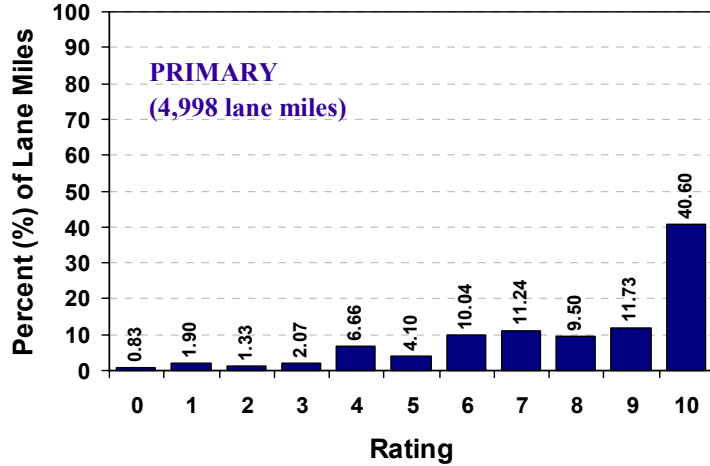
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1999 Crack Distribution by System

District 3

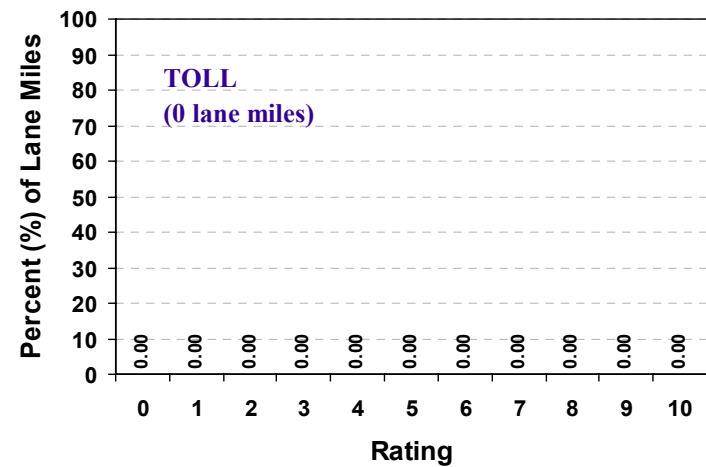
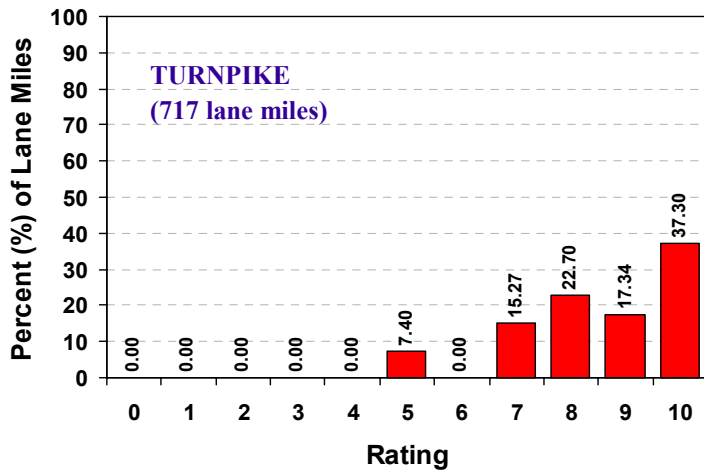
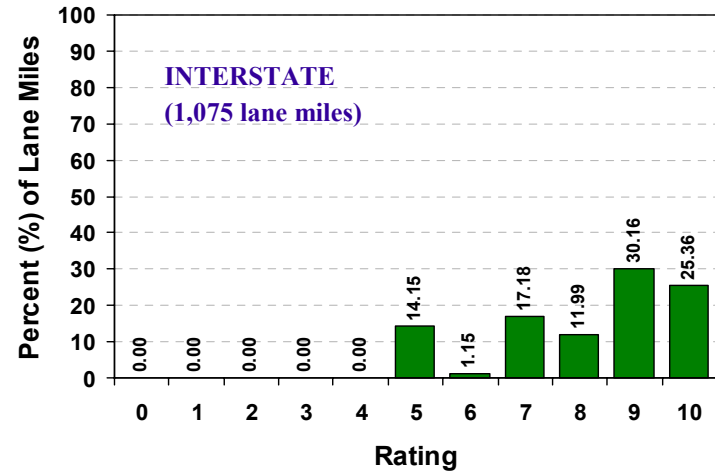
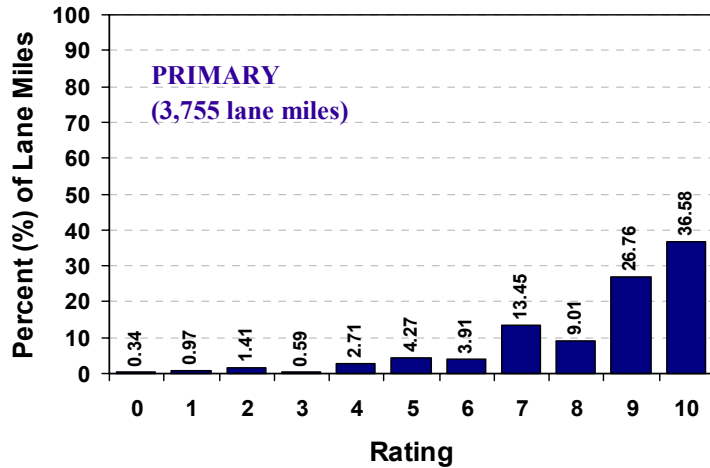
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1999 Crack Distribution by System

District 4

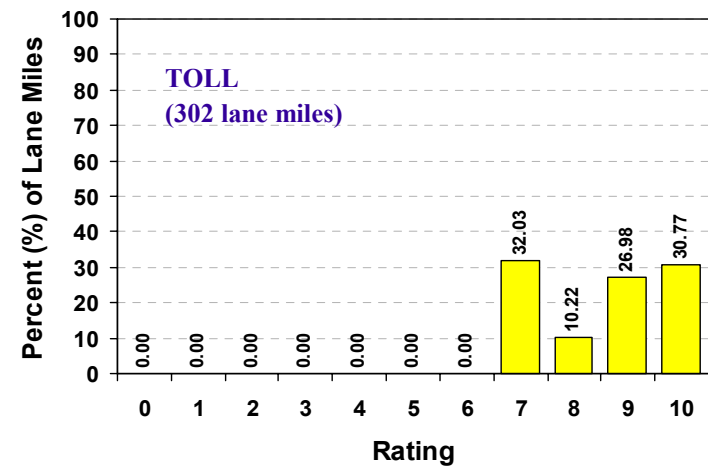
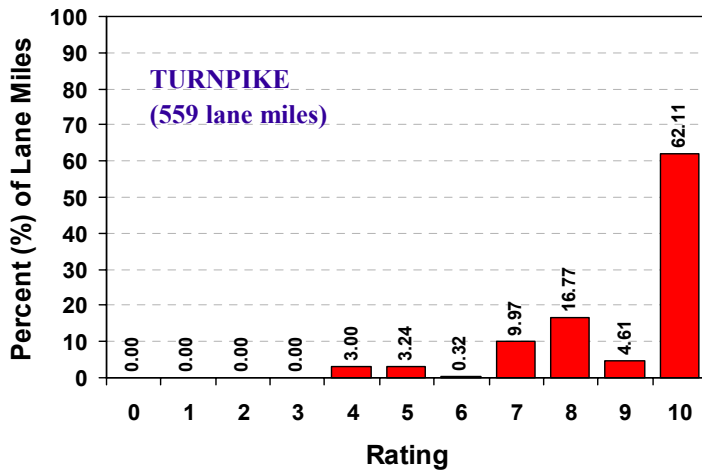
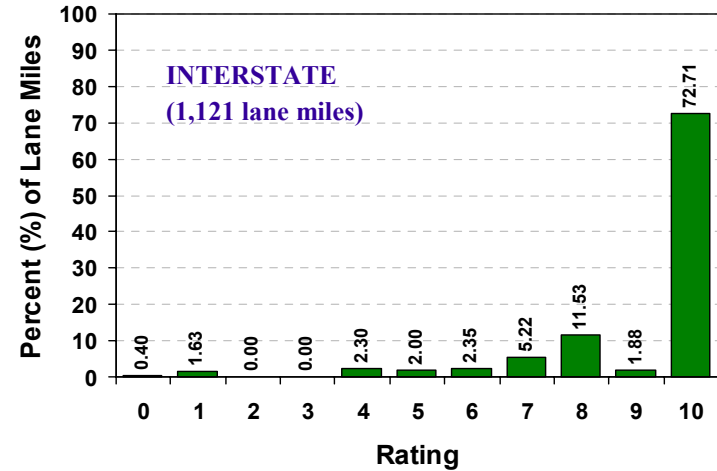
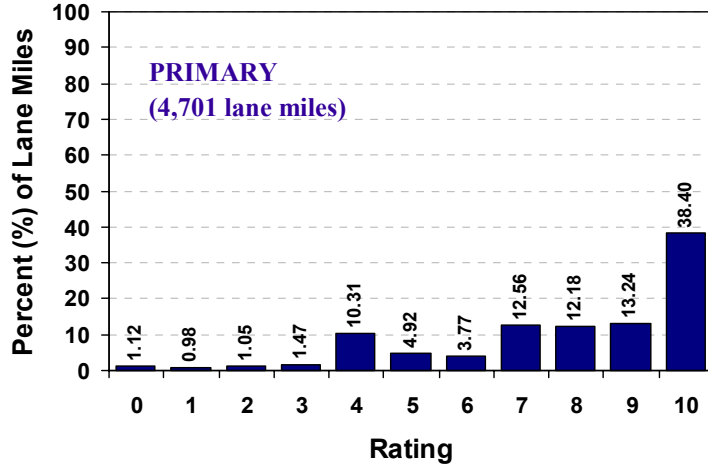
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1999 Crack Distribution by System

District 5

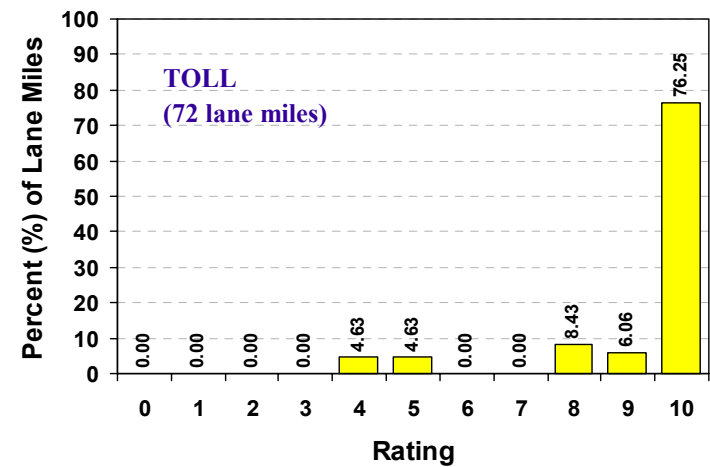
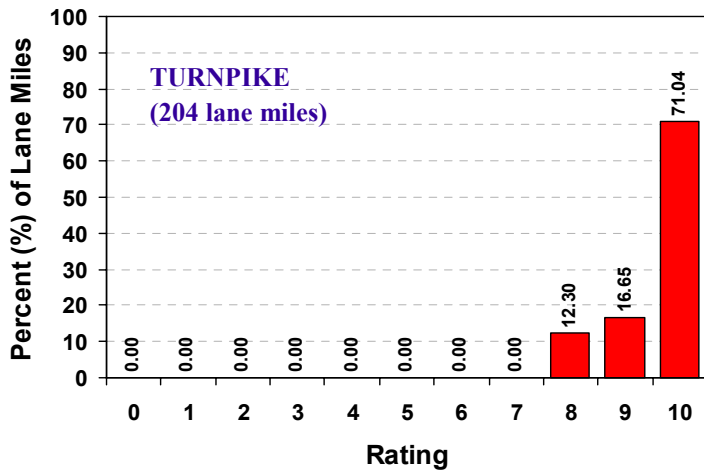
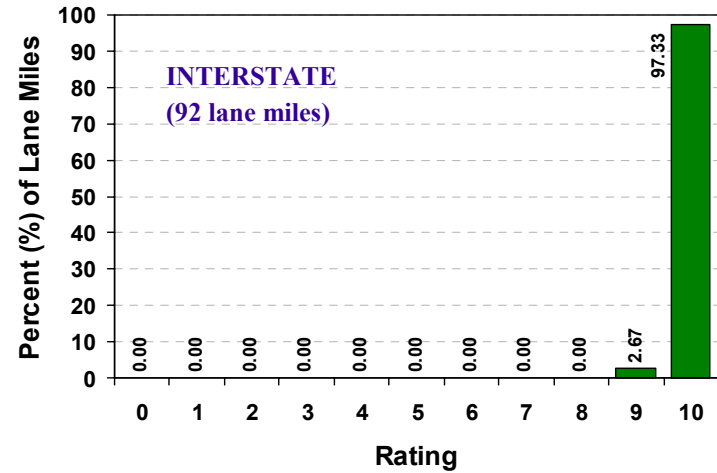
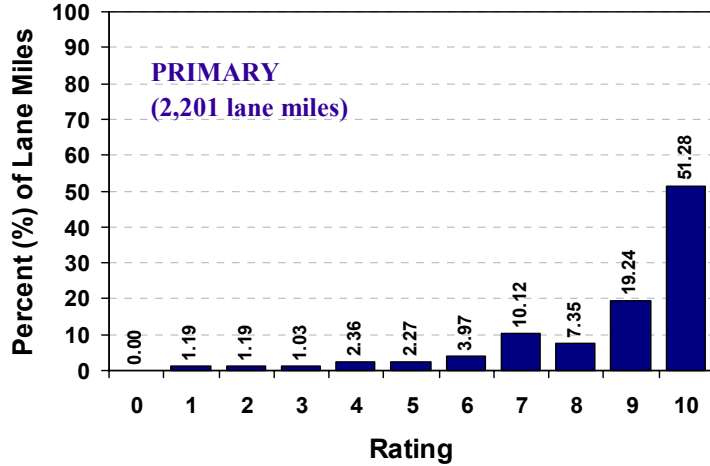
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1999 Crack Distribution by System

District 6

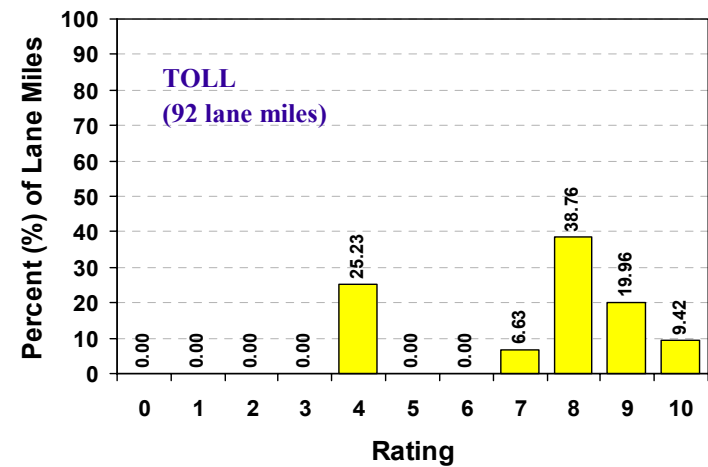
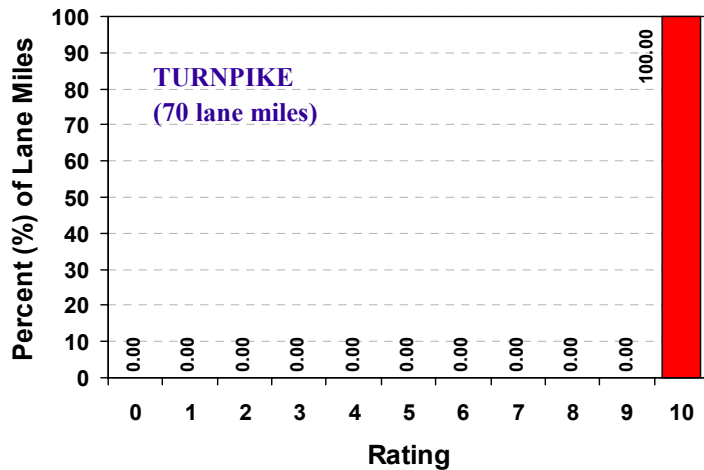
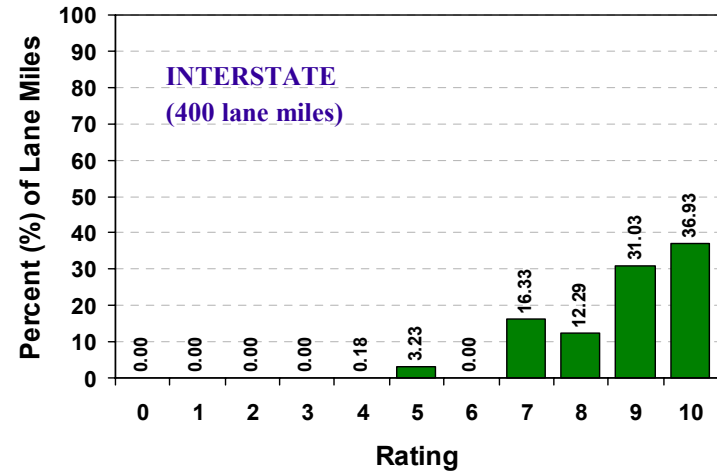
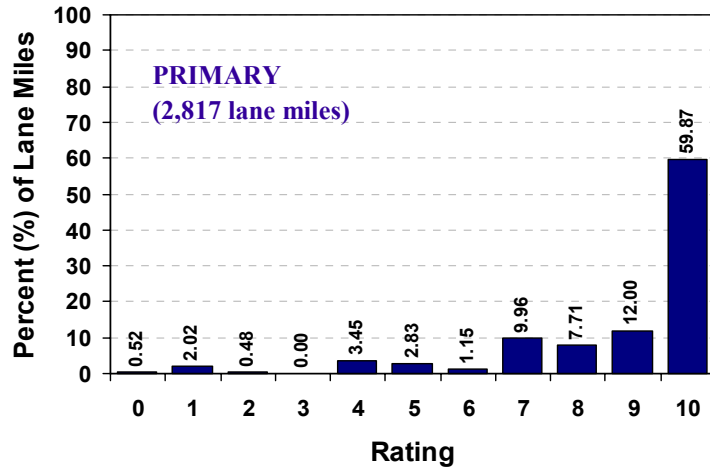
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1999 Crack Distribution by System

District 7

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SECTION III

RUT RATING

BY

SYSTEM AND DISTRICT



SECTION III

Rut Rating by System and District

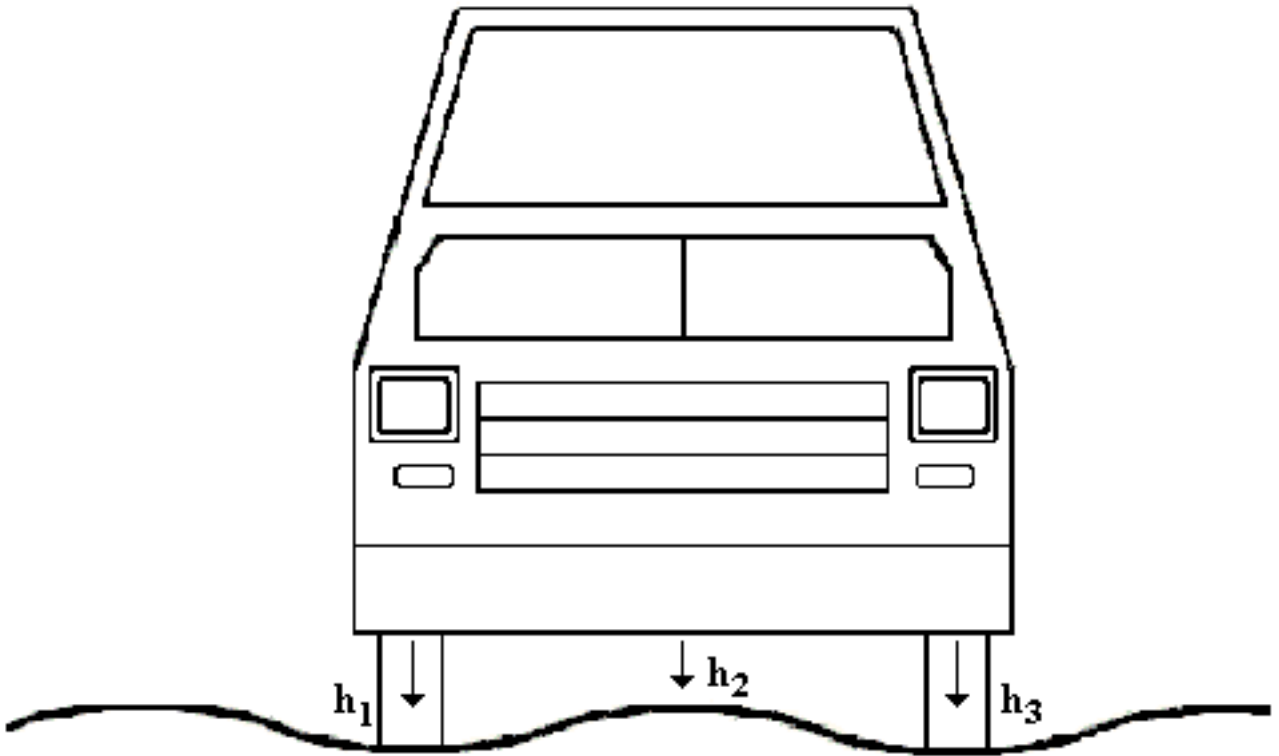
Rut Rating Criteria

- 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.
- The difference in elevations between the wheel path and the center of the travel lane is the Rut Depth.
- Rut Depth is measured simultaneously with the Ride values using a profiler. See Fig. III-1 on next page.
- The profiler measures Rut Depth approximately 30 times per inch when traveling at 60 mph. The measurements are then stored on 1 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 1/8 inch of average of 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 1/2 inch of rutting. Currently a rating of six or less makes pavement segments eligible for rehabilitation.
- The 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 sensors and the roadway surface directly below each sensor. See diagram on page 20.

Road Profiler

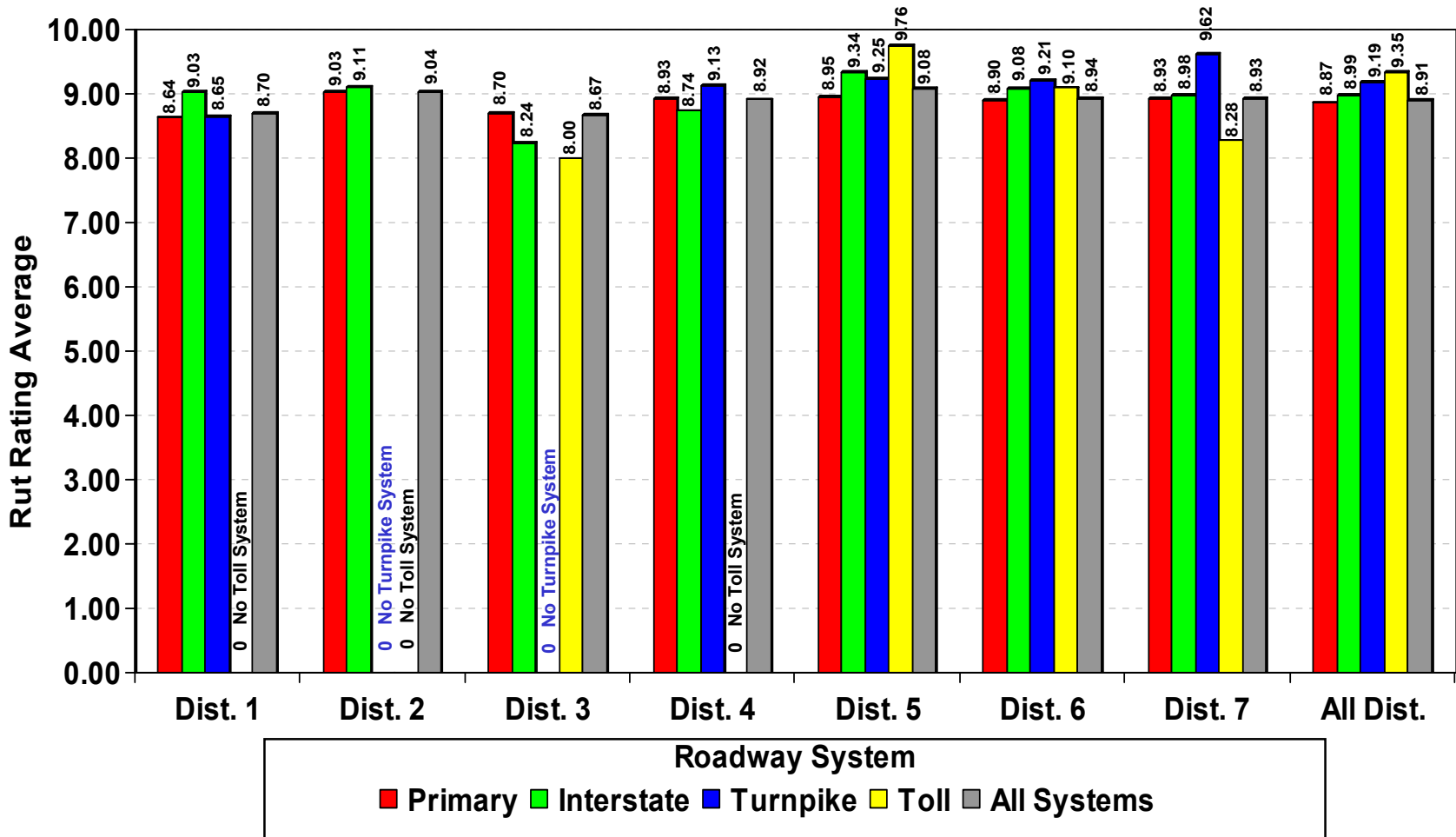


$$RUT\ DEPTH = \frac{(h_1 - h_2) + (h_3 - h_2)}{2}$$

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

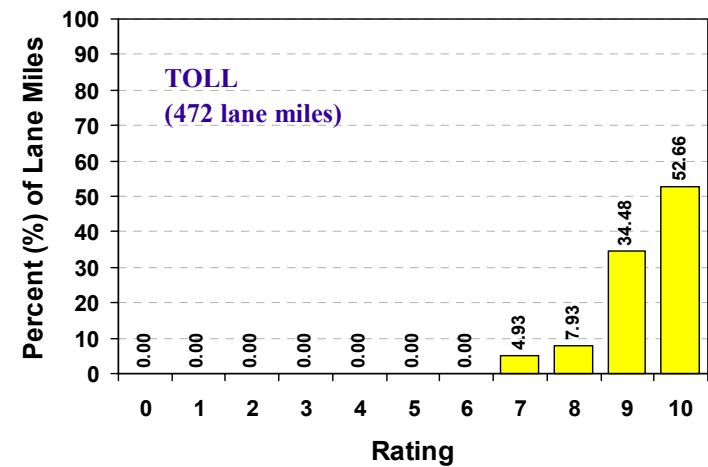
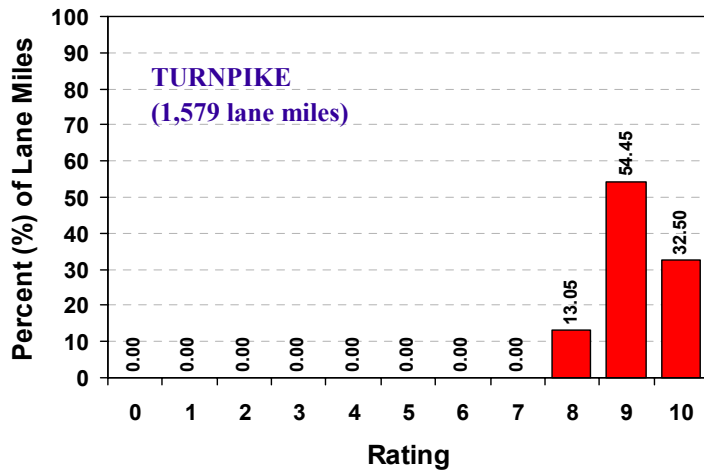
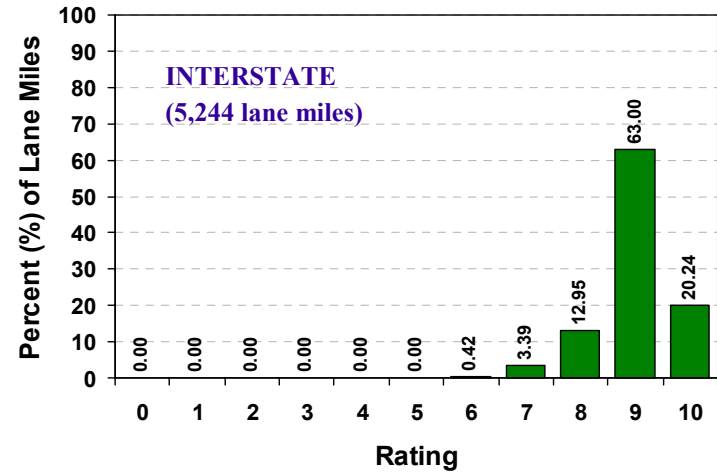
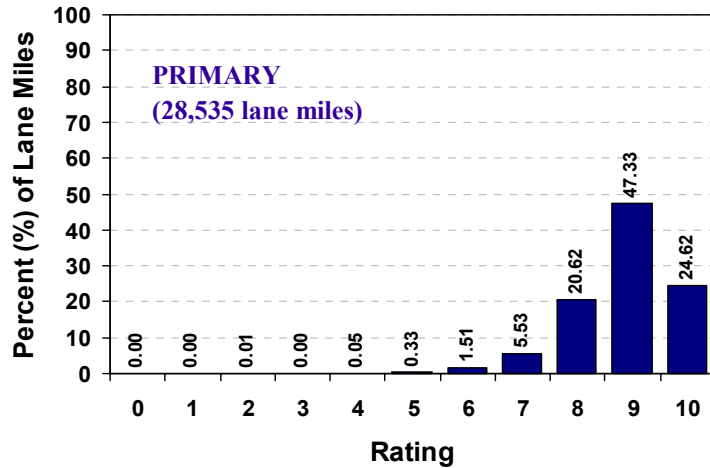
Rut Ratings by System and District

1999 Flexible Pavement Condition Survey



1999 Rut Distribution by System

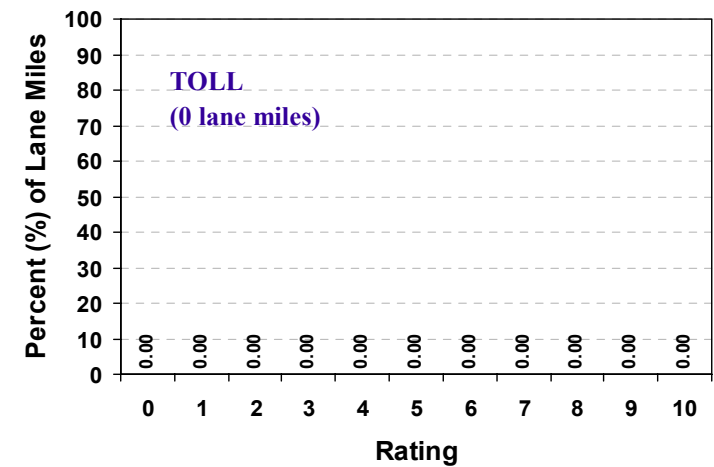
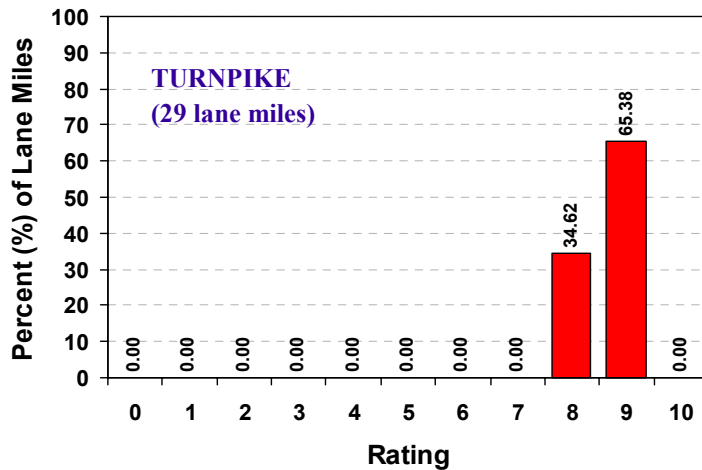
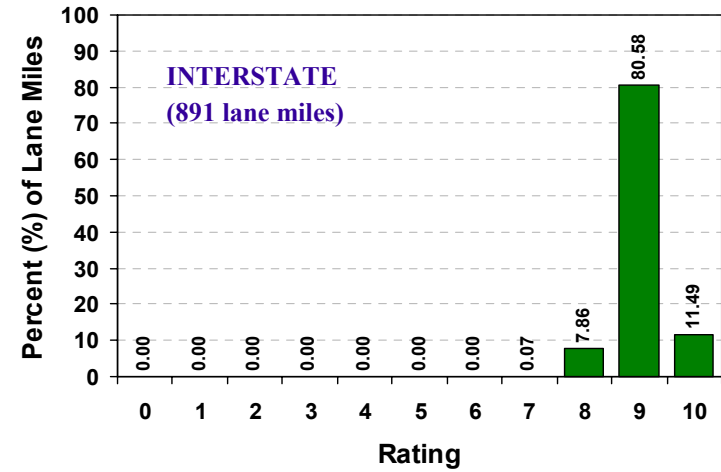
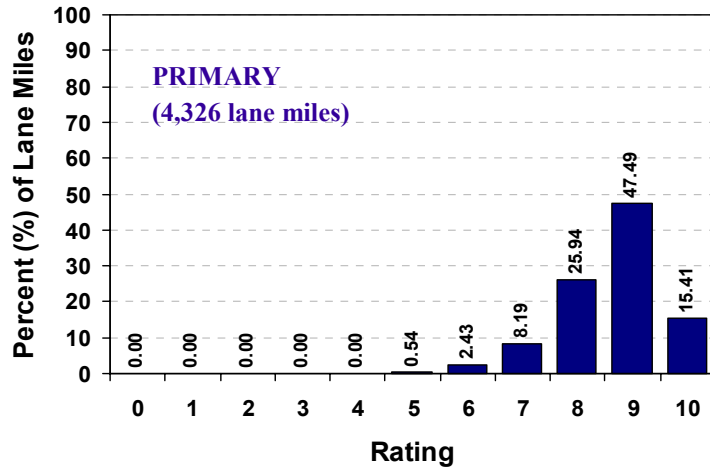
Statewide



1999 Rut Distribution by System

District 1

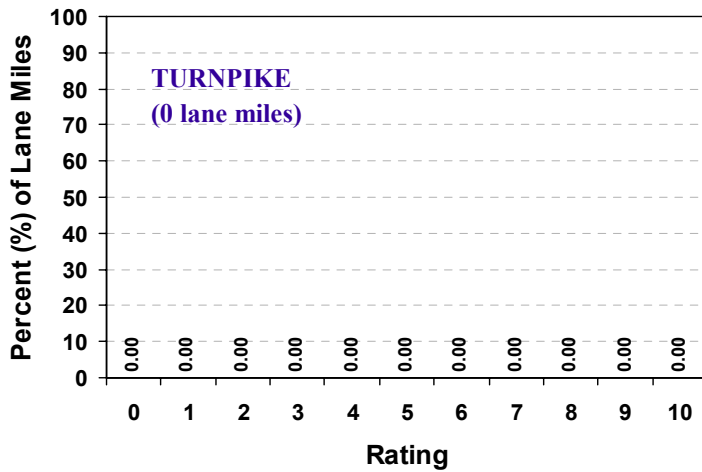
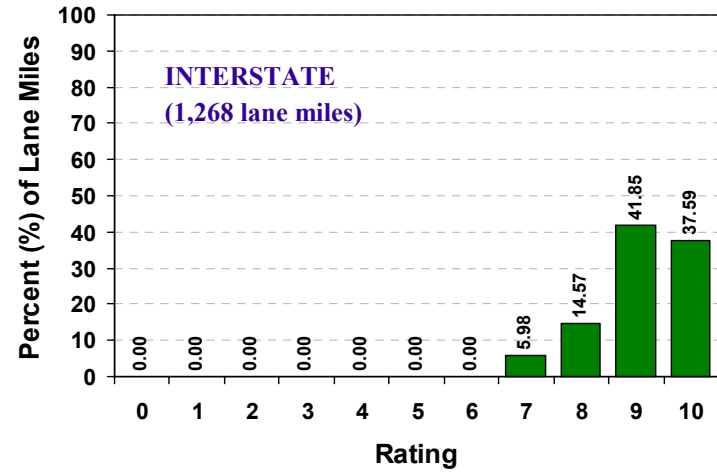
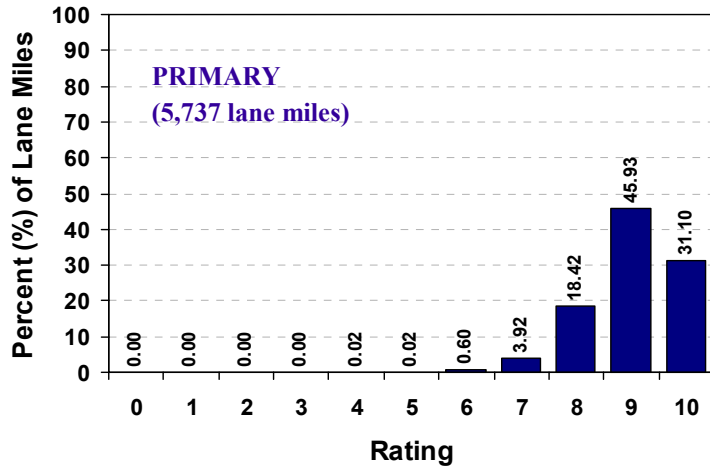
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1999 Rut Distribution by System

District 2

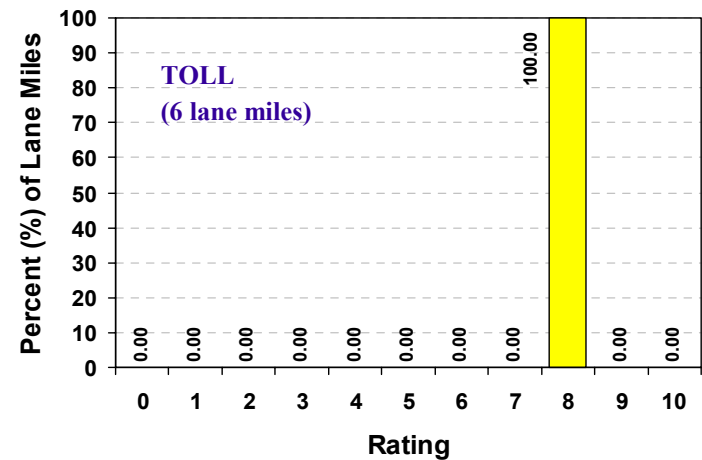
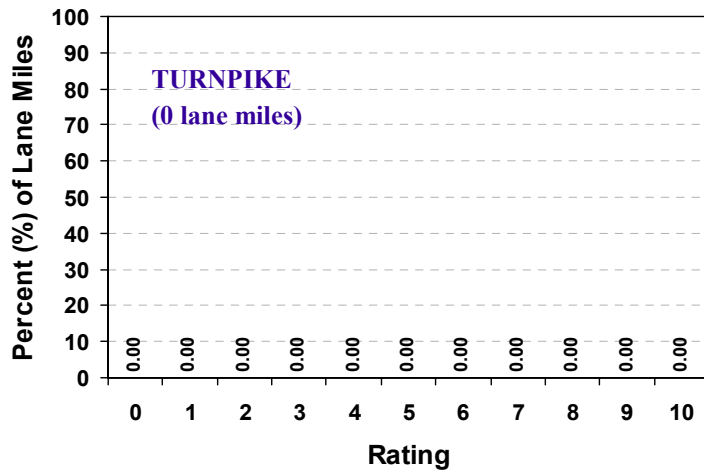
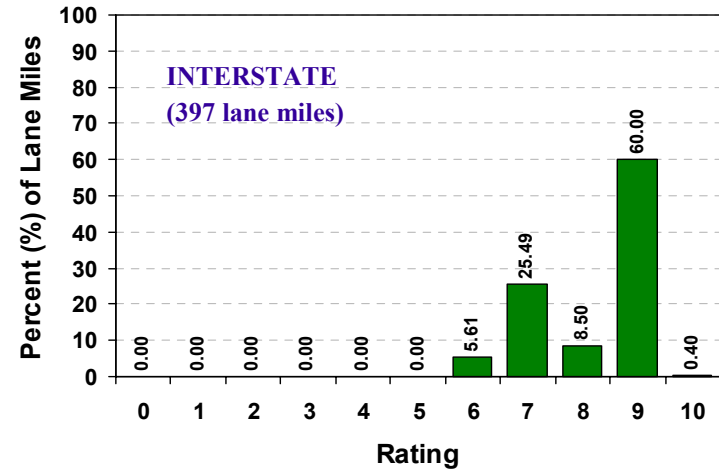
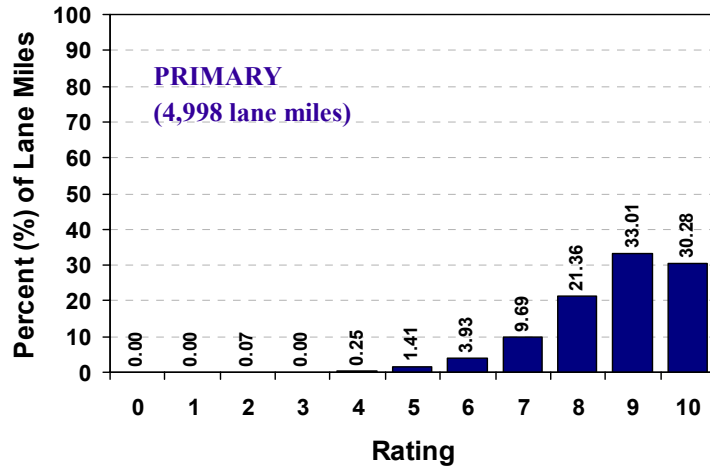
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1999 Rut Distribution by System

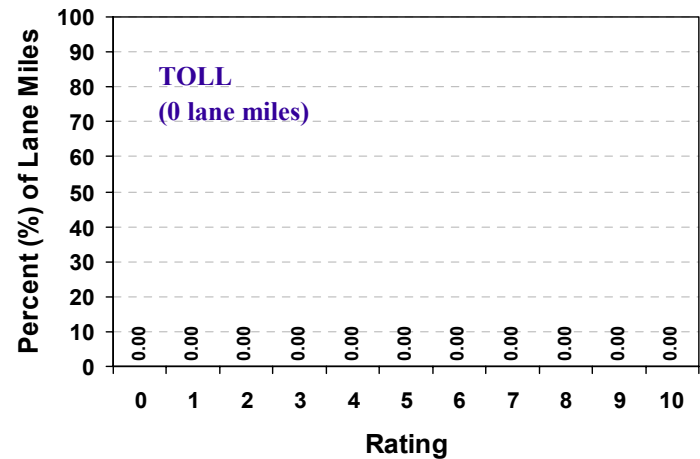
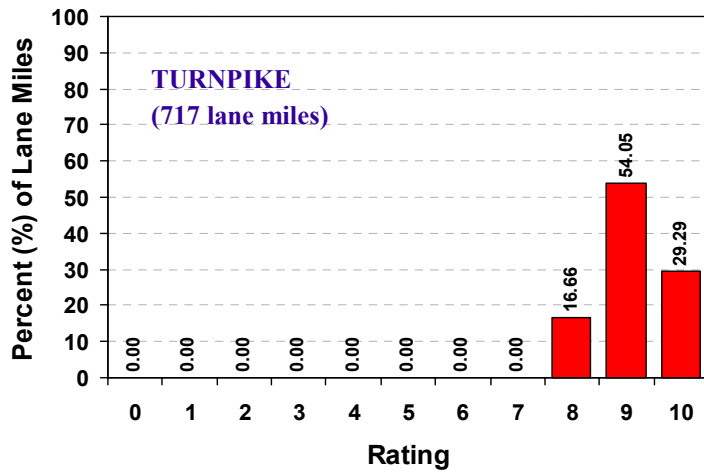
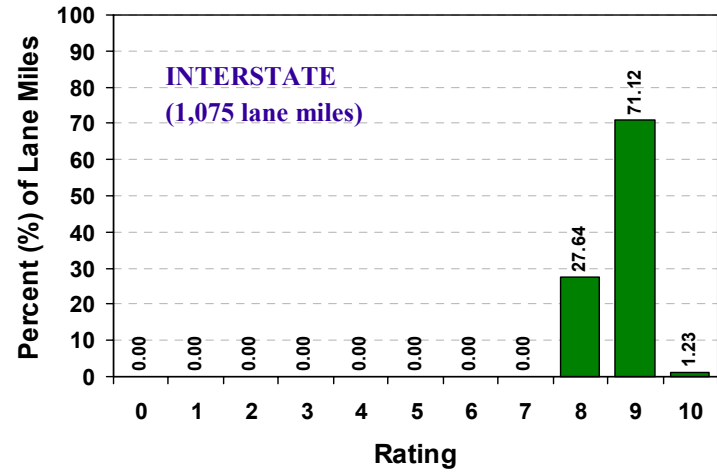
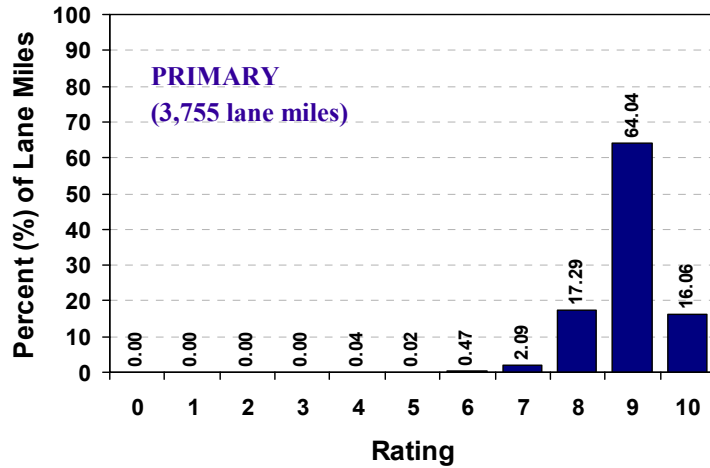
District 3

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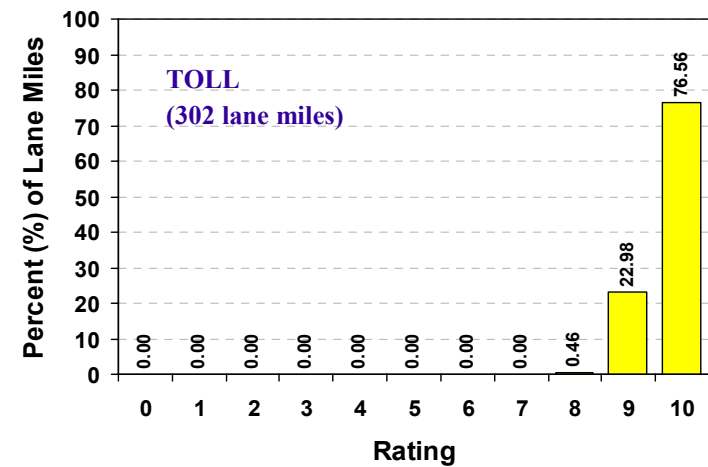
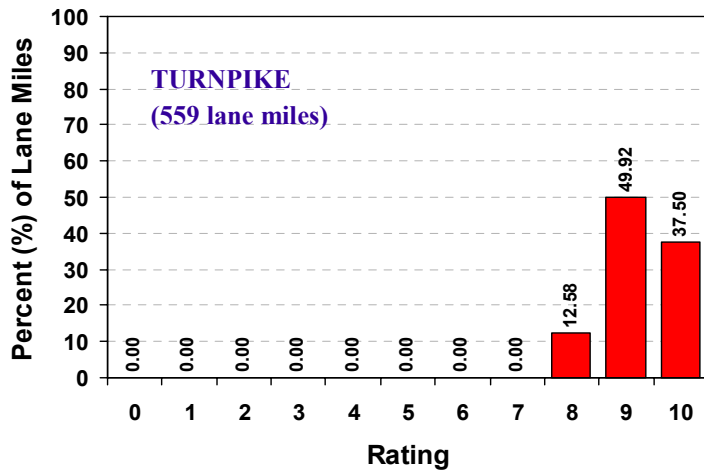
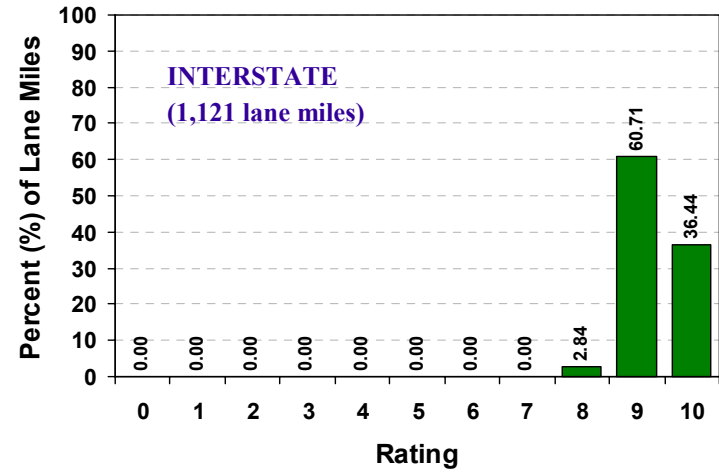
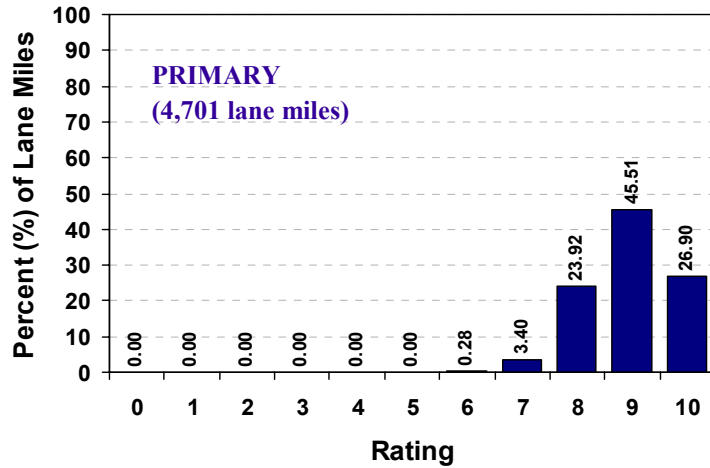
1999 Rut Distribution by System

District 4



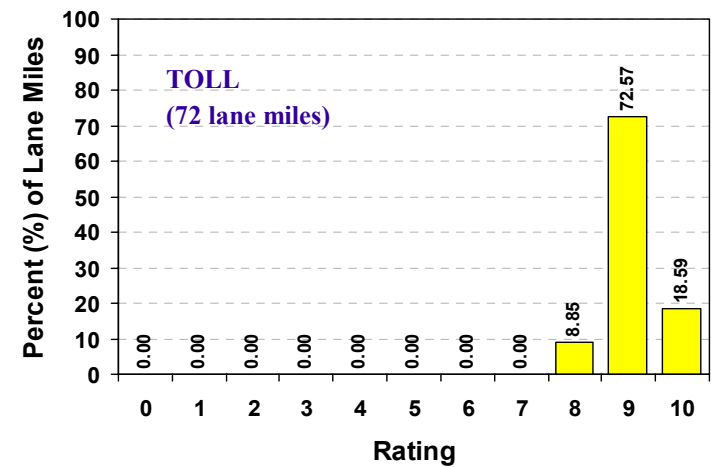
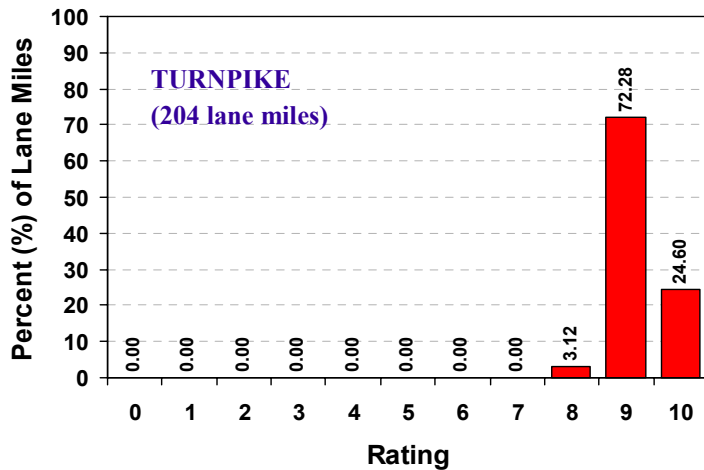
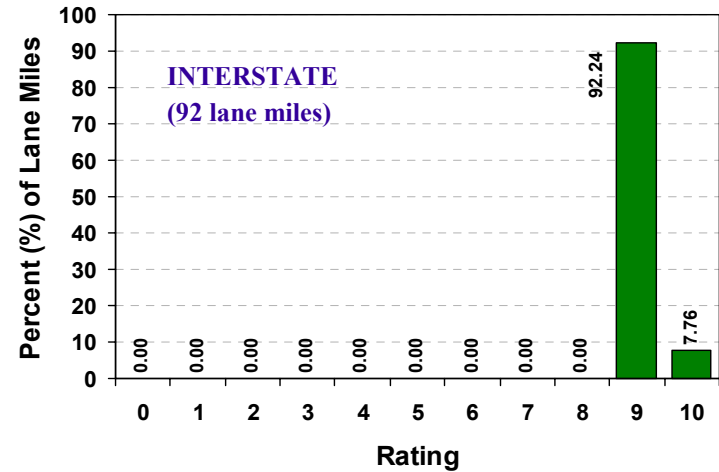
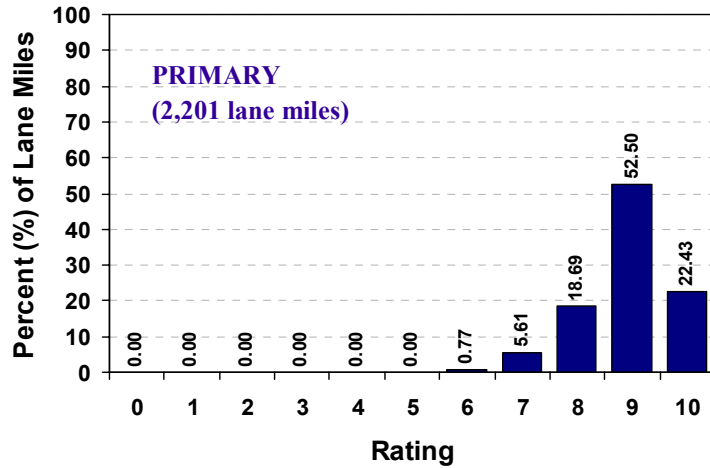
1999 Rut Distribution by System

District 5



1999 Rut Distribution by System

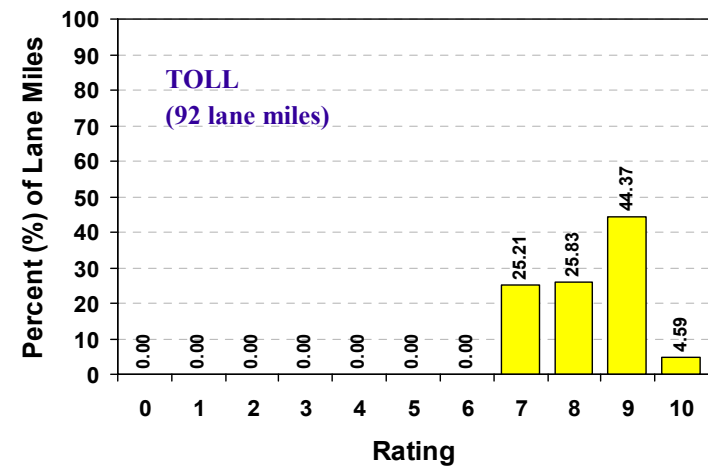
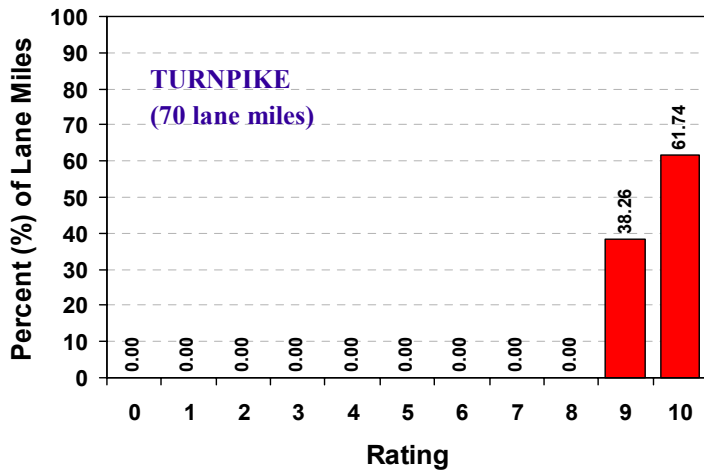
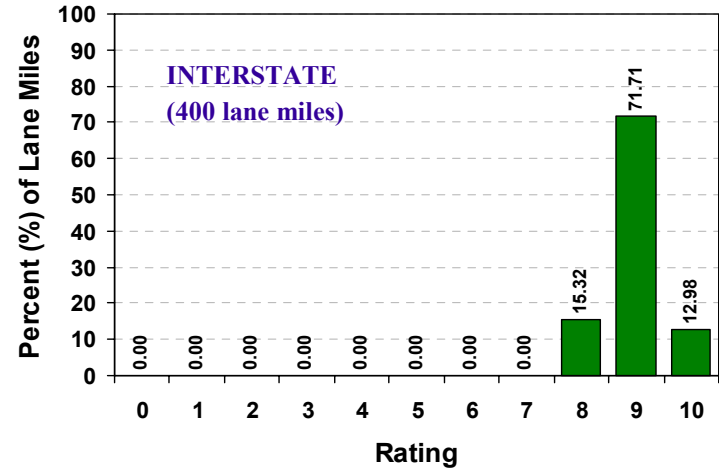
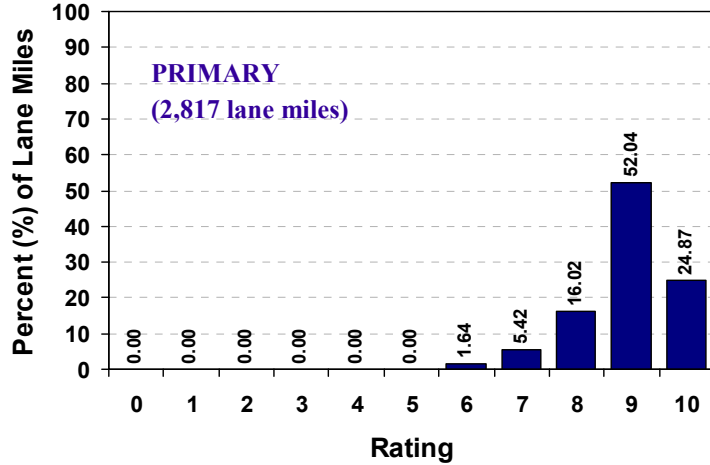
District 6



1999 Rut Distribution by System

District 7

29



SECTION IV

RIDE RATING

BY

SYSTEM AND DISTRICT



SECTION IV

Ride Rating by System and District

Ride Rating Criteria

- Ride Ratings measure the rideability 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).

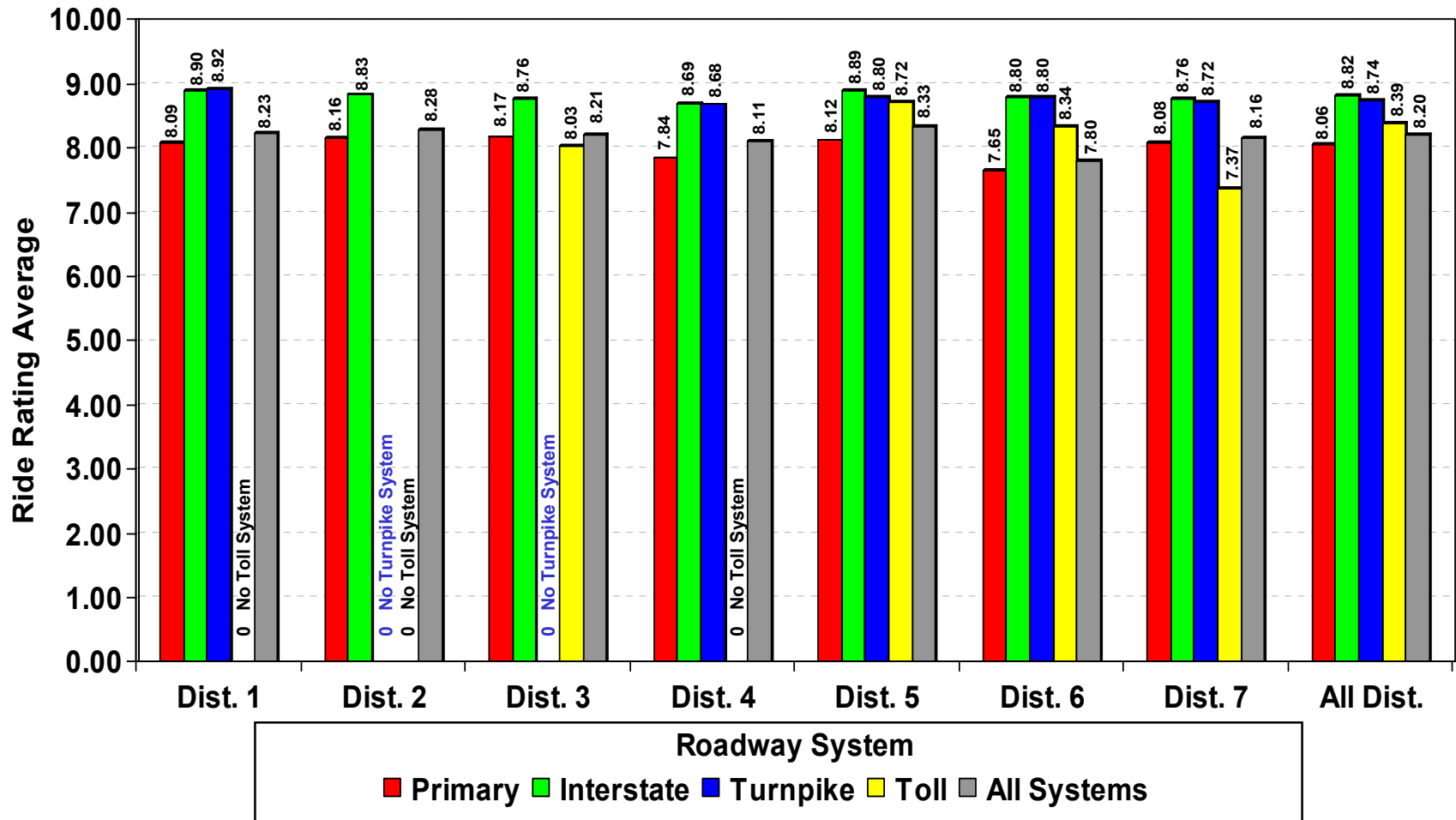
Ride Number x 2 = Ride Rating

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 developed in National Cooperative Highway Research Project (NCHRP) 1-23. Ride Number is an ASTM Standard (E-1489).

- Rideability is greatly affected, among other things, by the following factors:
 - ✦ 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 a rating of six or less makes pavement segments eligible for rehabilitation.
- The Ride deficiency Rating is subtracted from a perfect score of 10.

Ride Ratings by System and District

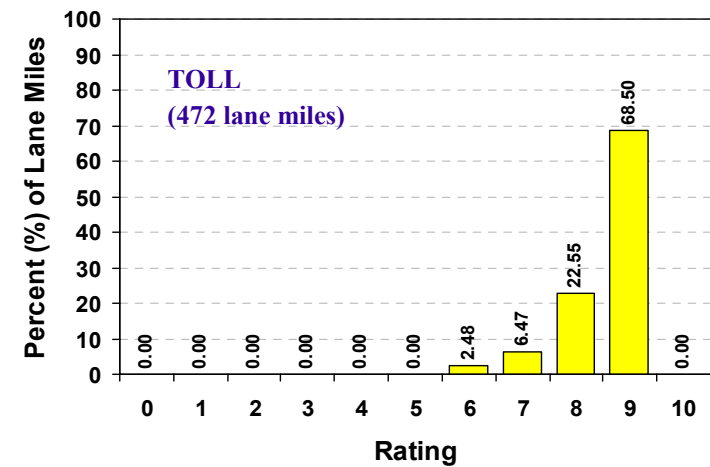
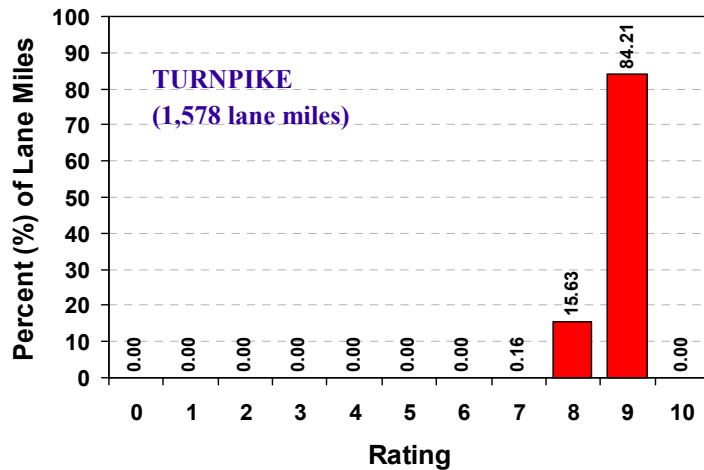
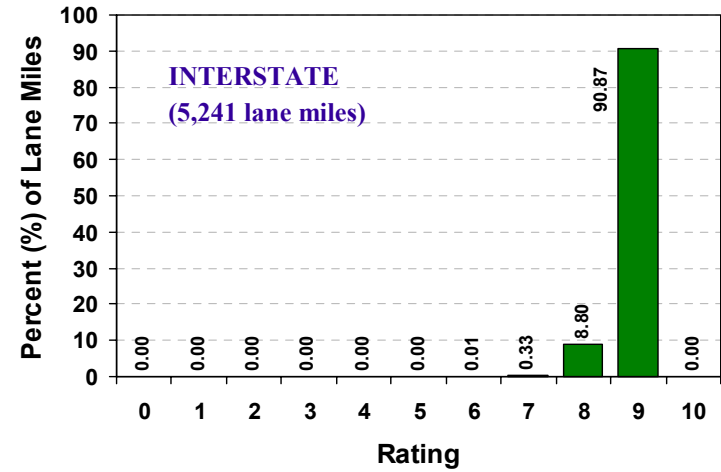
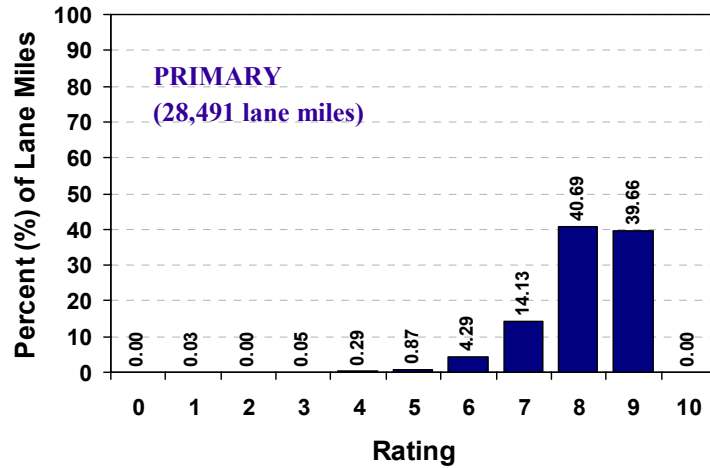
1999 Flexible Pavement Condition Survey



1999 Ride Distribution by System

Statewide

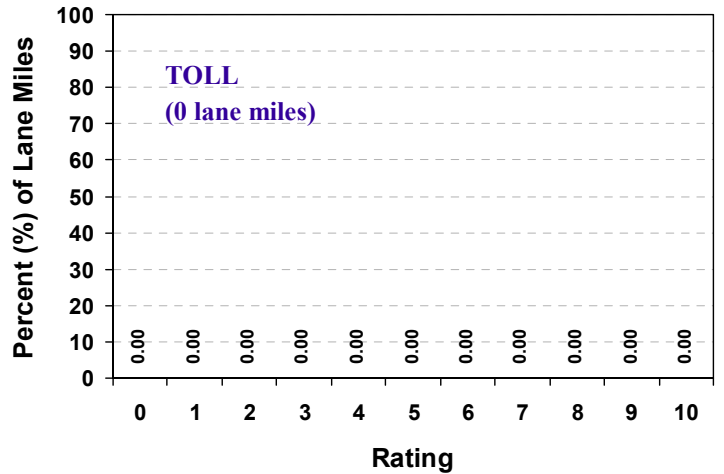
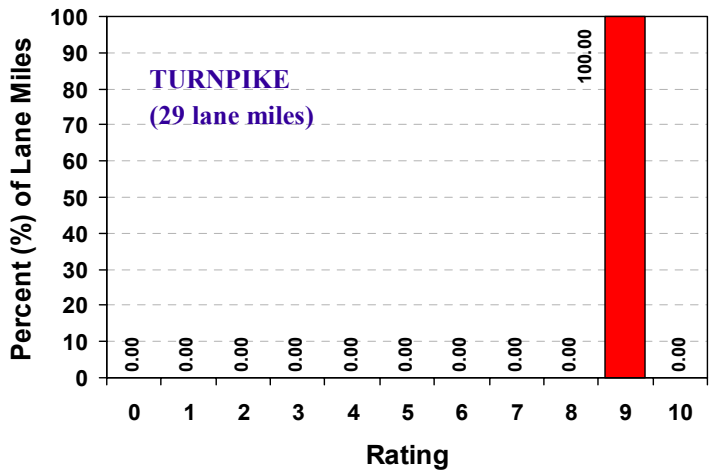
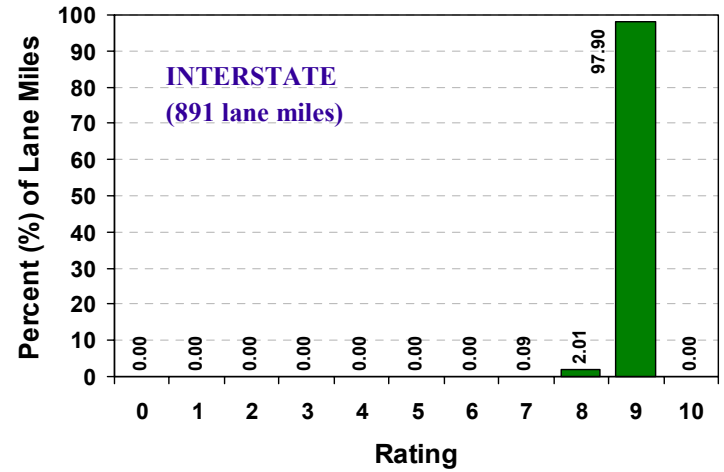
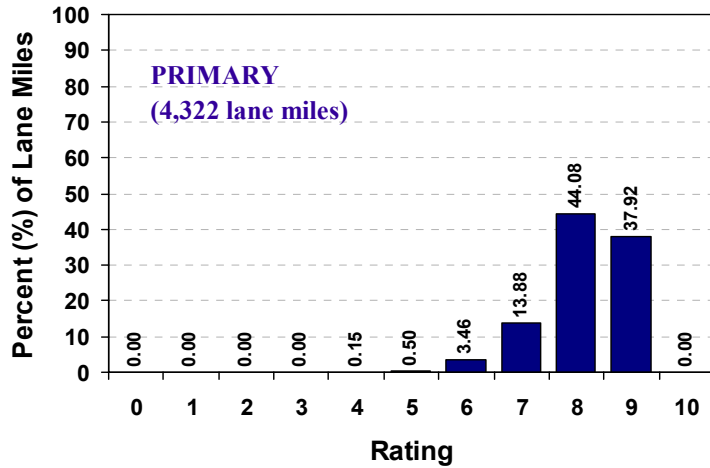
33



1999 Ride Distribution by System

District 1

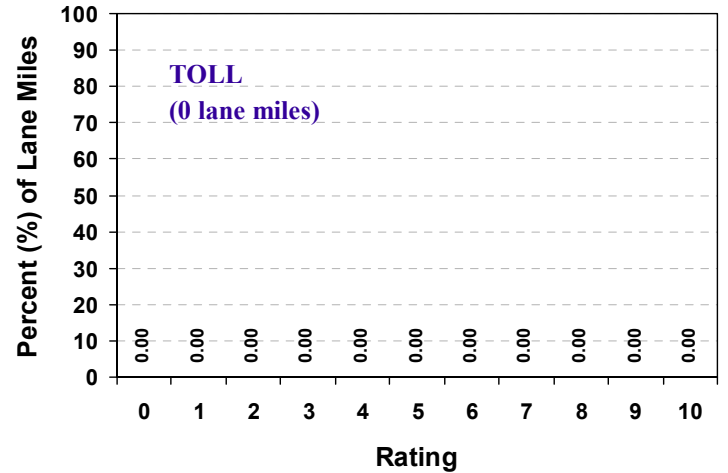
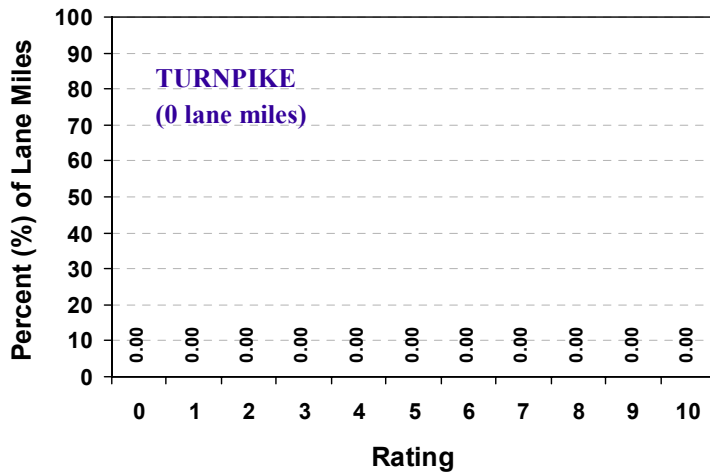
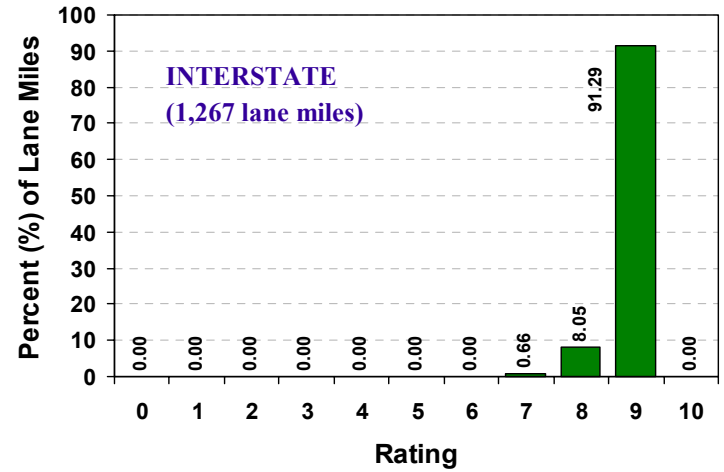
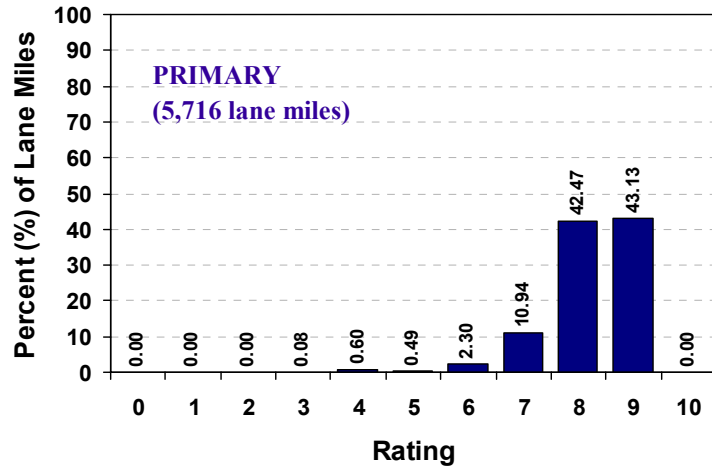
34



1999 Ride Distribution by System

District 2

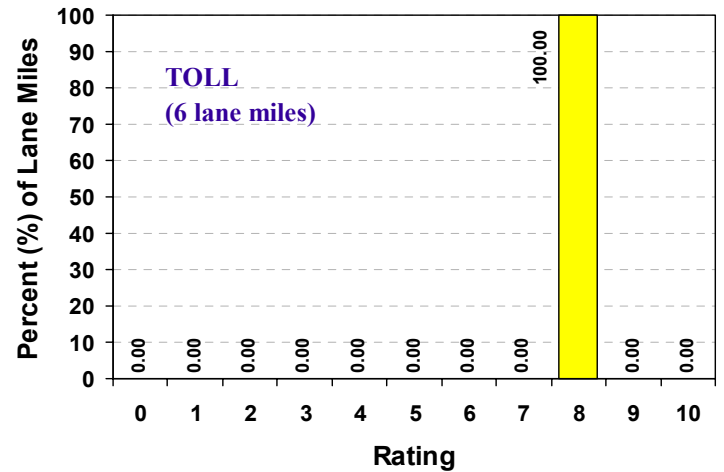
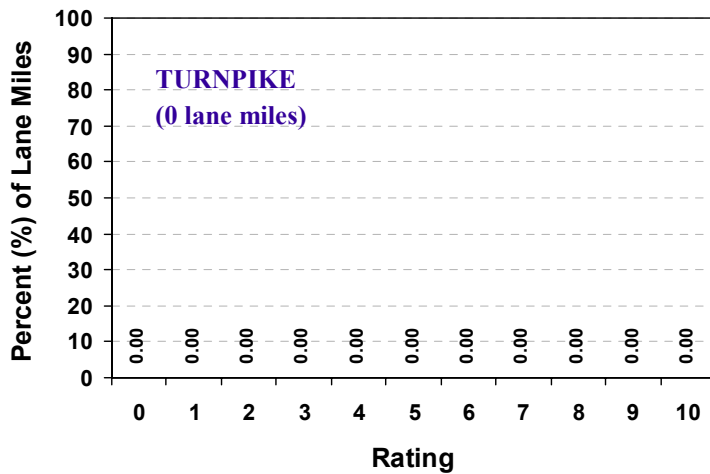
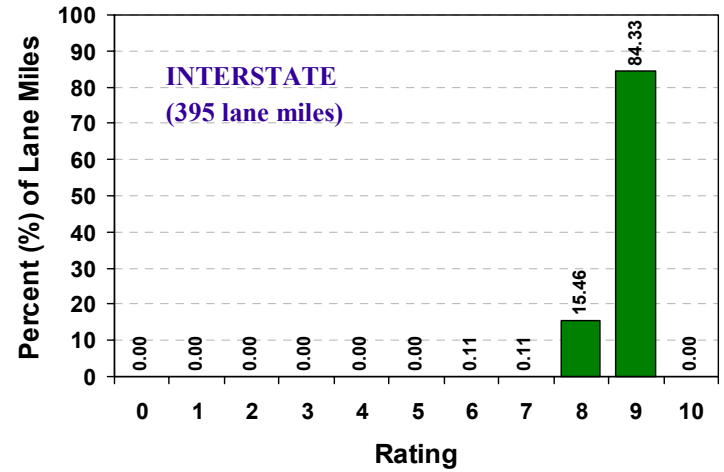
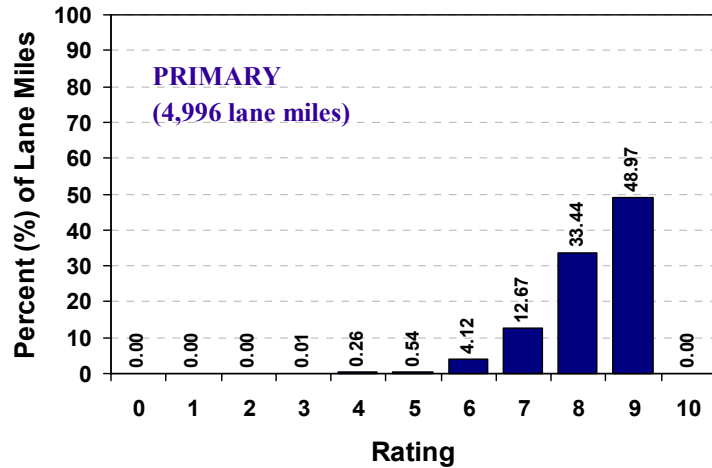
53



1999 Ride Distribution by System

District 3

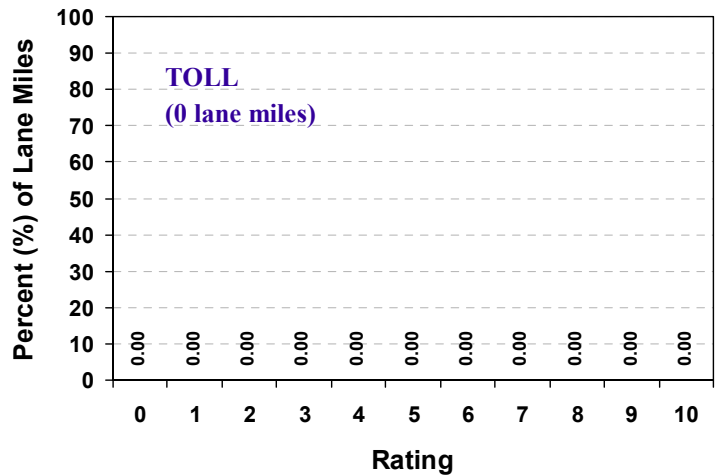
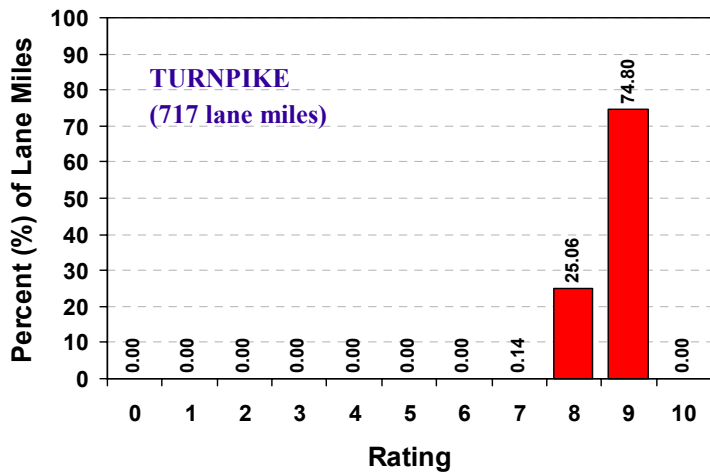
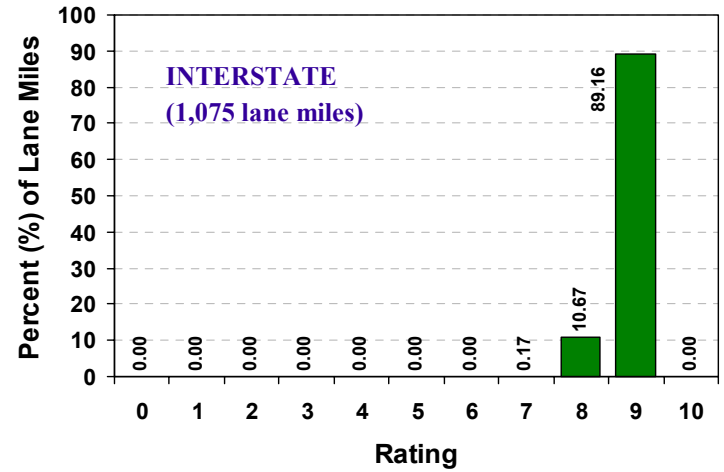
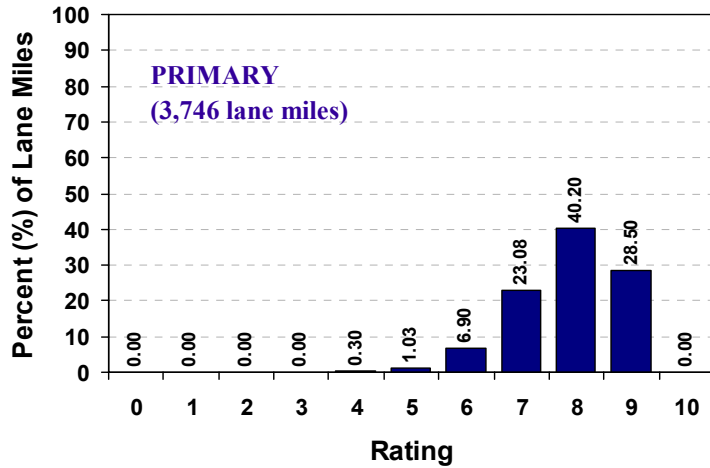
96



1999 Ride Distribution by System

District 4

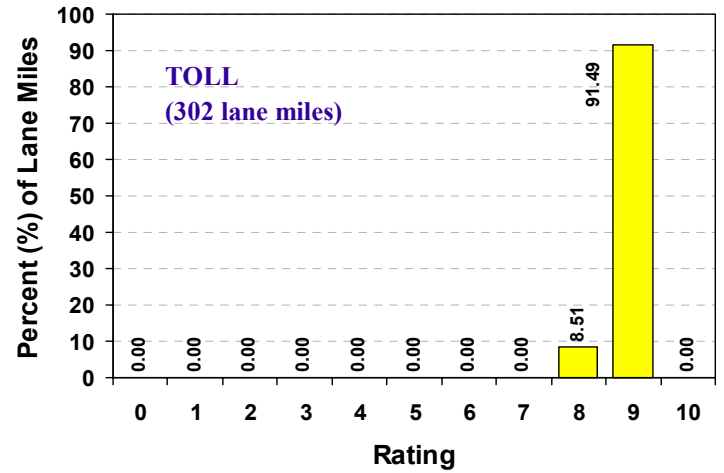
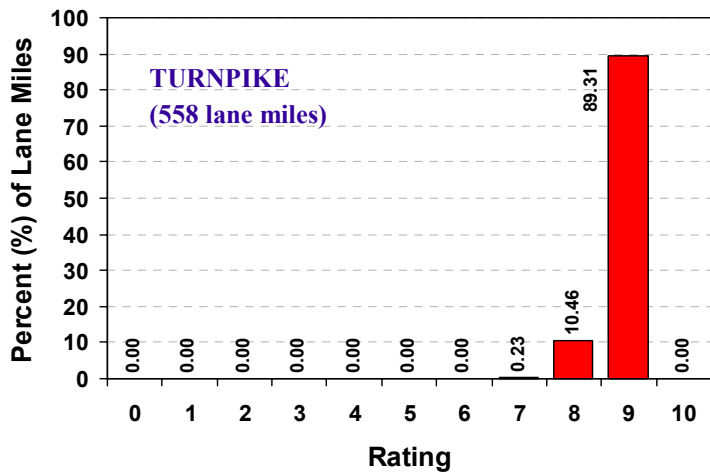
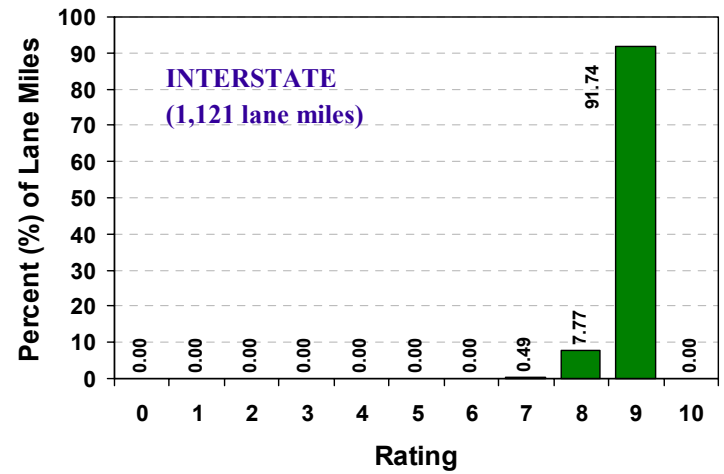
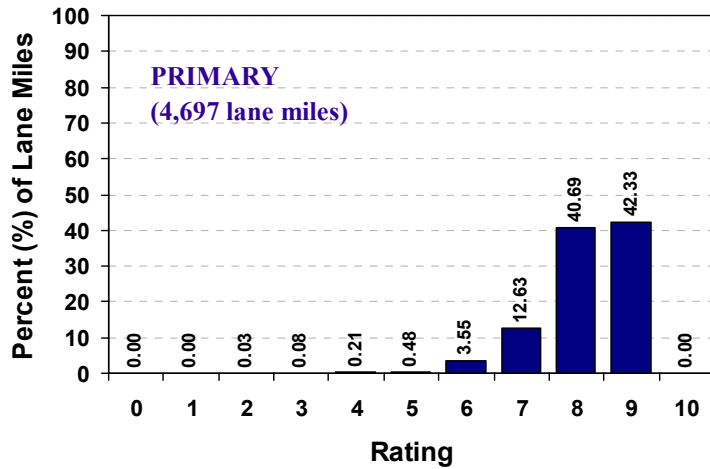
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1999 Ride Distribution by System

District 5

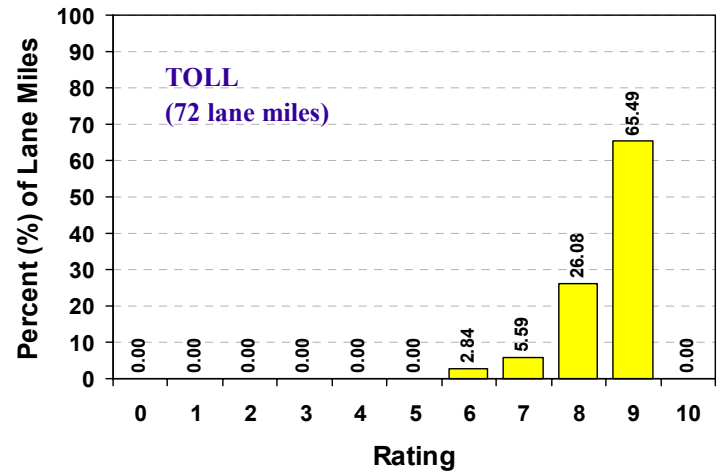
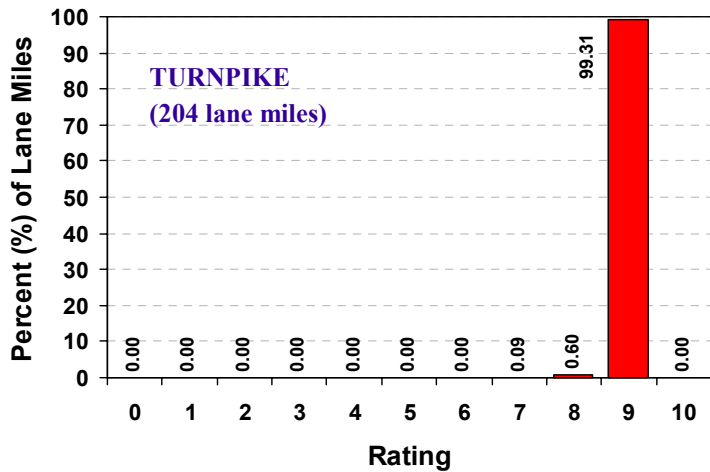
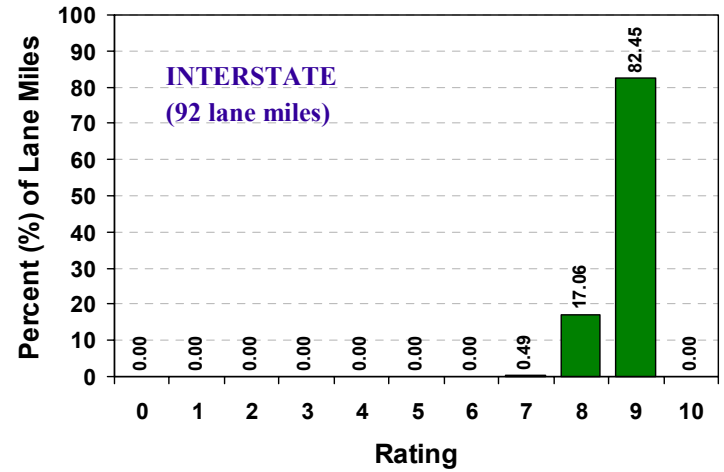
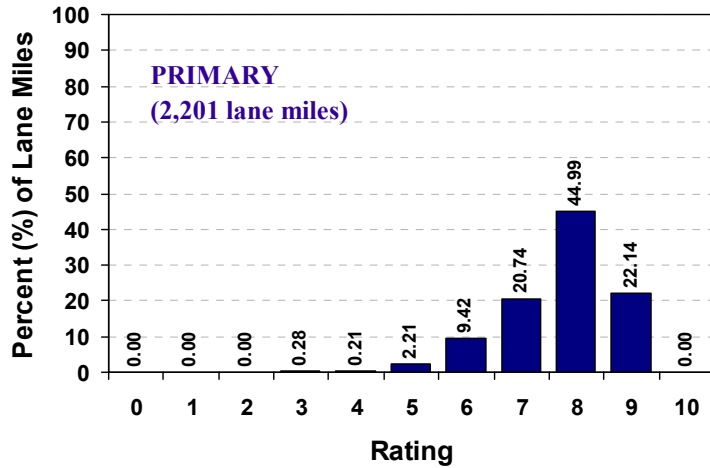
83



1999 Ride Distribution by System

District 6

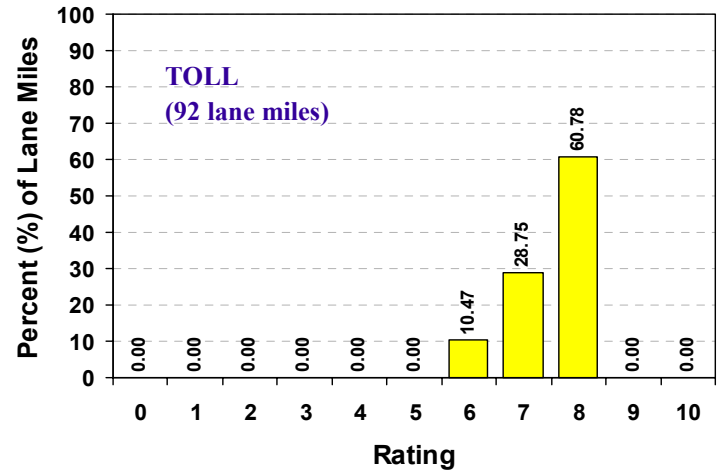
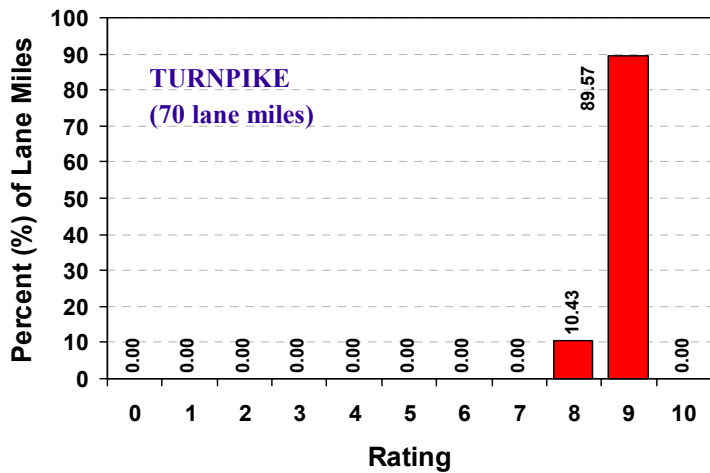
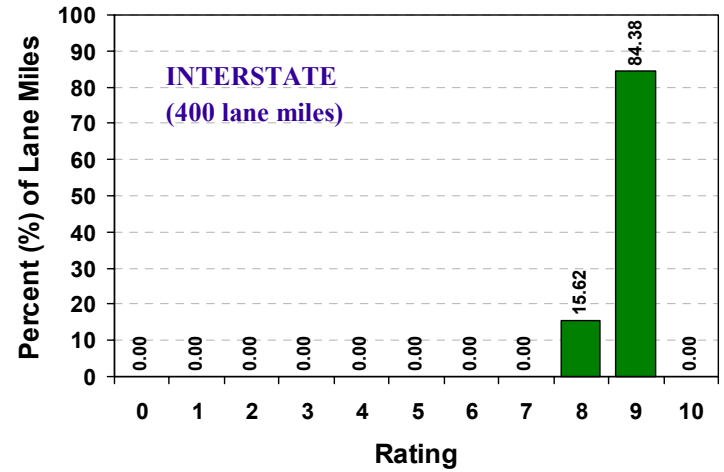
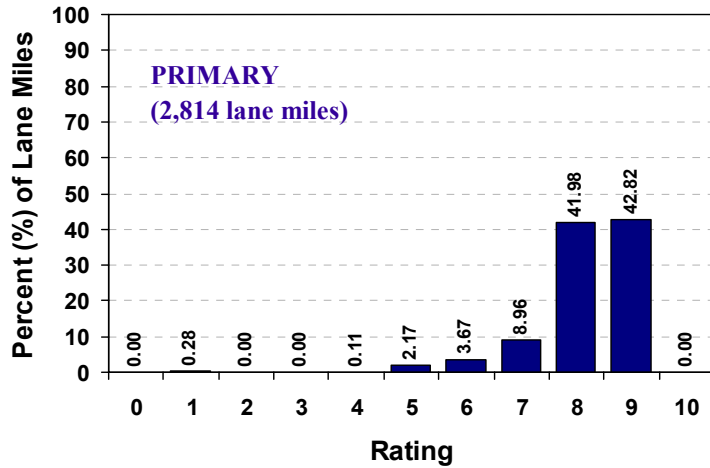
63



1999 Ride Distribution by System

District 7

40



SECTION V

CRACK, RIDE & RUT

DISTRIBUTIONS

BY

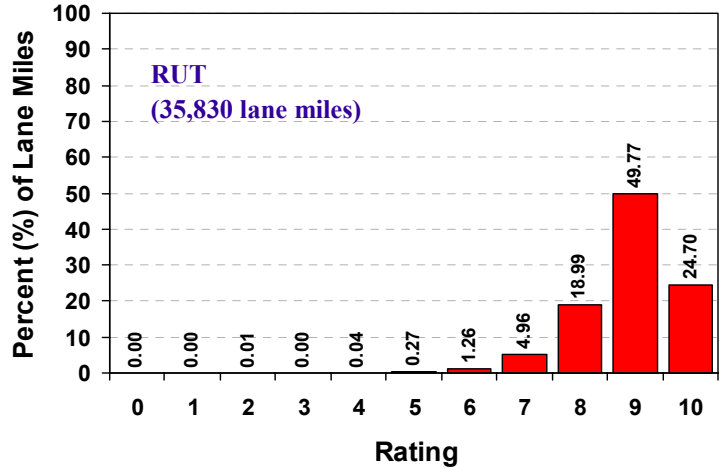
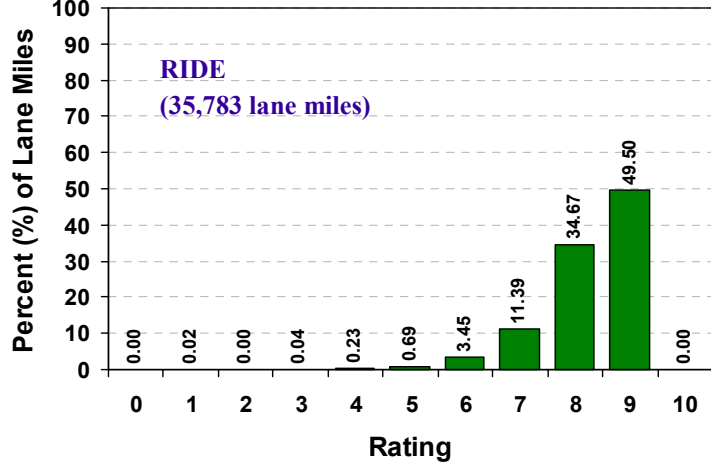
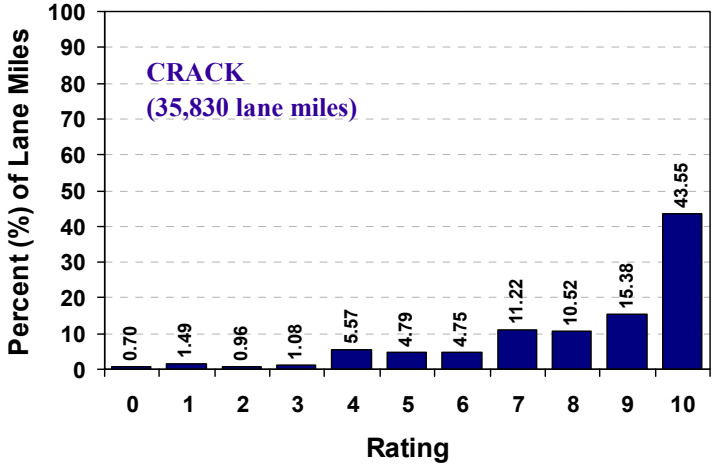
DISTRICT

(ALL SYSTEMS COMBINED)



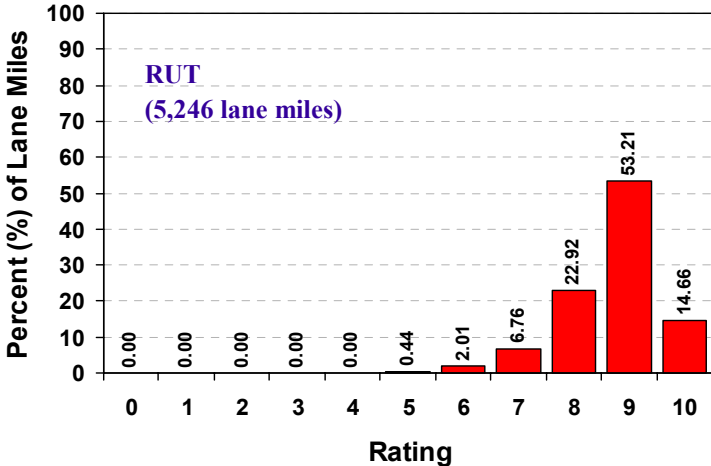
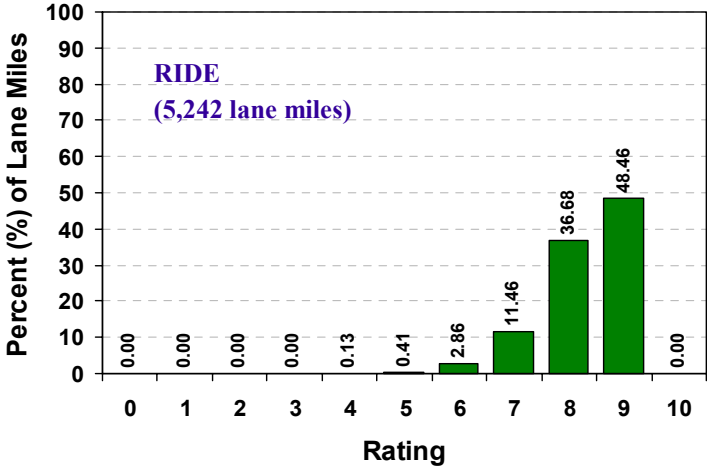
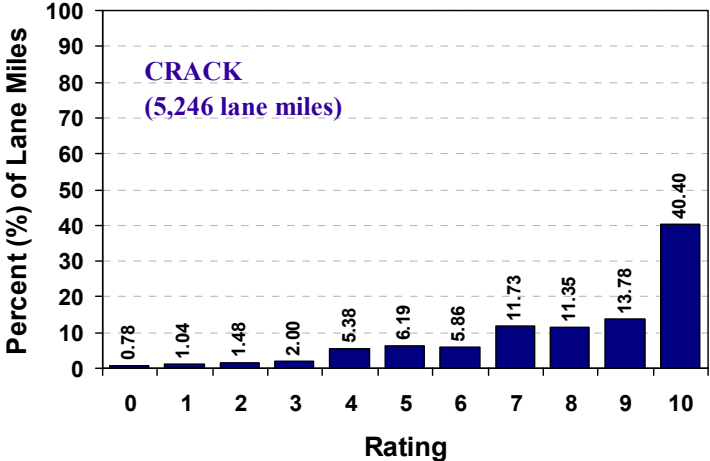
1999 Crack, Ride & Rut Distribution

Statewide (All Systems)



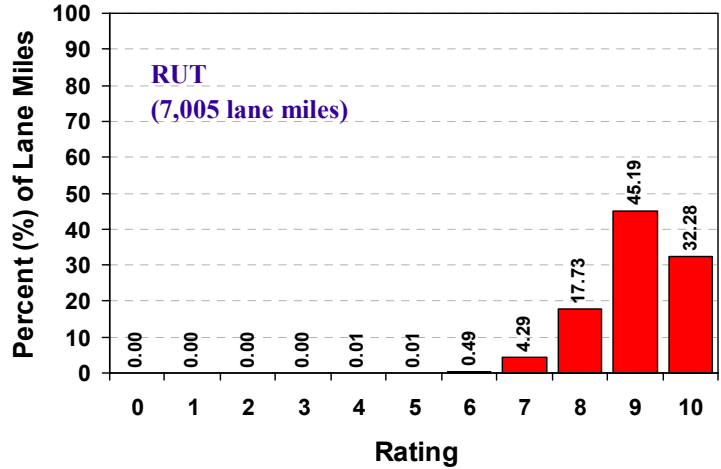
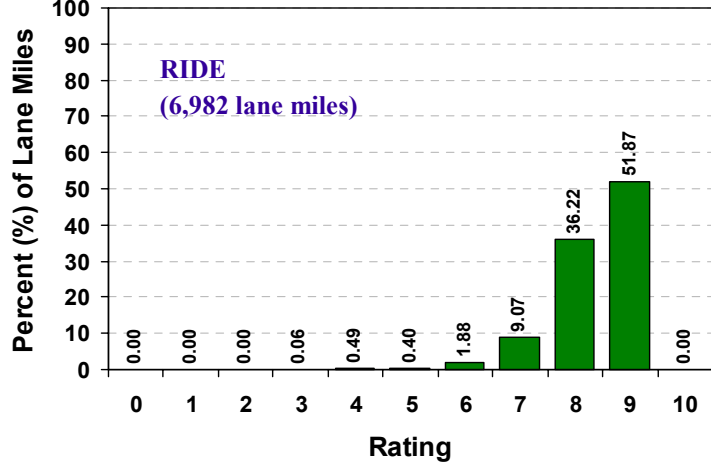
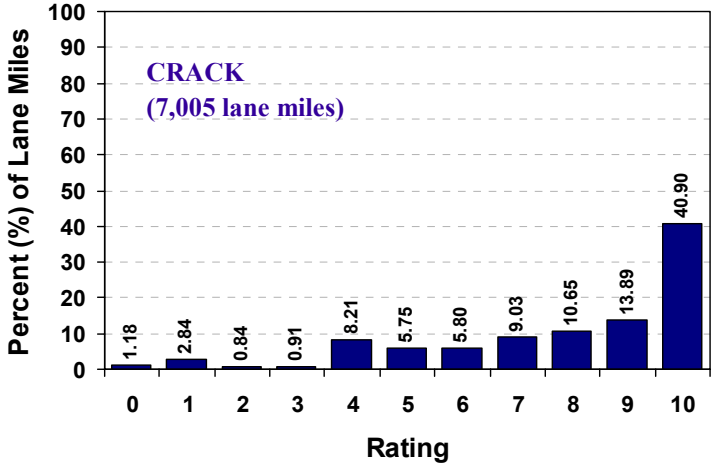
1999 Crack, Ride & Rut Distribution

District 1 (All Systems)



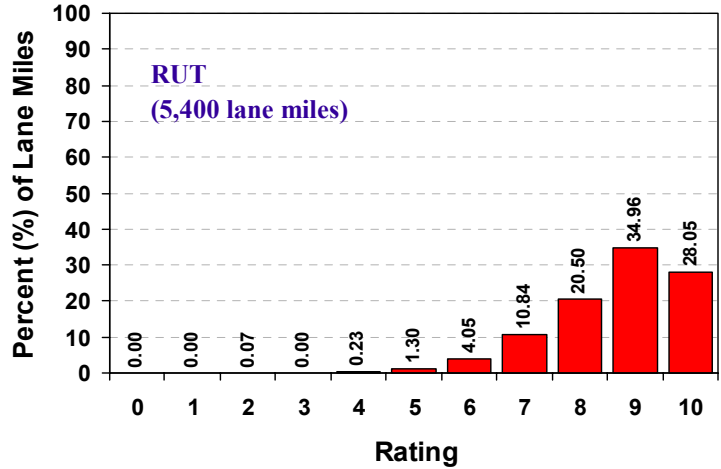
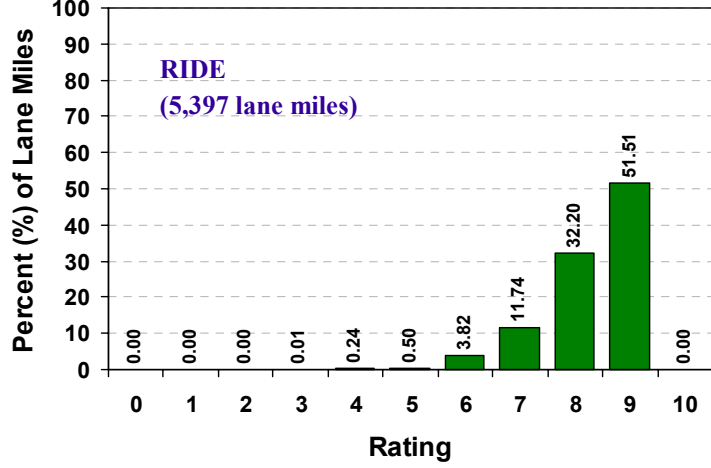
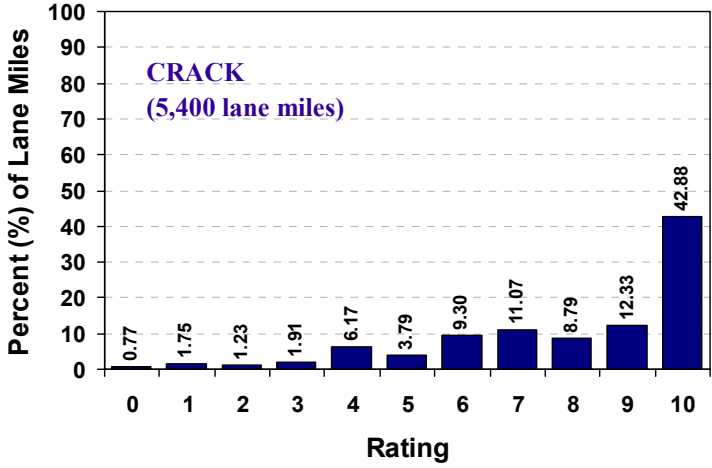
1999 Crack, Ride & Rut Distribution

District 2 (All Systems)



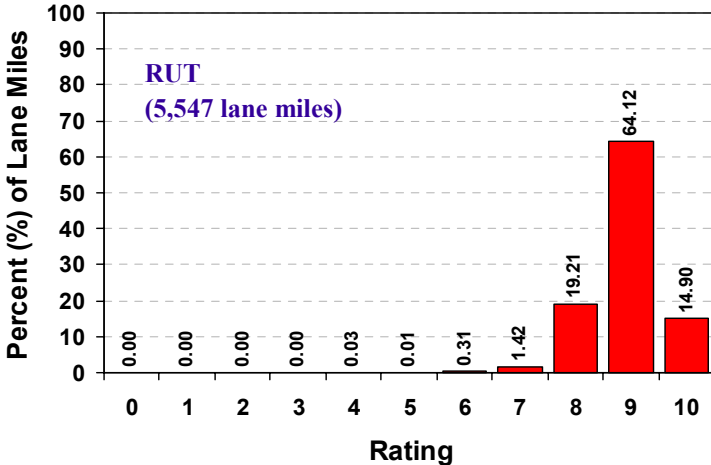
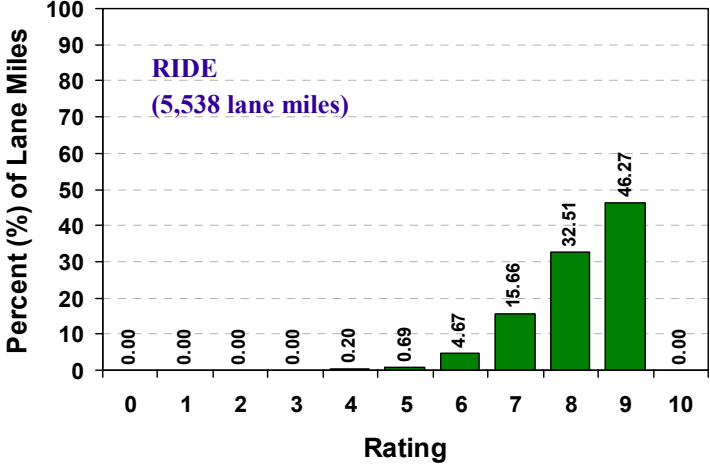
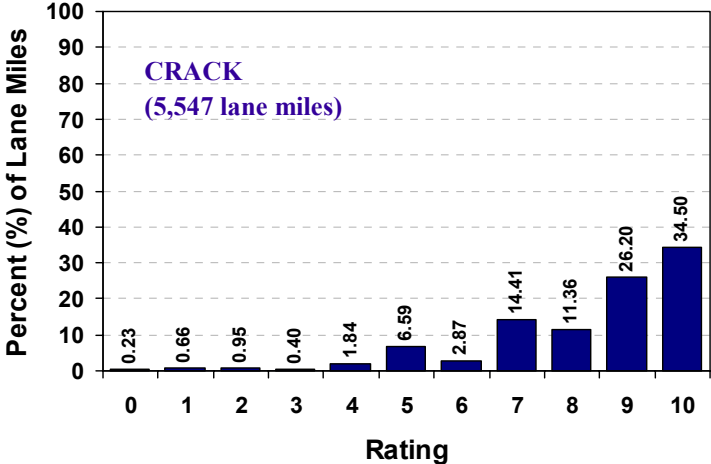
1999 Crack, Ride & Rut Distribution

District 3 (All Systems)



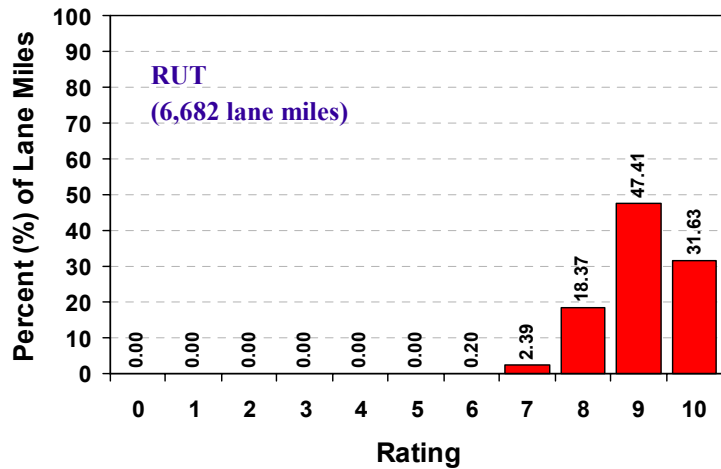
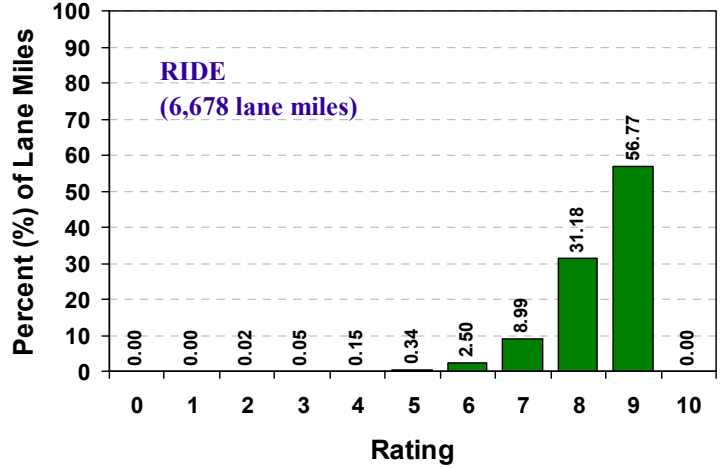
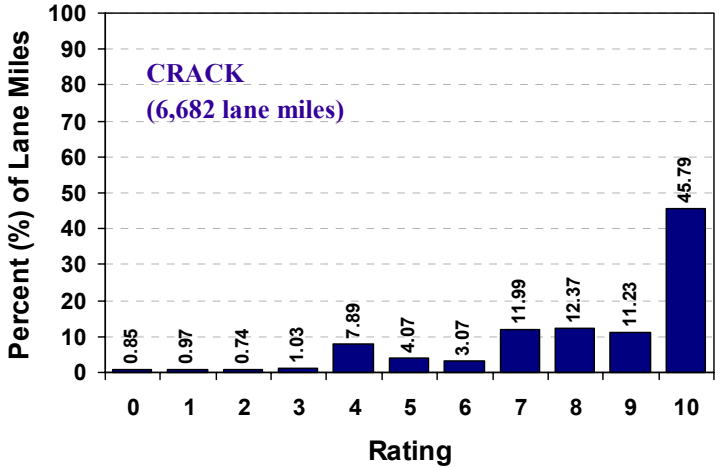
1999 Crack, Ride & Rut Distribution

District 4 (All Systems)



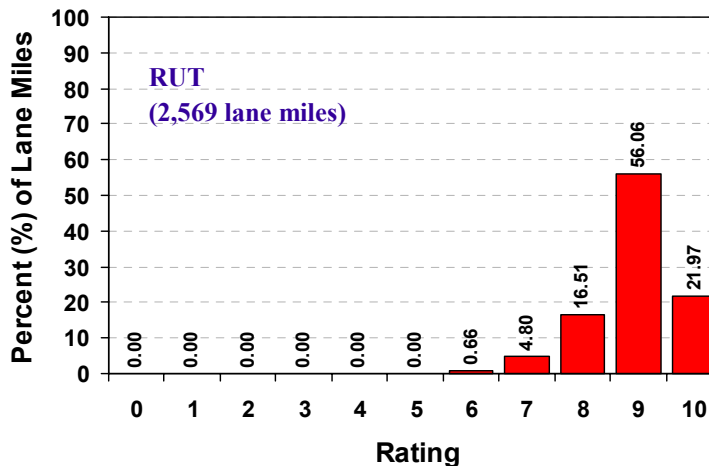
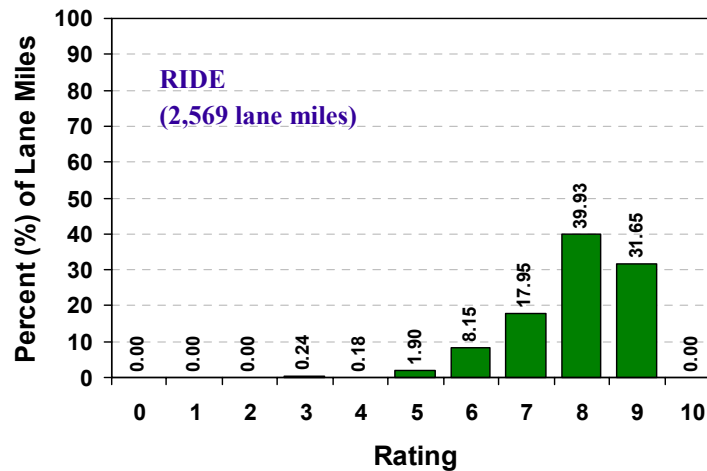
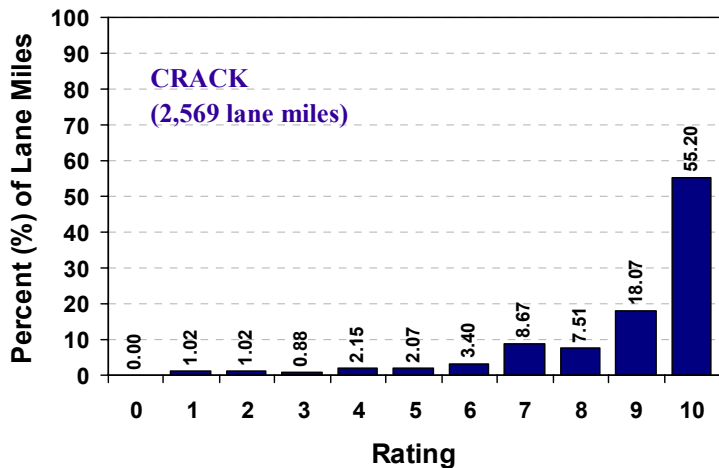
1999 Crack, Ride & Rut Distribution

District 5 (All Systems)



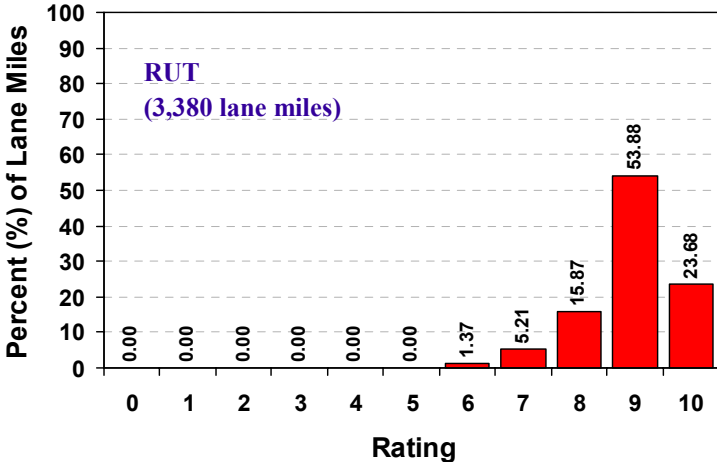
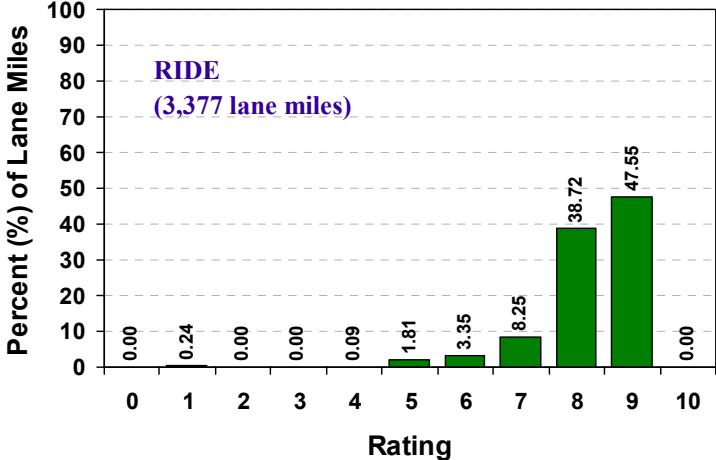
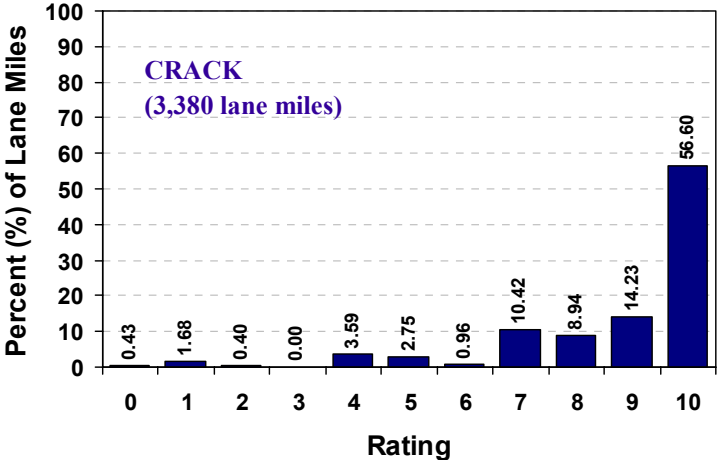
1999 Crack, Ride & Rut Distribution

District 6 (All Systems)



1999 Crack, Ride & Rut Distribution

District 7 (All Systems)



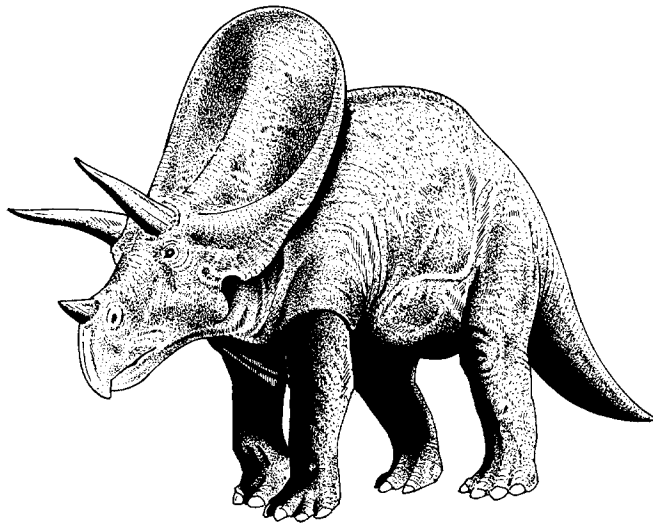
SECTION VI

HISTORICAL

INFORMATION

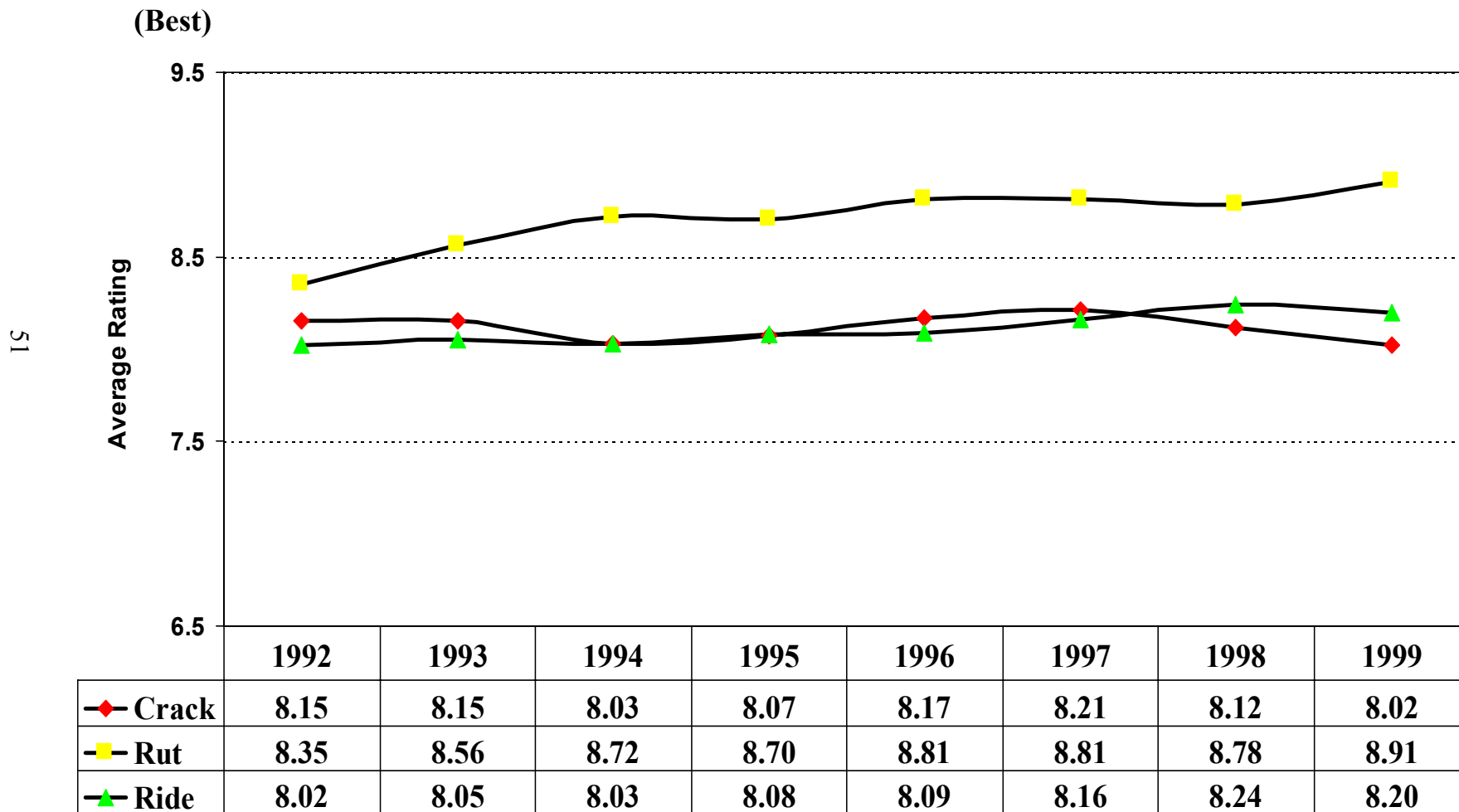
BY

DISTRICT



All Districts

Historical Information

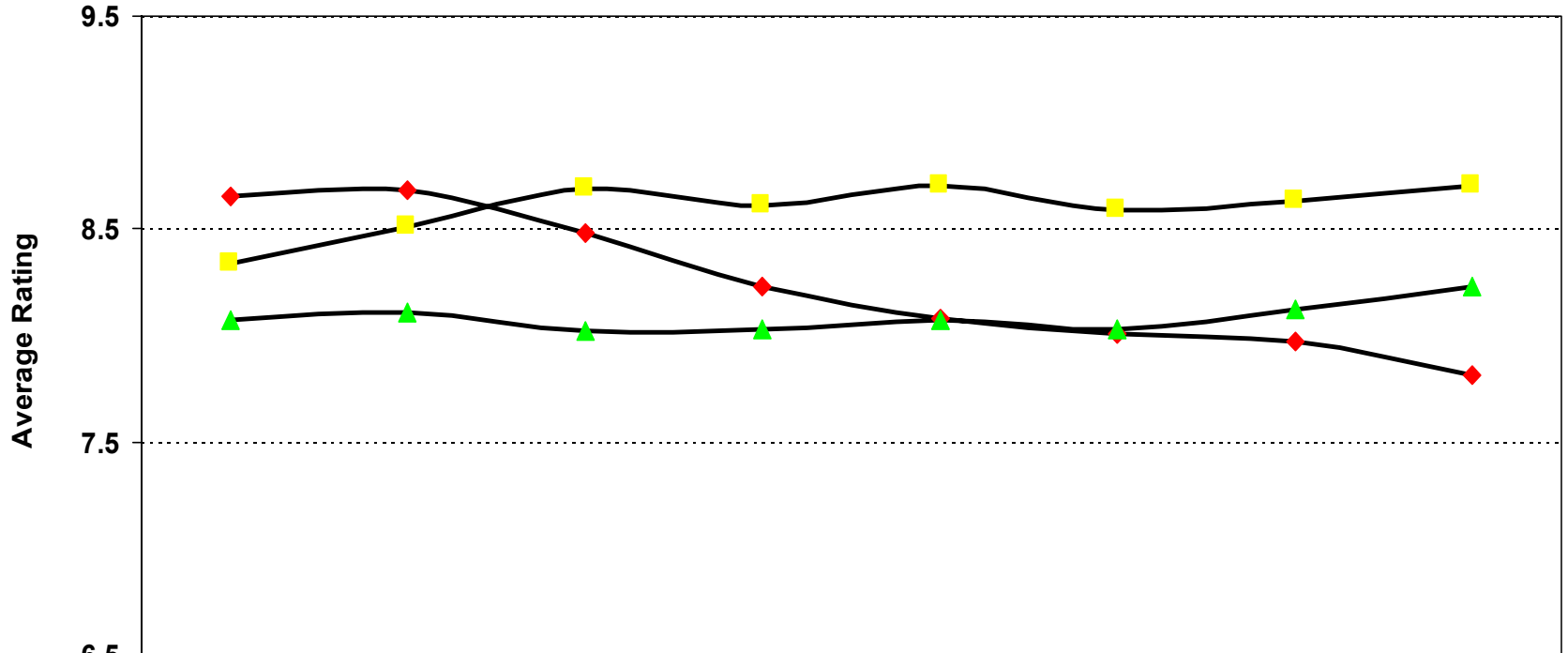


District 1

Historical Information

52

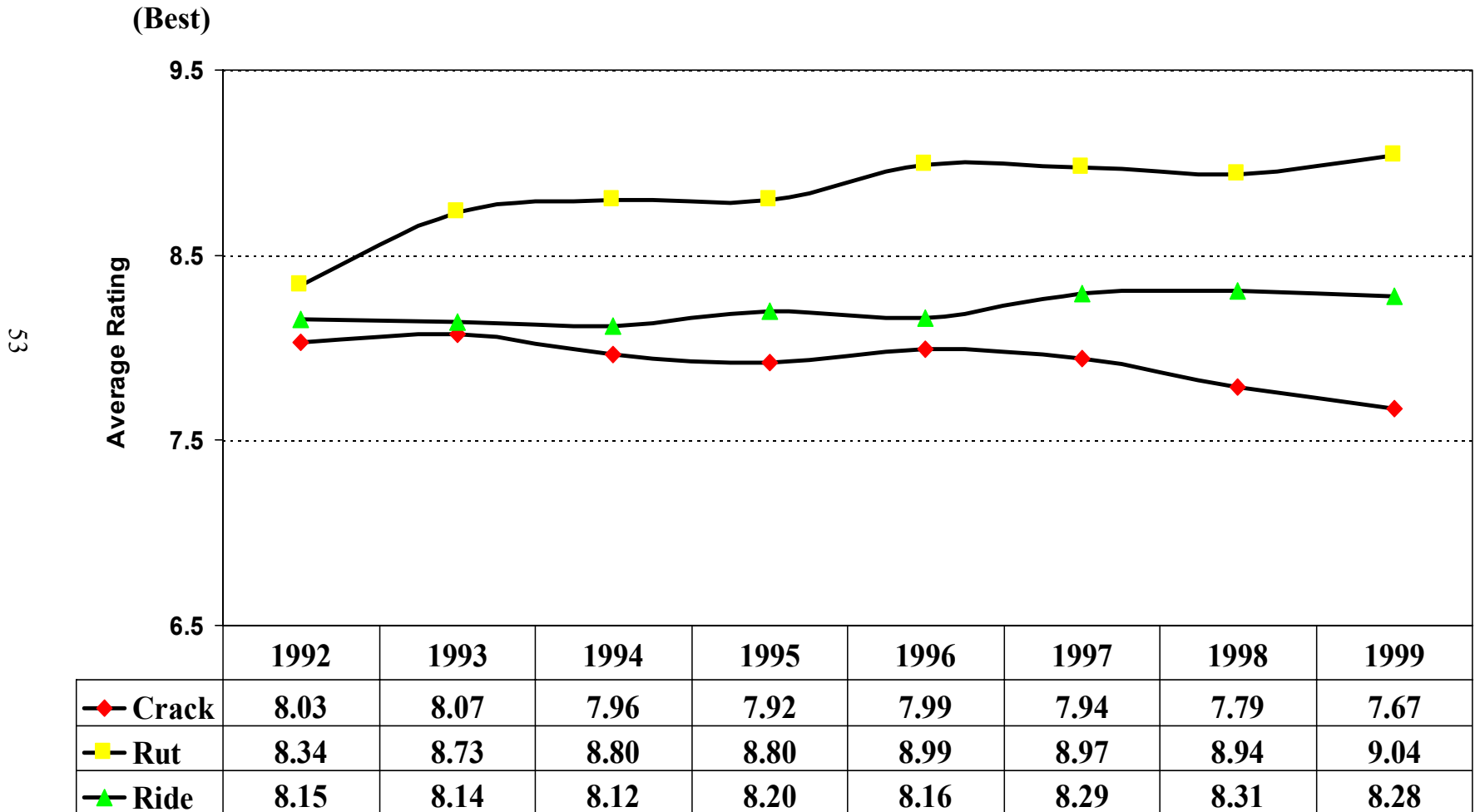
(Best)



	1992	1993	1994	1995	1996	1997	1998	1999
—◆— Crack	8.65	8.68	8.48	8.23	8.08	8.01	7.97	7.81
—■— Rut	8.34	8.51	8.69	8.61	8.70	8.59	8.63	8.70
—▲— Ride	8.07	8.11	8.02	8.03	8.07	8.03	8.12	8.23

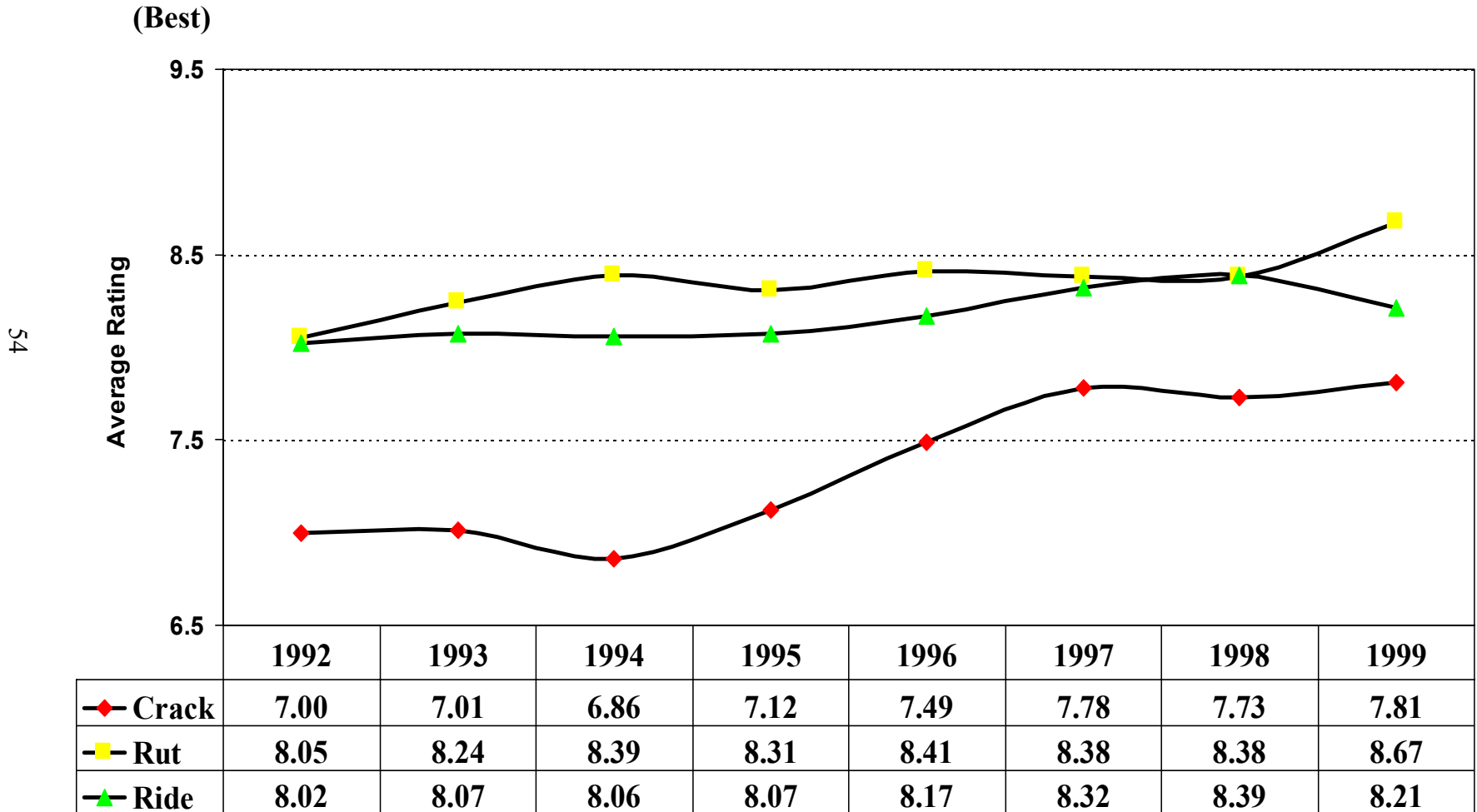
District 2

Historical Information



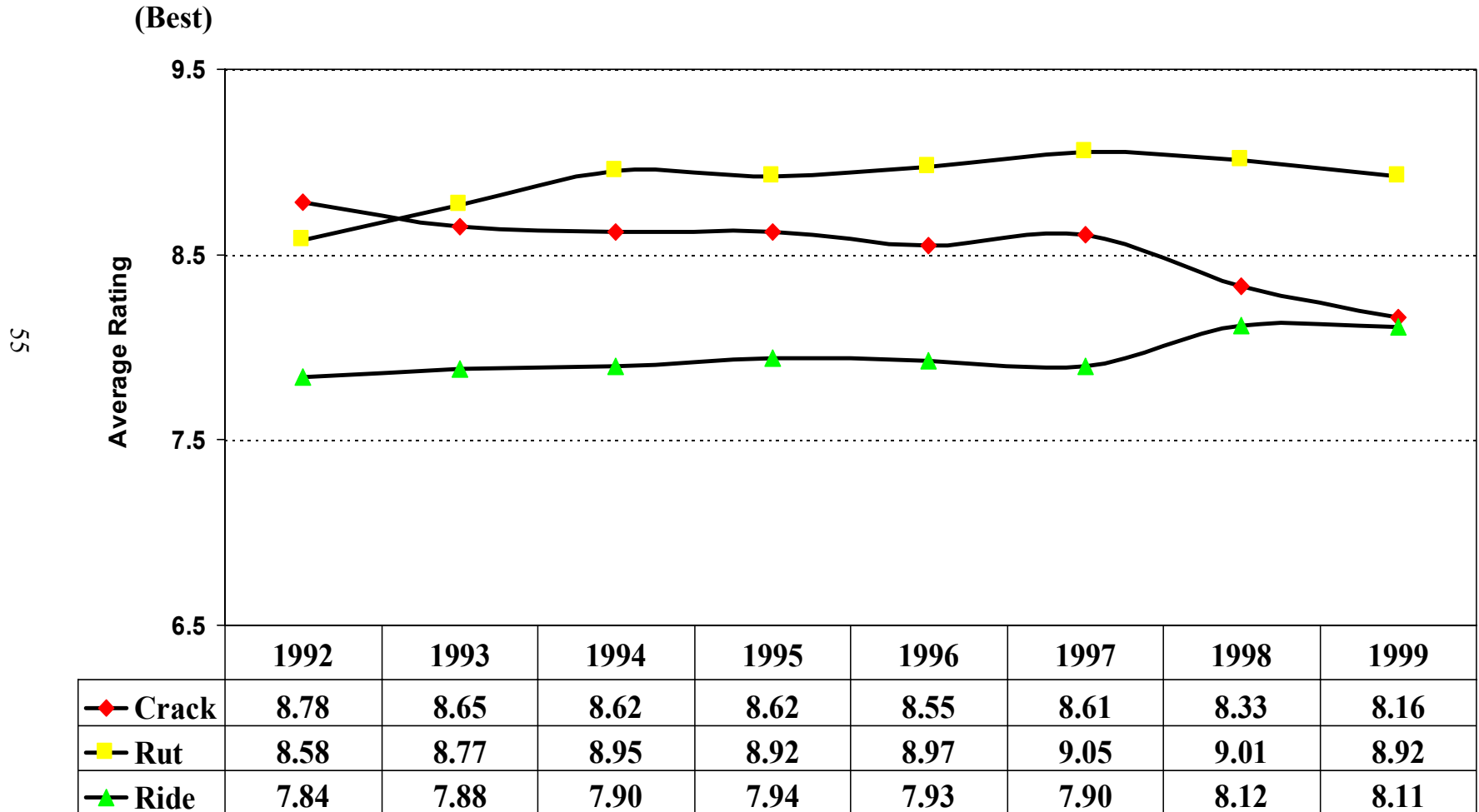
District 3

Historical Information



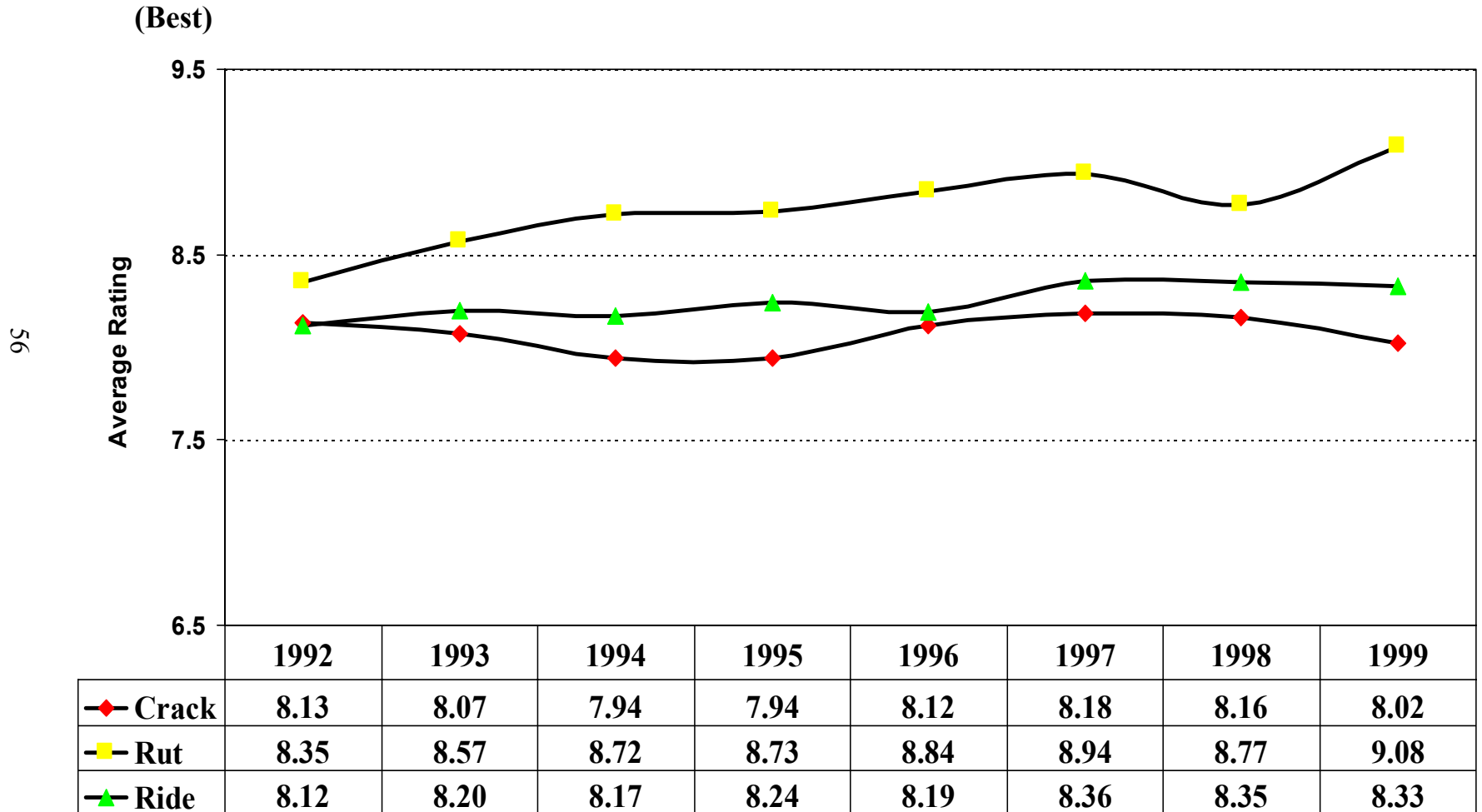
District 4

Historical Information



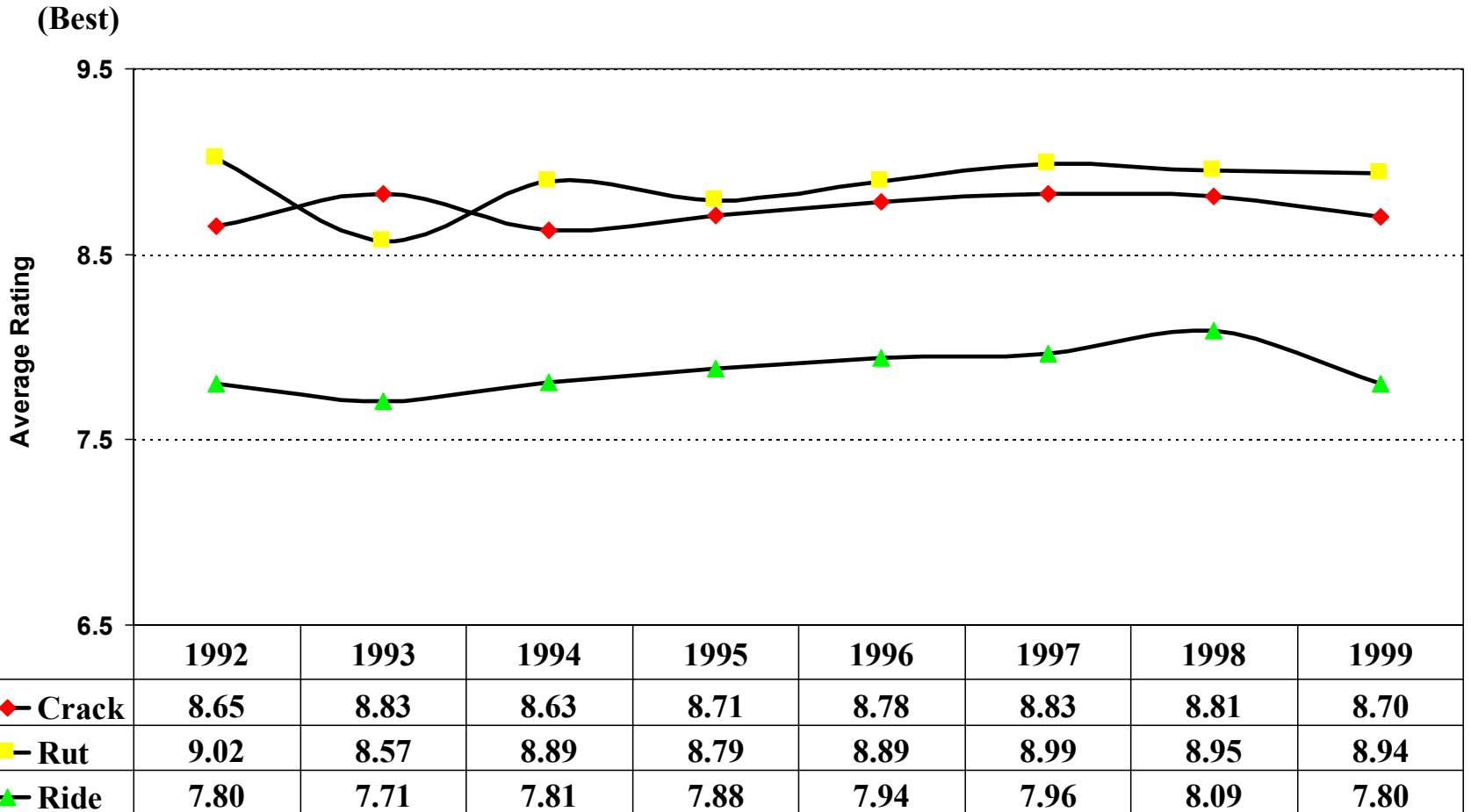
District 5

Historical Information



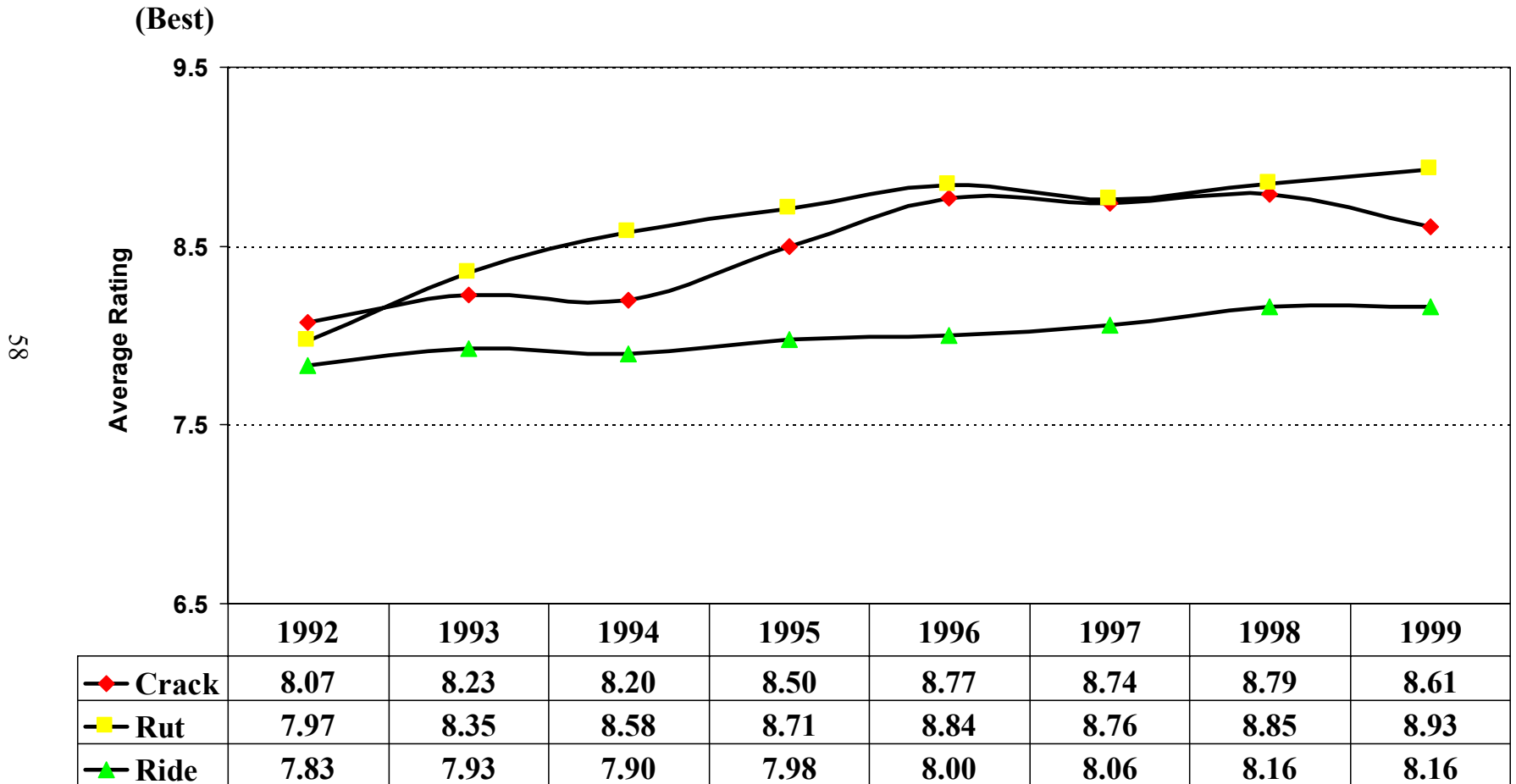
District 6

Historical Information



District 7

Historical Information



SECTION VII

HISTORICAL

INFORMATION

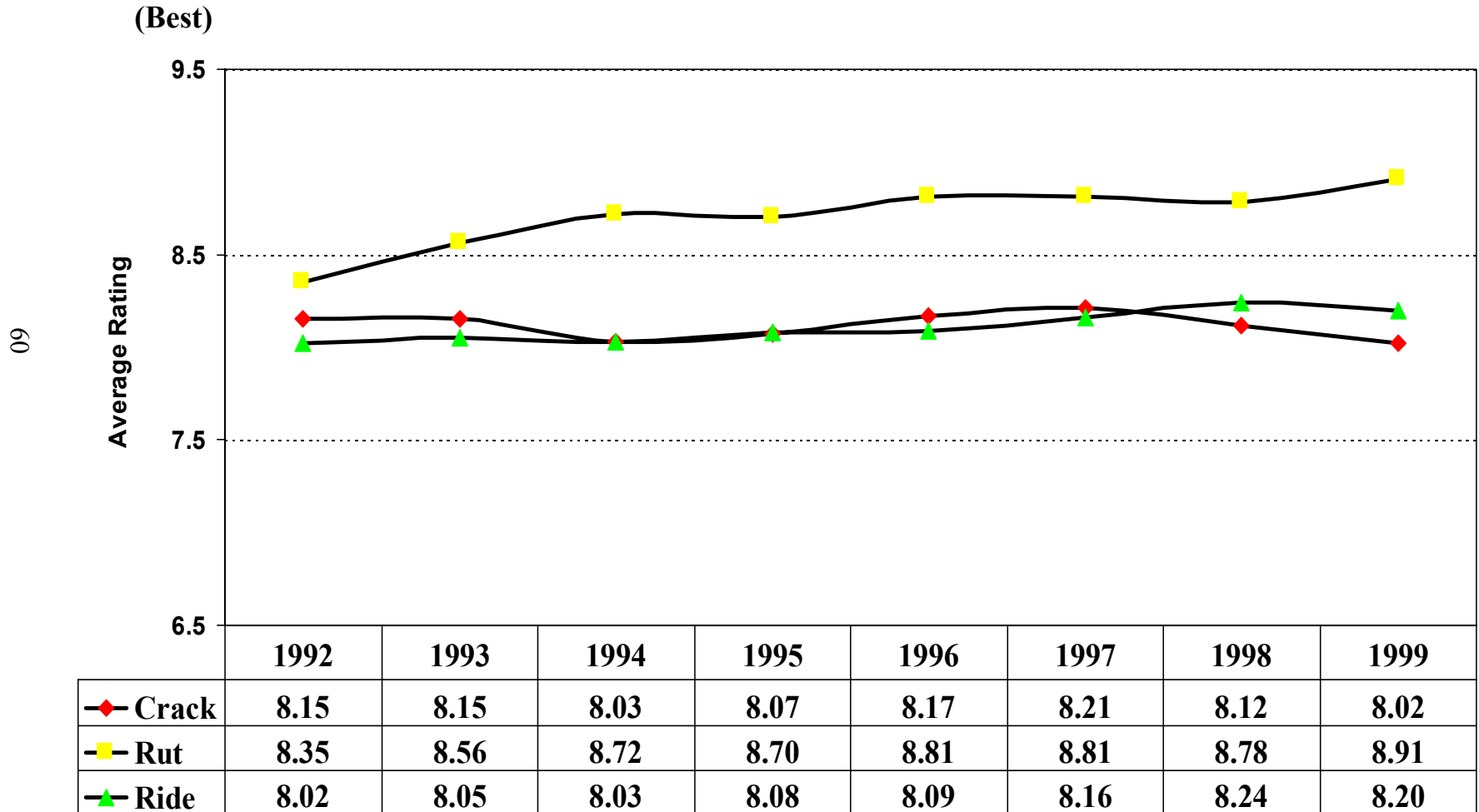
BY

SYSTEM



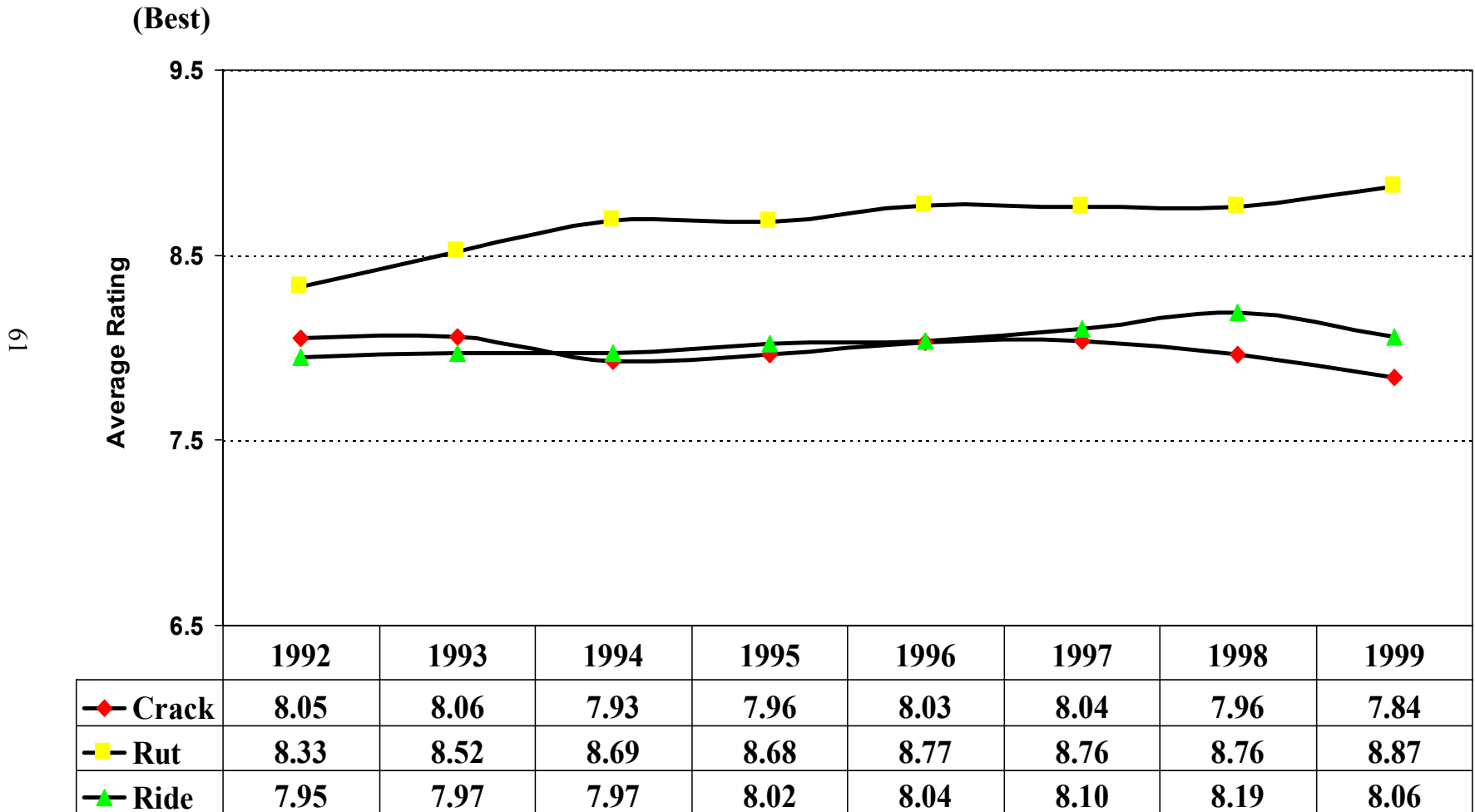
All Systems

Historical Information



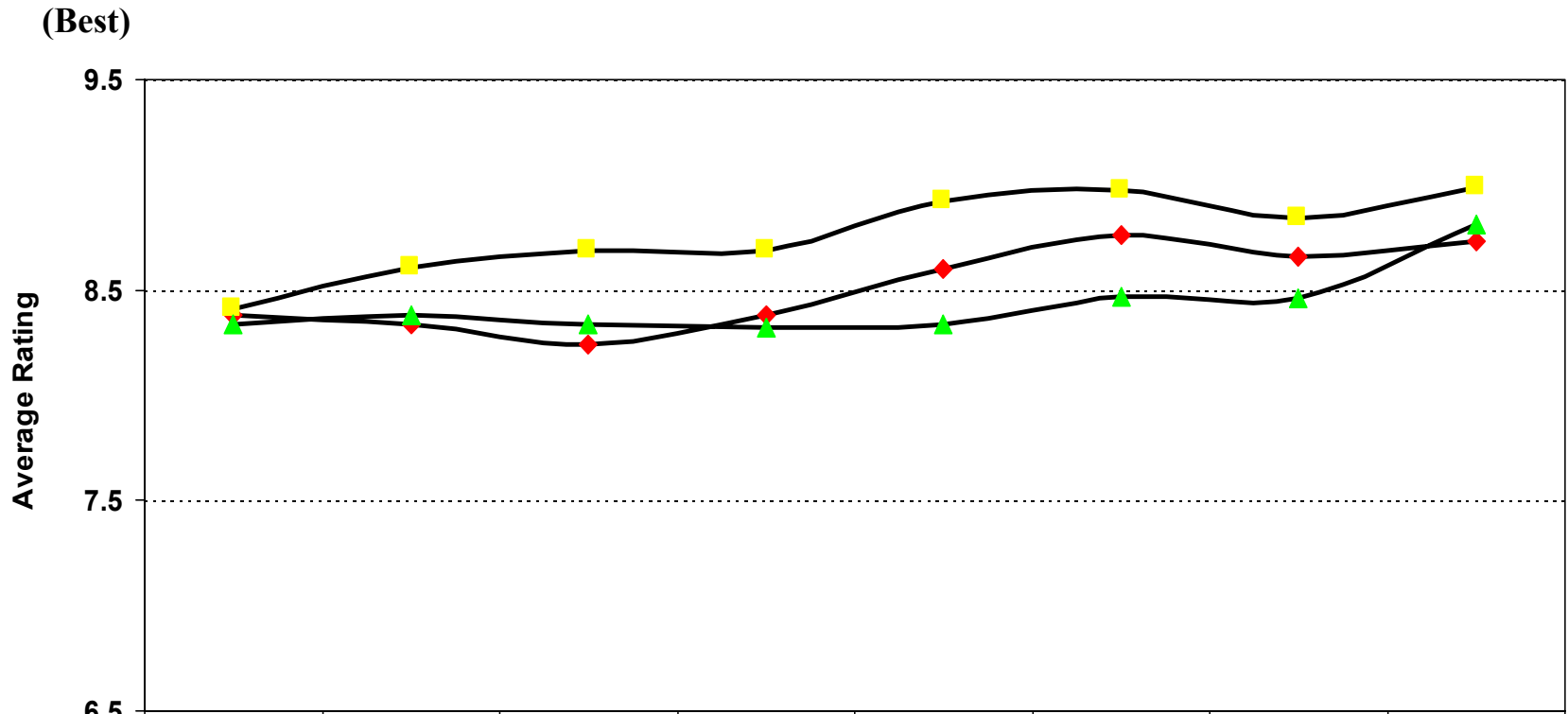
Primary System

Historical Information



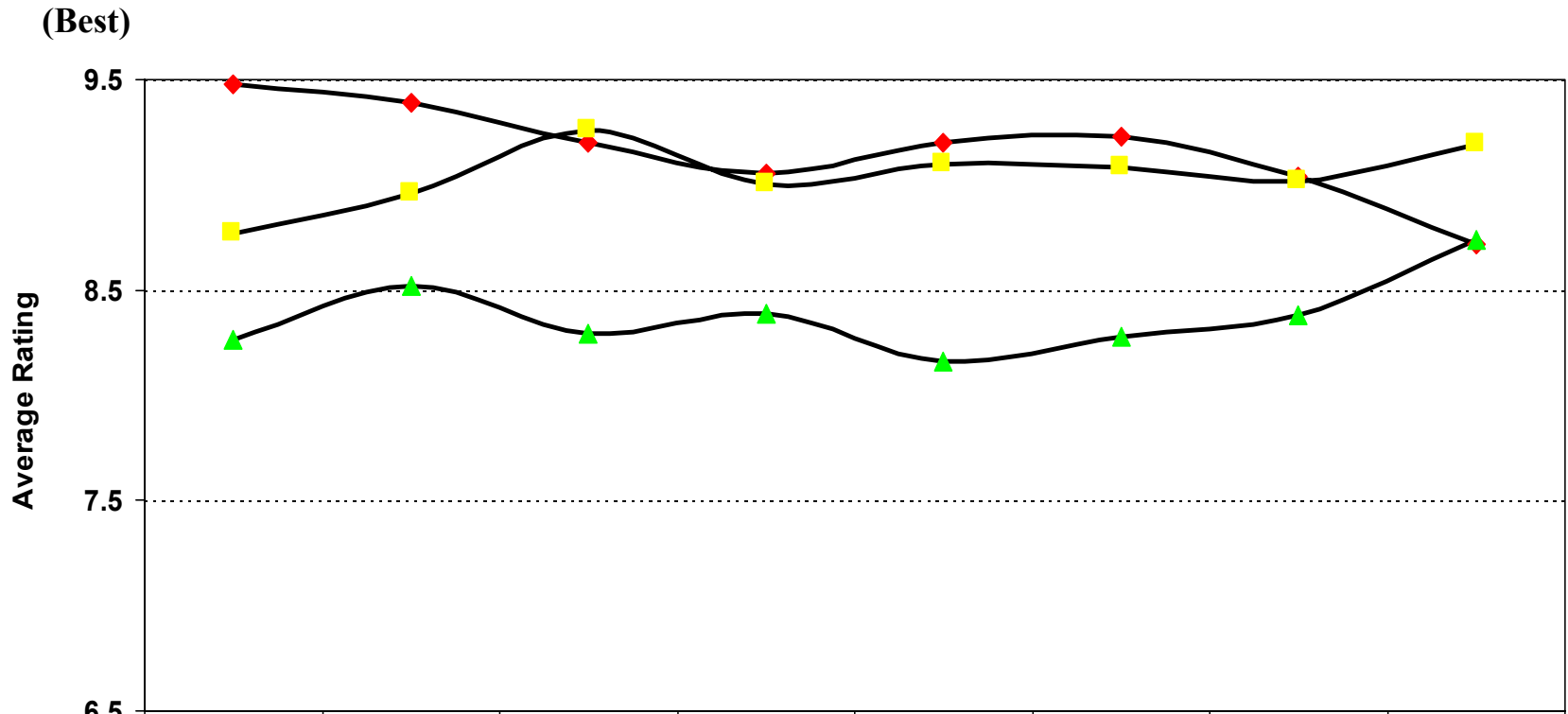
Interstate System

Historical Information



Turnpike System

Historical Information



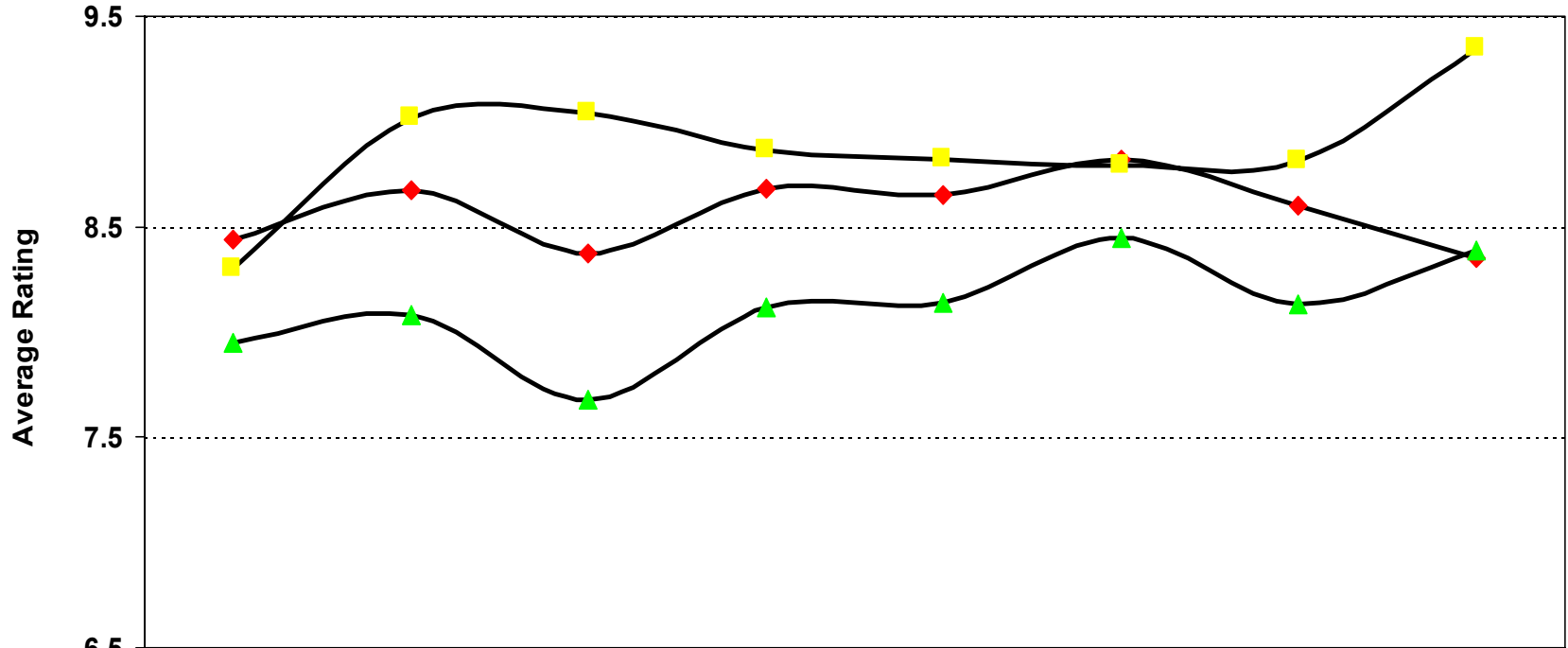
	1992	1993	1994	1995	1996	1997	1998	1999
—◆— Crack	9.48	9.39	9.20	9.05	9.20	9.23	9.04	8.72
—■— Rut	8.77	8.96	9.26	9.00	9.10	9.08	9.02	9.19
—▲— Ride	8.26	8.52	8.29	8.39	8.16	8.28	8.38	8.74

Toll System

Historical Information

64

(Best)



	1992	1993	1994	1995	1996	1997	1998	1999
—◆— Crack	8.44	8.67	8.37	8.68	8.65	8.82	8.60	8.35
—■— Rut	8.30	9.02	9.04	8.86	8.82	8.79	8.81	9.35
—▲— Ride	7.95	8.08	7.68	8.12	8.14	8.45	8.13	8.39

SECTION VIII

RAVELING

INFORMATION



SECTION VIII

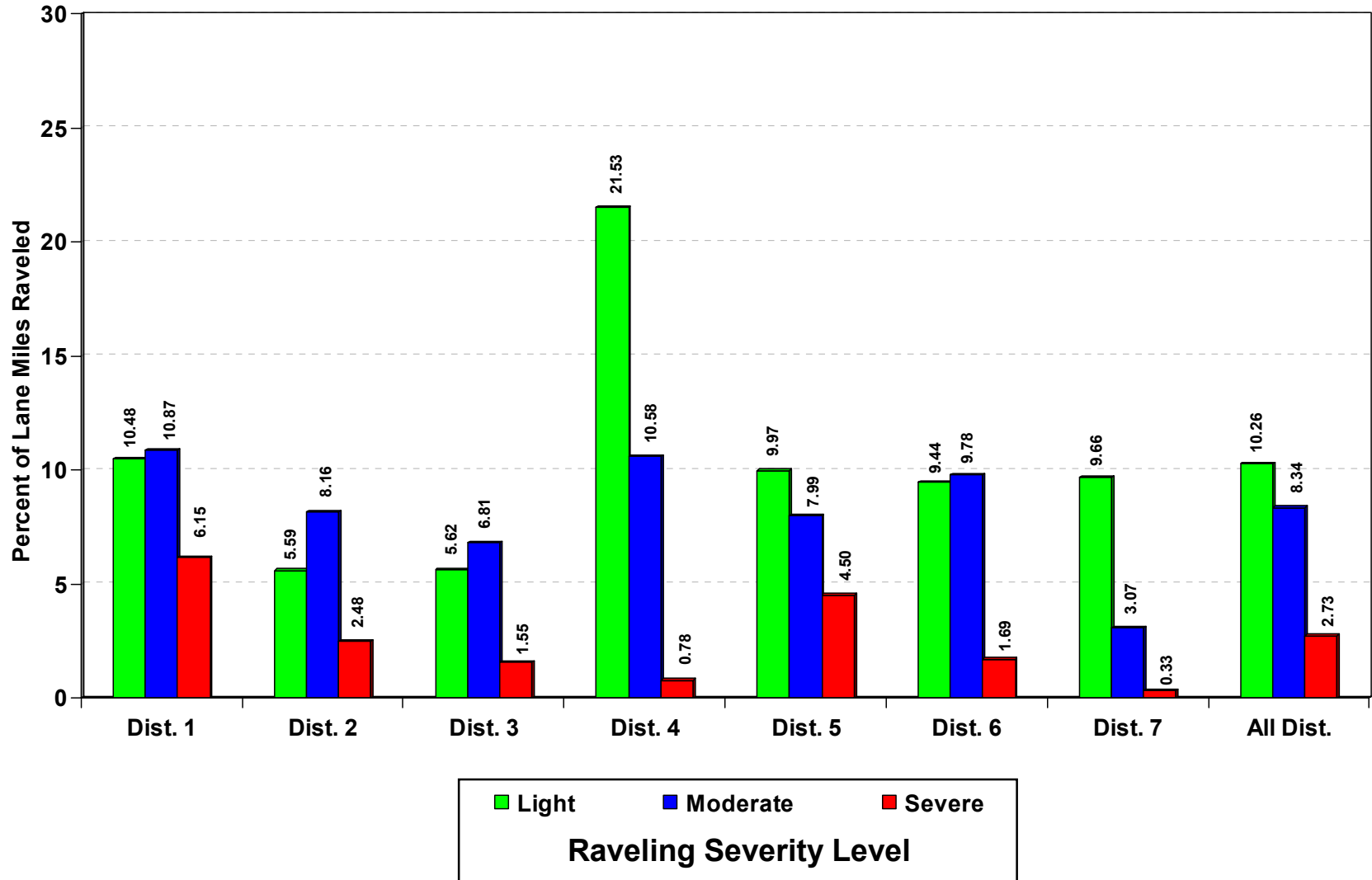
Raveling

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 aggregate is also 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 aggregate has progressed.
- Severe Raveling occurs when the aggregate and/or binder has worn away and the surface texture is becoming rough and pitted; loss of aggregate very noticeable.

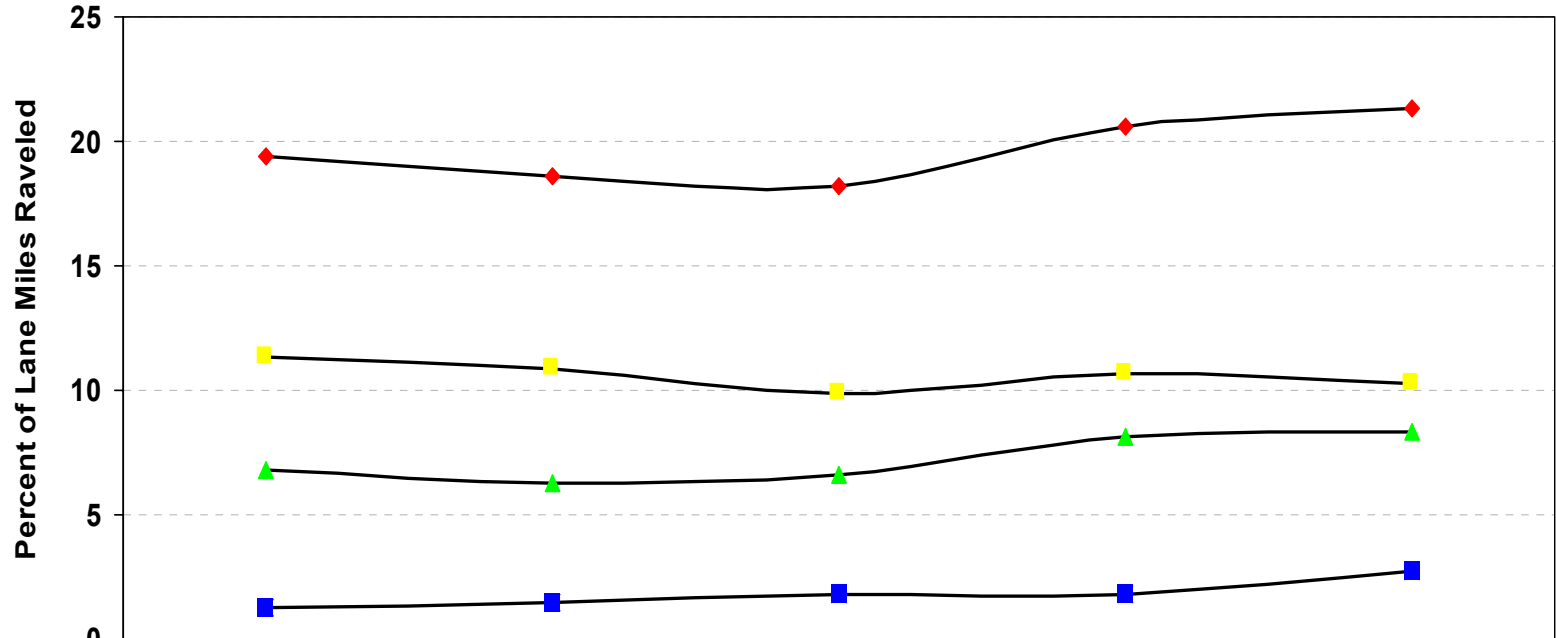
1999 Raveling Survey by District

L9



1999 Raveling Survey History

All Systems Combined



	1995	1996	1997	1998	1999
◆ Combined	19.42	18.62	18.22	20.59	21.33
■ Light	11.34	10.89	9.85	10.65	10.26
▲ Moderate	6.79	6.28	6.59	8.14	8.34
■ Severe	1.29	1.45	1.78	1.80	2.73

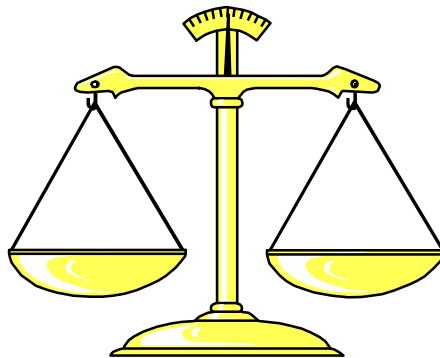
SECTION IX

CRACK, RIDE & RUT

RATINGS COMPARISON

BETWEEN

1999 & 1998



SECTION IX

Crack, Ride, & Rut Ratings Comparison

Rating Comparison Criteria

The following pavement types have been omitted because they exhibit known changes to the pavement surface such as new construction, rehabilitation, or no ratings:

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)

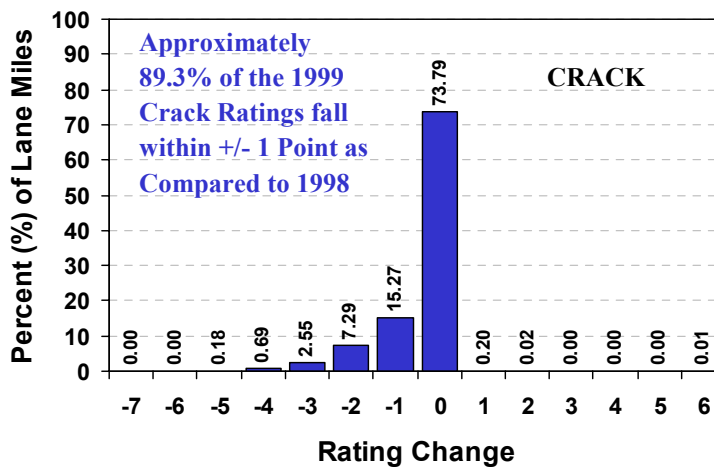
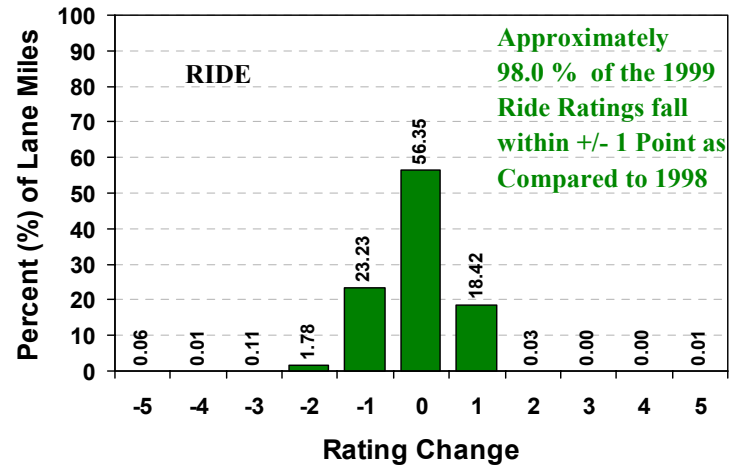
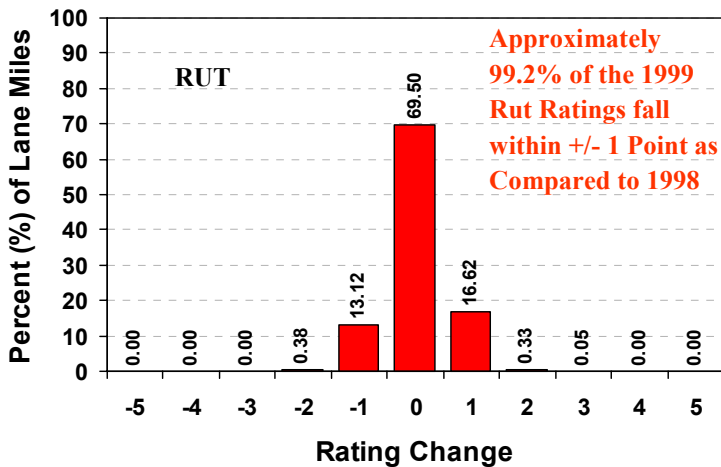
Type 7 - New Pavement (Overlays)

Type 8 - Under Construction

Type 9 - Structures or exceptions that are State-maintained

Crack, Ride & Rut Changes

1999 as Compared to 1998



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