TTI-2-18-75-199-1F

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TEXAS
TRANSPORTATION
INSTITUTE

STATE DEPARTMENT
OF HIGHWAYS AND
PUBLIC TRANSPORTATION

COOPERATIVE
RESEARCH

IMPLEMENTING MAINTENANCE RATING TECHNIQUES

in cooperation with the
Department of Transportation
Federal Highway Administration

RESEARCH REPORT 199-1F
TUDY 2-18-75-199
AINTENANCE RATING

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
TTI-2-18-75-199-1F		

4. Title and Subtitle	5. Report Date
IMPLEMENTING MAINTENANCE RATING TECHNIQUES	September, 1976
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
J. A. Epps I. E. Larrimore, Jr. W. W. Scott, Jr.	Research Report 199-1F

9. Performing Organization Name and Address	10. Work Unit No.
Texas Transportation Institute Texas A&M University College Station, Texas 77843	11. Contract or Grant No. Research Study 2-18-75-199
	13. Type of Report and Period Covered Final - September, 1974 September, 1976
12. Sponsoring Agency Name and Address Texas State Department of Highways and Public Transportation Transportation Planning Division P.O. Box 5051 Austin, Texas 78763	14. Sponsoring Agency Code

15. Supplementary Notes
Research performed in cooperation with DOT and FHWA
Research Study Title: "Maintenance Rating Techniques."

16. Abstract

Training schools were conducted to instruct Texas State Department of Highways and Public Transportation personnel in the use of the Maintenance Rating System. The results of these schools were utilized to determine the accuracy of the maintenance rating scores obtained on a particular roadway section.

An urban maintenance rating system has been developed. This subjective rating system has been modeled after the rating system currently utilized in Texas. However, additional roadway features are evaluated in the urban rating system.

17. Key Words	18. Distribution Statement
Maintenance, roadway rating, pavement condition survey, training, pavement distress.	No Restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	50	

Form DOT F 1700.7 (8-69)

IMPLEMENTING MAINTENANCE RATING TECHNIQUES

by

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Research Report 199-1F

Maintenance Rating Techniques

Research Study No. 2-18-75-199

Sponsored by:

The Texas State Department of Highways and Public Transportation

in cooperation with

U. S. Department of Transportation
Federal Highway Administration

September, 1976

Texas Transportation Institute
Texas A&M University
College Station, Texas

ABSTRACT

Training schools were conducted to instruct Texas State Department of Highways and Public Transportation personnel in the use of the Maintenance Rating System. The results of these schools were utilized to determine the accuracy of the maintenance rating scores obtained on a particular roadway section.

An urban maintenance rating system has been developed. This subjective rating system has been modeled after the rating system currently utilized in Texas. However, additional roadway features are evaluated in the urban rating system.

Key Words

Maintenance, roadway rating, pavement condition survey, training, pavement distress.

PREFACE

This is the final report for the one year Research Study 2-18-75-199 "Maintenance Rating Techniques". The report discusses the implementation of the Maintenance Rating System as developed in Research Study 2-18-71-151 "Maintenance Quality, Methods and Ratings" and the development of an urban maintenance rating system. The results of the visual evaluation methods described in this report together with other survey types can be utilized for scheduling maintenance activities as well as other uses.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to the Texas State Department of Highways and Public Transportation's Maintenance Practices Committees whose guidance was instrumental in the development of the Maintenance Rating System. The Area II Research Committee of the Texas State Department of Highways and Public Transportation was instrumental in implementing this training program. Mr. W. B. Collier, District 15 Maintenance Engineer, contributed to the development of the urban rating system.

IMPLEMENTATION STATEMENT

Information presented in this report will be useful to maintenance engineers for assessing the accuracy of the maintenance rating scores. The urban maintenance rating system presented is suggested for trial implementation.

SUMMARY

Seven maintenance rater training schools have been conducted which trained Texas State Department of Highways and Public Transportation District personnel to utilize the maintenance rating form for both flexible and rigid pavements. Three rating sessions were conducted at each school.

Upon completion, it was determined that approximately 68 percent of the individuals attending the schools obtained maintenance rating scores within $\pm$ 10 points of each other. A comparison between the instructors and the students' ratings for the third rating session revealed that 73 percent of the pavements evaluated were within $\pm$ 5 points and 100 percent were within $\pm$ 10 points.

An urban rating system has been proposed. The pavement and shoulder items are identical to those presently utilized on the maintenance rating form. Items under the headings of roadside, drainage, and traffic service have been increased over the number presently utilized.

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INTRODUCTION

Funding for highway maintenance operations in Texas as well as most states comprises a significant and continually increasing portion of the total highway budget. The increasing public demand for higher levels of service constantly widens the gap between funds available for maintenance operations and the funds required to provide this desired level of service. The existence of this situation makes it imperative to develop a system that will assist the engineers in short and long range maintenance planning.

Research Study 2-18-71-151 "Maintenance Quality, Methods and Ratings", a cooperative study between the Texas State Department of Highways and Public Transportation and the Texas Transportation Institute, responded to this need by developing selected management tools as outlined by the study objectives given below:

1. Develop a system by which all highway maintenance operations can be coded and placed into functional groups,

2. Develop maintenance quality standards and maintenance methods for the various highway classes,

3. Develop a maintenance rating system that can be used as a basis to schedule highway maintenance operations and

4. Implement on a trial basis the maintenance rating system and assess the established quality standards and maintenance methods.

References 1 and 2 describes the development of the maintenance operation codes, quality standards and maintenance methods. These codes and methods are scheduled for implementation by the Texas State Department of Highways and Public Transportation. References 3, 4, 5 and 6

describe the development and use of the maintenance rating system.

As described above Research Study 2-18-71-151 established the foundation for a viable roadway condition rating system. The purpose of this visual evaluation is to provide information that can be used together with other data for the following purposes:

1. Define the present condition of the roadway,

2. Compare the present condition of a roadway with the past condition of the roadway to predict the future condition of the roadway,

3. Determine maintenance needs in terms of materials, equipment, manpower and dollars,

4. Establish maintenance priorities based upon available resources and

5. Identify those maintenance activities which provide the greatest return for the maintenance investment.

Extended refinements and utilization of this revised rating technique form the basis of Research Study 2-18-75-199, the results of which are presented in this report. Research Study 2-18-75-199 was a one-year cooperative study between the Texas State Department of Highways and Public Transportation and the Texas Transportation Institute. The primary work items in this study are as follows:

1. Implement the Maintenance Rating System developed in Research Study 2-18-71-151,

2. Conduct a statewide survey of the 250 randomly selected roadway sections,

3. Re-evaluate the assigned weighting factors to the various types of observed distress and roadway condition and

4. Develop an urban visual rating system.

Statewide survey data were collected on the randomly selected roadway sections. The survey consisted of Mays Ride Meter roughness data and the visually obtained maintenance rating scores. These data are reported in reference 4 and will be compared with surveys conducted in other years in future reports on Study 2-8-75-207 titled "Flexible Pavement Evaluation and Rehabilitation."

Weighting factors assigned to the various types of observed distress and roadway conditions were based primarily on experience gained in Districts 7 and 21 together with information published in the literature. Sufficient data from other districts representing other geographical areas were not available prior to the termination of this project to make rational adjustments in the proposed weighting or deduct factors. It is therefore suggested that the method of determining the maintenance rating scores remain unchanged but the engineering interpretation of the scores consider the various types of pavement distress common to certain geographical areas of Texas. For example, the randomly selected roadway sections selected throughout Texas have indicated that a transverse and longitudinal cracking pattern is more common to west Texas flexible pavements than to east Texas flexible pavements. Lower pavement rating scores may result for the general west Texas area because of this prevalent type of cracking.

Implementation of the Maintenance Rating System and development of an urban rating system which are items 1 and 4 of Research Study 2-18-75-199 work plan are discussed in detail in the remainder of the report.

MAINTENANCE RATING SCHOOLS

Implementation of the Maintenance Rating System involved the training schools, follow-up visits to districts to insure proper understanding of the principles proposed in the training schools and detailed assistance to District 21 personnel to improve the use of maintenance rating information. Improvements in maintanance rating techniques developed in cooperation with District 21 personnel are reported in reference 4.

Seven training schools were conducted by Texas Transportation Institute and Texas State Department of Highways and Public Transportation personnel for Texas State Department of Highways and Public Transportation districts and central office personnel. The locations, dates and districts or central office divisions involved in the training schools are shown on Table 1. Each district was requested to send three individuals to be trained as raters together with an individual from the district office maintenance management staff such as the district maintenance engineers. The individuals to be trained as raters were typically classified in maintenance technician categories.

Training School Format

The format utilized to conduct the training school is shown on Table 2. The morning session of the first day consisted of a slide presentation* introducing the purpose of the training school, the need for maintenance rating and the equipment and techniques available for

*This slide presentation is available upon request from File D-18, Texas State Department of Highways and Public Transportation, Austin, Texas 78701

TABLE 1. Rater Training Schools

LOCATION	DISTRICTS INVOLVED		DATES OF SCHOOL
	District Number	Location of District Office	
Wichita Falls	3	Wichita Falls	September 10-11, 1974
	4	Amarillo	
	5	Lubbock	
	25	Childress	
Lufkin	11	Lufkin	November 5-6, 1974
	12	Houston	
	17	Bryan	
	20	Beaumont	
Odessa	6	Odessa	November 12-13, 1974
	8	Abilene	
	22	Del Rio	
	24	El Paso	
Corpus Christi	13	Yoakum	January 21-22, 1975
	15	San Antonio	
	16	Corpus Christi	
	21	Pharr	
Austin	14*	Austin	January 29-30, 1975
Tyler	1	Paris	March 12-13, 1975
	10	Tyler	
	11	Lufkin	
	18	Dallas	
	19	Atlanta	
Brownwood	2	Fort Worth	March 18-19, 1975
	7	San Angelo	
	9	Waco	
	23	Brownwood	

*Central Office Personnel Attended, Files D-8, D-10, D-18, and D-19.

TABLE 2. Training School Format

FIRST DAY

A.M.

I. Introduction
   - A. Purpose of roadway maintenance evaluation
   - B. Types of equipment available for evaluation

II. Visual Evaluation Form
   - A. Selection of section to be evaluated
   - B. Definition of section to be evaluated
   - C. Pavement evaluation
     1. Types of distress
     2. Amount of distress
     3. Severity of distress
   - D. Shoulder evaluation
   - E. Roadside and drainage evaluation
   - F. Traffic services evaluation

P.M.

I. Conduct First Roadway Evaluation

II. Scoring System

III. Score First Evaluation

SECOND DAY

A.M.

I. Discuss Results of First Evaluation

II. Conduct Second Roadway Evaluation

P.M.

I. Score Second Evaluation

II. Discuss Results of Second Evaluation

III. Conduct Third Evaluation

IV. Score Third Evaluation

maintenance rating. Research Report 151-2 "Roadway Maintenance Evaluation User's Manual" (3) was utilized extensively as an aid during the training process. The manual was sent to the districts prior to the training schools for study for those attending the training program.

The afternoon of the first day was occupied performing roadway evaluations on selected roadway segments, an explanation of the scoring system and scoring of the roadways evaluated. The roadway evaluations were performed by each individual attending the training school. For roadway inventory purposes it is suggested that the collective opinions of two raters be recorded on the revised survey form shown in Figure 1.

The second day was occupied by discussing the results of roadway evaluations, making roadway evaluations and explaining the uses of rating information. Three field roadway evaluation sessions were scheduled for each school. Weather and time commitments prevented a third field evaluation at some of the sites. District maintenance management personnel (usually the District Maintenance Engineer) were briefed on application of maintenance rating information during the second roadway evaluation session conducted the morning of the second day. Computer programs developed for trial implementation in District 21 were discussed as well as techniques utilized by other highway districts in Texas and other states in the United States.

Accuracy of Maintenance Rating Scores

As expected considerable data scatter existed between raters for a particular roadway segment. An indication of the magnitude of this scatter can be obtained from Tables 3 and 4. Table 3 is a statistical summary of ratings obtained during the maintenance rating schools by

TABLE 3. Statistical Summary of Ratings Obtained During Maintenance Rating School

LOCATION		FIRST RATING																			
		PRS				SRS				RRS				DRS				TRS			
School	Roadway	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N
WICHITA FALLS	US 281-0	77.0	16.0	55	16	74.1	10.0	27	16	80.4	5.8	20	16	72.2	21.6	47	16	87.9	5.1	14	16
	SH 79	52.2	17.7	56	16	61.6	25.4	66	16	84.4	5.7	20	16	78.1	13.4	47	16	85.8	5.0	14	16
	FM 1954-A	80.1	6.7	25	16	72.2	18.2	65	16	78.5	7.9	25	16	69.2	14.0	57	16	80.0	7.9	24	16
	FM 1954-B	72.2	23.0	34	13	75.0	18.0	65	13	78.2	7.1	25	13	71.7	13.1	40	13	71.7	3.1	16	13
	FM 171																				
	FM 1740-0																				
	FM 1740-3																				
	US 281-19																				
ODESSA	LP 338	88.4	8.2	26	18	77.8	9.1	24	18	79.9	7.9	25	18	78.9	7.7	27	18	84.1	5.9	26	18
	FM 1882-0	58.2	22.2	76	18	68.9	11.1	39	18	71.7	13.7	55	18	72.4	11.8	44	18	81.8	7.9	24	18
	FM 1882-2	47.3	14.0	28	17	66.3	9.9	34	17	69.3	14.3	50	17	67.8	14.0	46	17	83.8	8.4	26	17
	IH 20-L	80.1	11.7	38	17	81.7	9.0	27	17	79.1	8.6	27	17	84.7	8.2	27	17	87.3	4.7	14	17
	IH 20-M	99.0	1.4	2	7	83.6	7.6	21	7	87.3	8.1	20	7	87.1	7.1	20	7	89.7	6.9	18	7
	US 385R																				
	US 385S																				
	US 385L																				
	FM 1936																				
	SH 158																				
	US 385M																				
LUFKIN	FM 2021	79.6	17.1	51	18	61.2	16.1	65	18	70.1	10.9	30	18	68.2	12.9	47	18	78.4	9.0	32	18
	FM 843	80.7	10.7	21	18	59.8	16.4	70	18	72.3	6.5	27	18	58.9	8.0	26	18	73.4	5.9	20	18
	LP 287-11R	69.5	16.6	58	17	71.0	5.8	23	17	67.1	9.2	33	17	70.2	9.7	26	17	74.0	7.5	20	17
	US 69-9	57.4	19.6	84	18	70.4	9.0	34	18	73.2	7.5	28	18	68.7	11.5	37	18	78.0			
	LP 287-9																				
	SH 103																				
	US 69-20																				
	LP 287-0																				
	SH 94																				
CORPUS CHRISTI	FM 43	90.9	13.5	27	16	65.3	6.6	22	16	75.6	7.8	33	16	69.4	14.3	40	16	83.5	5.1	16	16
	SH 286	58.6	15.5	46	16	67.2	9.1	35	16	72.8	7.2	23	16	71.6	9.5	33	16	81.0	7.9	30	16
	FM 1694	69.1	16.3	58	16	65.6	12.0	45	16	78.1	9.1	27	16	70.1	10.1	34	16	83.6	6.6	20	16
	FM 1694	62.1	17.2	59	16	65.0	9.3	30	16	79.1	9.5	27	16	71.3	10.3	37	16	85.5	5.8	18	16
AUSTIN	US 290	93.6	7.5	20	12	71.9	5.9	23	12	72.8	6.7	25	12	76.4	8.1	30	12	77.5	5.6	20	12
	FM 969L	53.4	22.5	70	10																
	FM 969R	81.2	11.3	39	12	62.1	10.5	35	12	70.9	10.0	35	12	75.8	16.0	50	12	83.0	9.4	38	12
	SH 71	59.6	20.6	67	12	77.3	13.0	40	12	85.2	17.3	50	12	89.8	13.8	37	12	90.2	10.7	26	12
	FM 973	62.0	6.6	13	12	56.7	12.3	50	12	65.4	9.7	35	12	67.8	13.6	43	12	81.8	7.5	22	12
	FM 1325S																				
	FM 1325R																				
	FM 685R																				
	FM 1825S																				
	FM 1825R																				
TYLER	FM 2661-3	76.0	13.3	55	17	64.1	11.5	40	17	58.1	9.2	35	17	66.7	9.7	34	17	77.2	8.0	30	17
	FM 2661-10	81.9	9.6	30	17	66.8	10.3	35	17	61.6	8.5	30	17	65.5	11.3	40	17	81.4	6.8	22	17
	SH 155	57.7	14.8	52	15	73.7	7.5	27	15	75.1	6.4	22	15	72.3	8.0	30	15	77.9	6.5	28	15
	LP 323-LR	64.1	12.6	45	17	70.2	8.4	29	17												
	LP 323-MS	88.0	5.3	18	10	75.4	16.5	33	10												
	US 69																				
	FM 344																				
	SH 110																				
	FM 756																				
BROWNWOOD	US 67	87.8	4.5	17	10	80.5	5.8	20	10	86.3	7.4	23	10	84.4	5.2	13	10	88.6	4.9	14	10
	FM 585	80.5	7.0	21	10	62.0	13.2	40	10	81.8	9.0	28	10	75.3	7.9	24	10	84.8	6.3	18	10
	SH 279	93.2	3.8	12	10	71.8	6.0	13	10	77.6	5.2	15	10	77.1	9.8	30	10	86.8	4.7	14	10
	US 84																				
	US 183-19																				
	US 183-15																				
	FM 2126																				
	US 377																				

LOCATION		SECOND RATING																			
		PRS				SRS				RRS				DRS				TRS			
School	Roadway	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N
WICHITA FALLS	US 281-0																				
	SH 79	42.7	14.8	41	12																
	FM 1954-A																				
	FM 1954-B																				
	FM 171	66.8	9.0	27	12	70.7	8.5	31	12	69.4	6.8	25	12	68.0	13.3	44	12	68.3	9.2	34	12
	FM 1740-0	62.0	18.2	60	12	79.1	16.9	55	12	80.3	6.8	20	12	70.4	11.0	33	12	76.5	8.4	28	12
	FM 1740-3	89.8	5.5	18	12	80.8	14.0	40	12	83.3	6.8	22	12	75.3	11.8	40	12	78.8	7.9	24	12
	US 281-19																				
ODESSA	LP 338																				
	FM 1882-0	55.6	14.4	37	8																
	FM 1882-2																				
	IH 20-L																				
	IH 20-M																				
	US 385R	73.4	9.1	36	13																
	US 385S	87.7	5.9	19	12																
	US 385L	92.4	3.7	13	12																
	FM 1936																				
	SH 158																				
	US 385M																				
LUFKIN	FM 2021																				
	FM 843																				
	LP 287-11R	85.9	6.1	21	16																
	US 69-9																				
	LP 287-9	90.2	5.4	22	13	75.1	13.0	46	13	78.5	14.2	35	13	75.9	14.2	43	13	82.3	12.9	42	13
	SH 103	71.4	10.3	33	16	74.7	9.8	34	16	68.1	9.7	35	16	67.8	14.9	50	16	81.3	10.9	32	16
	US 69-20	63.9	7.0	22	13																
	LP 287-0																				
	SH 94																				
CORPUS CHRISTI	FM 43																				
	SH 286																				
	FM 1694																				
	FM 1694																				
AUSTIN	US 290																				
	FM 969L																				
	FM 969R																				
	SH 71																				
	FM 973																				
	FM 1325S	91.2	6.9	20	6																
	FM 1325R	73.5	11.8	33	6																
	FM 685R	86.3	7.0	15	6																
	FM 1825S	58.2	14.5	38	6																
	FM 1825R	58.0	11.7	35	6																
TYLER	FM 2661-3																				
	FM 2661-10																				
	SH 155																				
	LP 323-LR																				
	LP 323-MS																				
	US 69	56.3	14.1	42	12	66.9	4.0	14	12	73.0	5.2	17	12	70.5	6.4	20	12	76.0	6.6	12	12
	FM 344	90.1	2.4	8	12	68.3	12.9	45	12	70.9	5.5	15	12	21.6	4.2	17	12	77.5	7.8	16	12
	SH 110	67.8	14.3	45	12	69.7	5.0	13	12	70.0	2.7	7	12	67.8	5.4	20	12	79.8	3.6	12	12
	FM 756	84.5	7.6	17	12	60.0	7.4	20	12	61.3	6.2	17	12	61.3	6.8	27	12	82.5	6.7	18	12
BROWNWOOD	US 67	89.4	7.1	25	14																
	FM 585																				
	SH 279																				
	US 84	79.7	6.5	20	14	78.1	10.1	33	14	85.1	12.7	35	14	83.1	14.9	43	14	90.0	9.5	24	14
	US 183-19	48.7	19.9	77	13																
	US 183-15	54.1	13.2	41	13																
	FM 2126																				
	US 377																				

LOCATION		THIRD RATING																			
		PRS				SRS				RRS				DRS				TRS			
School	Roadway	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N	$\bar{X}$	σ	R	N
WICHITA FALLS	US 281-0	78.2	6.4	22	12																
	SH 79																				
	FM 1954-A																				
	FM 1954-B																				
	FM 171																				
	FM 1740-0																				
	FM 1740-3																				
	US 281-19	81.0	9.4	29	15	78.9	8.4	31	15	86.6	7.3	30	15	80.9	10.1	37	15	86.9	7.7	24	15
ODESSA	LP 338																				
	FM 1882-0																				
	FM 1882-2																				
	IH 20-L																				
	IH 20-M																				
	US 385R																				
	US 385S																				
	US 385L	75.1	6.4	24	16	77.4	8.1	28	16	83.8	6.9	25	16	84.3	9.0	36	16	86.8	6.5	26	16
	FM 1936	85.4	7.1	24	15	60.3	9.9	34	15	69.5	9.5	30	15	78.4	10.6	40	15	86.5	3.1	10	15
	SH 158	76.7	4.9	18	15	78.3	8.0	34	15	82.2	8.8	33	15	83.6	10.4	40	15	89.2	5.3	20	15
	US 385M	75.1	10.6	27	7	73.0	8.7	24	7	83.7	4.4	13	7	86.0	6.9	20	7	85.1	5.2	19	7
LUFKIN	FM 2021																				
	FM 843																				
	LP 287-11R																				
	US 69-9	57.2	15.5	51	13																
	LP 287-9																				
	SH 103																				
	US 69-20																				
	LP 287-0	74.5	13.6	40	13	77.8	8.8	32	13	79.0	8.9	28	13	59.5	14.3	43	13	77.7	8.7	30	13
	SH 94	66.3	13.2	43	12	60.2	13.5	39	12	71.3	13.6	43	12	61.9	13.8	53	12	78.0	8.2	32	12
CORPUS CHRISTI	FM 43																				
	SH 286																				
	FM 1694																				
	FM 1694																				
AUSTIN	US 290																				
	FM 969L																				
	FM 969R																				
	SH 71																				
	FM 973																				
	FM 1325S																				
	FM 1325R																				
	FM 685R																				
	FM 1825S																				
	FM 1825R																				
TYLER	FM 2661-3																				
	FM 2661-10																				
	SH 155																				
	LP 323-LR																				
	LP 323-MS																				
	US 69																				
	FM 344																				
	SH 110																				
	FM 756																				
BROWNWOOD	US 67																				
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	SH 279																				
	US 84																				
	US 183-19																				
	US 183-15																				
	FM 2126	91.0	3.7	12	13																
	US 377	84.4	3.4	8	11																

$\bar{X}$ = mean σ = coefficient of variation R = range of values N = number of raters

TABLE 4. Weighted Mean Standard Deviation

RATING	PRS		SRS		RRS		DRS		TRS	
	C_v	n	C_v	n	C_v	n	C_v	n	C_v	n
First	14.5	30	12.1	29	9.2	27	11.8	27	7.1	26
Second	10.7	25	11.1	9	8.6	10	11.3	10	8.6	10
Third	9.3	11	9.4	7	9.0	7	11.1	7	6.4	6

C_v = weighted coefficient of variation

n = number of roadway segments

TABLE 5. Comparison of Instructor and Student Rating Score

RATING	Total No. of Comparison	Percent of Comparisons Within	
		$\pm$ 5 Points	$\pm$ 10 Points
First	30	60	90
Second	25	40	84
Third	11	73	100

individuals who were being trained for each roadway segment evaluated. Statistical data includes mean, standard deviation, range and number of raters for the first, second and third rating sessions held during the schools. Data are presented for the following scores as described in reference 3 for each flexible pavement roadway rated;

1. PRS - Pavement Rating Score,
2. SRS - Shoulder Rating Score,
3. RRS - Roadside Rating Score,
4. DRS - Drainage Rating Score and
5. TRS - Traffic Services Rating Score.

Table 4 presents a summary of the weighted mean coefficients of variation for the maintenance rating scores on the first, second and third field rating sessions. In most cases the coefficient of variation decreased as the raters become more familiar with the techniques to be utilized and the definitions associated with the use of the rating form. From these data it appears as if 68 percent of a group of individuals will obtain maintenance rating scores (PRS, SRS, RRS, DRS and TRS) within $\pm$ 10 points of each other after attending the rater training school. It should be noted that these are scores of individual raters and not two men teams as suggested for roadway inventory purposes.

Data scatter of the magnitude shown on Table 3 is expected from a group of individuals being trained to conduct the visual maintenance rating or condition survey.

Each roadway section was evaluated by those being trained at the school and by 2 or 3 individuals who were responsible for conducting the

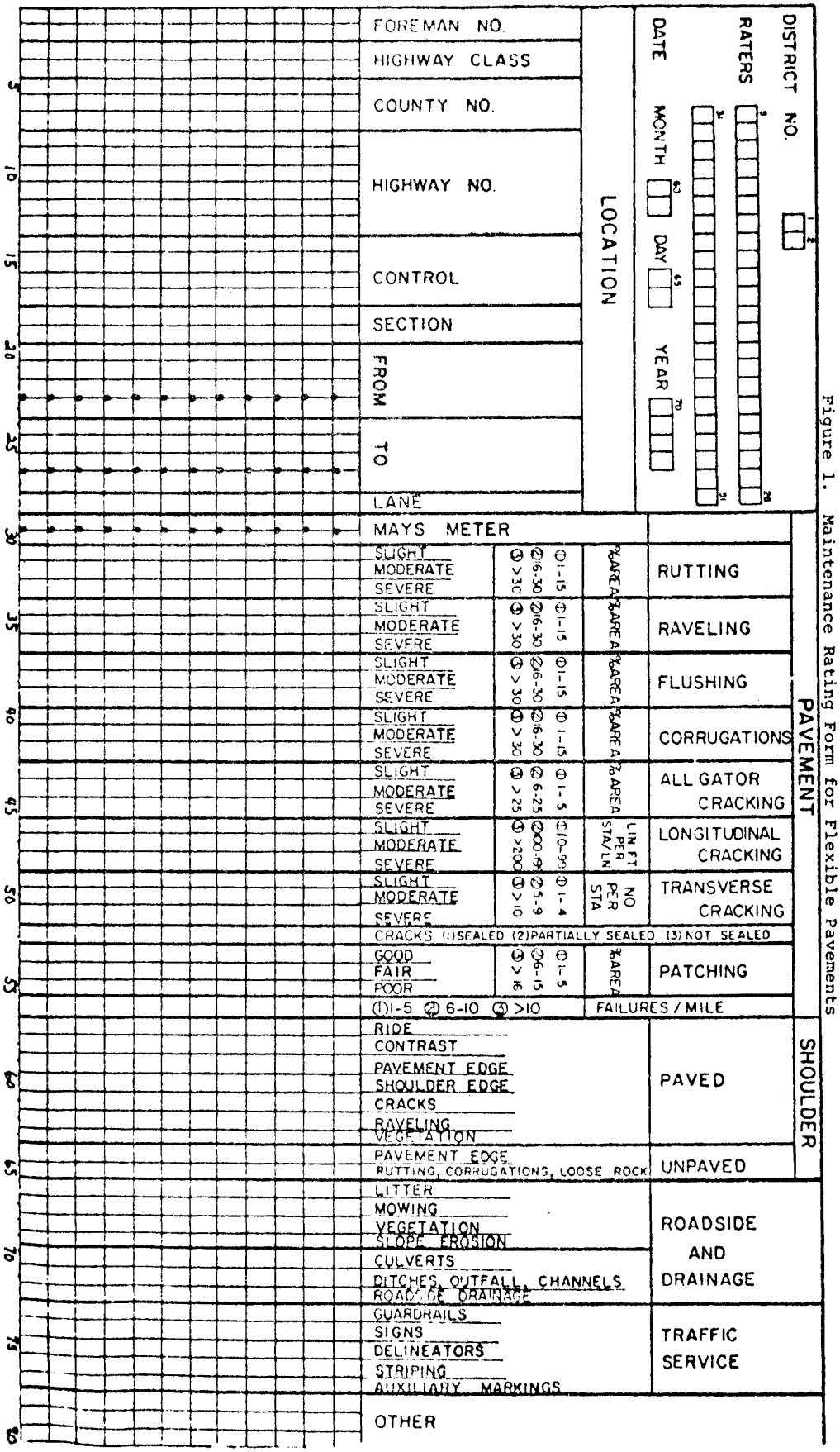

Figure 1. Maintenance Rating Form for Flexible Pavements

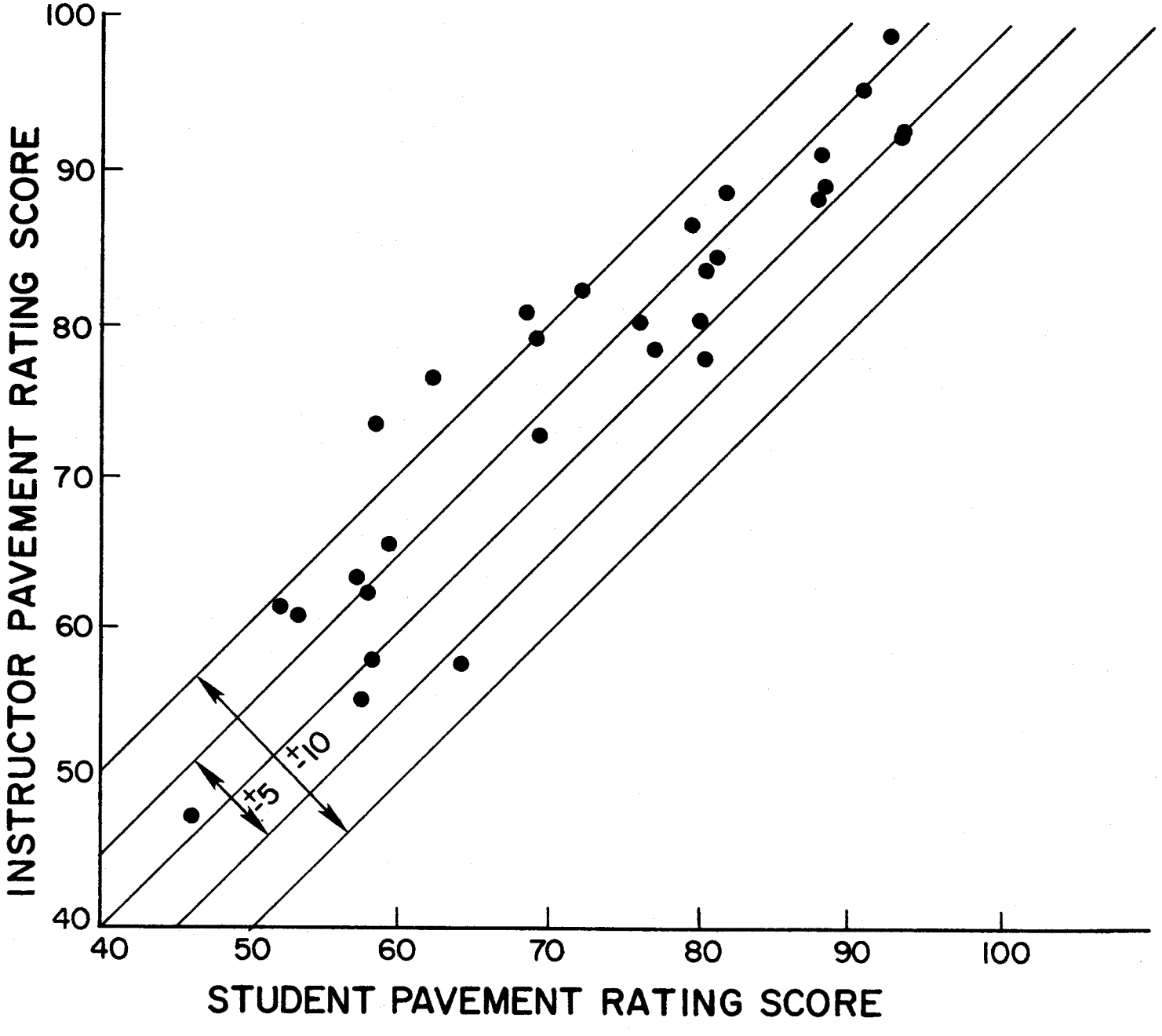

FIGURE 2. COMPARISON OF INSTRUCTOR AND STUDENT RATING SCORE– FIRST RATING

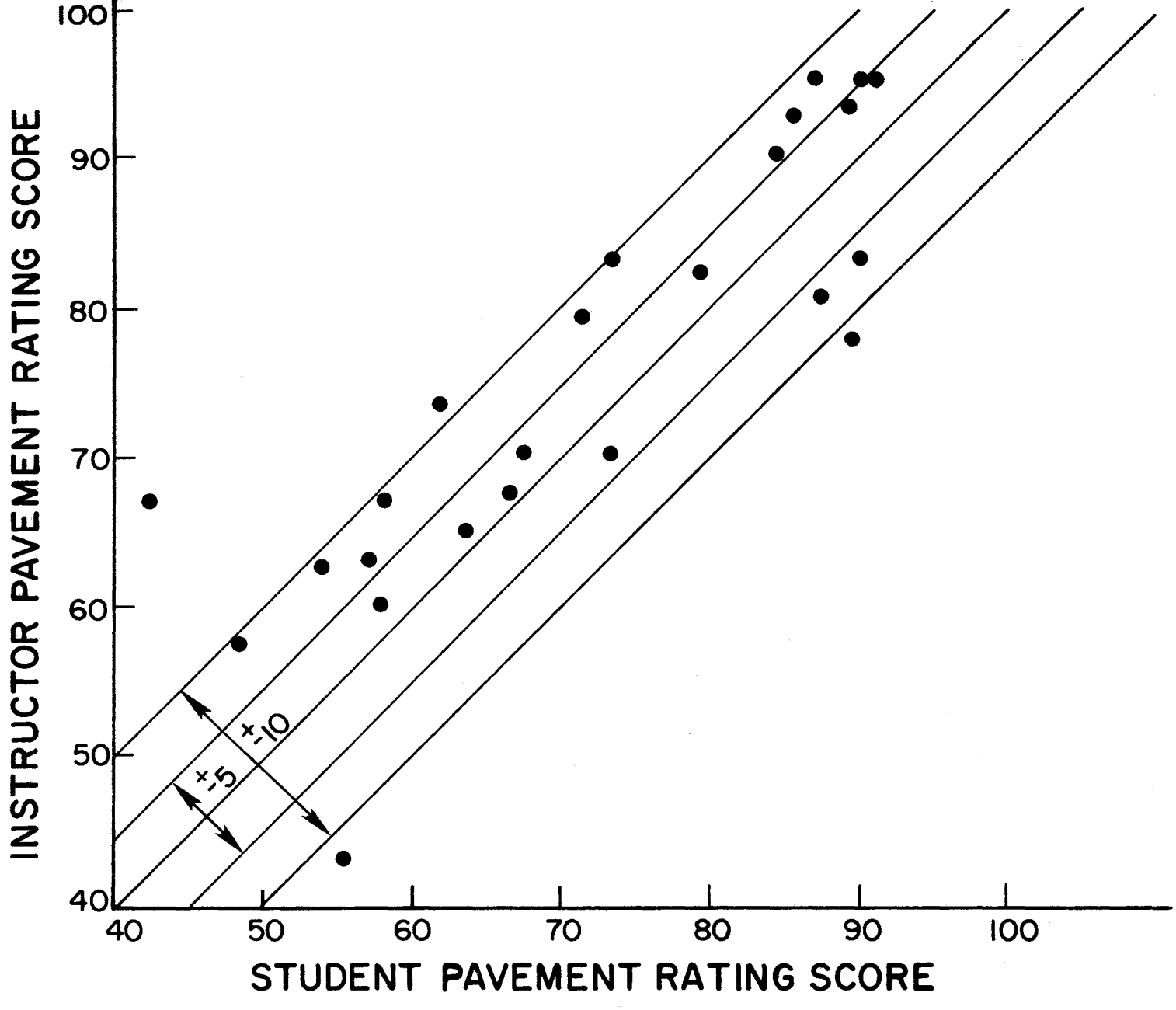

FIGURE 3. COMPARISON OF INSTRUCTOR AND STUDENT RATING SCORE – SECOND RATING

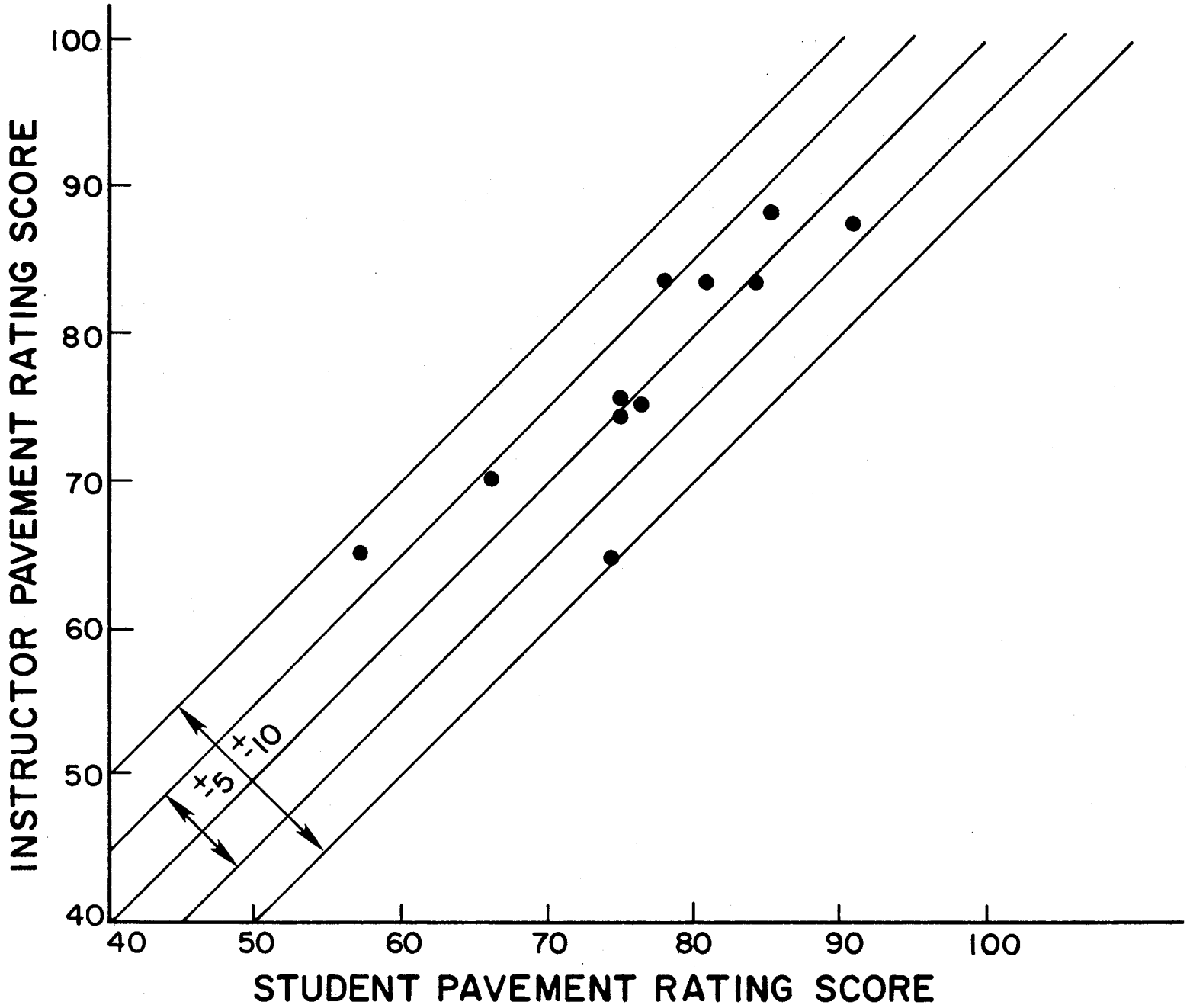

FIGURE 4. COMPARISON OF INSTRUCTOR AND STUDENT RATING SCORE-THIRD RATING

training program.* Mean pavement rating scores of the instructors and the students of the training schools are shown on Figures 2, 3 and 4 for the first, second and third ratings, respectively. In general those being trained obtained lower pavement rating scores than the instructors. Lines have been drawn on these figures to represent deviations of 5 and 10 points. Table 5 indicates the percent of pavements evaluated that had the instructor mean and the student mean scores within $\pm$ 5 and $\pm$ 10 points of each other. The third rating sessions of the schools resulted in the student and instructor mean pavement rating scores being within $\pm$ 5 points of each other on 73 percent of the pavements and within $\pm$ 10 points on 100 percent of the pavements.

The above information was developed to demonstrate the data scatter that will likely occur when comparing the results of various rating teams. Additionally these data indicate the ability of training schools to adequately train raters in various districts of the state. It appears as if instructors can train individuals to visually inspect roadways and obtain maintenance rating scores (PRS, SRS, RRS, DRS, TRS) within $\pm$ 10 points of the instructor rating on about 60-70 percent of all pavements surveyed. If two man instructor and two man student teams were utilized as is suggested for inventory purposes it would be likely that agreement could be obtained within $\pm$ 10 points on about 90 percent of all pavements rated.

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*W. W. Scott, Jr. and J. A. Epps from the Texas Transportation Institute and I. E. Larrimore of File D-18, Texas State Department of Highways and Public Transportation were responsible for conducting the training schools.

Some of the major problems noted during the conduct of this training program are described below.

Limits of Roadway Sections. The definition of the limits of a roadway section are described by a mile post designation. Typical "breaks" in a roadway that form segment limits are described in reference 3 as follows:

1. County line,
2. Control and section limits,
3. Limits of past or present construction projects,
4. Limits of seal or overlay projects,
5. Changes in roadway geometrics:
    a. from two lanes to four lanes or vice versa,
    b. from four lane divided to four lane undivided or vice versa,
    c. from controlled access to non-controlled access or vice versa,
    d. from roadway with paved shoulder to pavement without paved shoulder or vice versa,
    e. from rural to urban area or vice versa and
    f. from roadway with curb and gutter to section without curb and gutter or vice versa,
6. At maintenance section boundaries,
7. At certain roadway intersections where a single roadway is designated as more than one unit, and
8. Significant changes in visual appearance of the pavement, shoulder, roadside or traffic services.

In order to adequately define these roadway limits a significant amount of office work should be performed prior to initiation of the visual survey. Additionally, the raters must be constantly aware of changes in roadway geometrics and appearance of the pavement, shoulder, roadside, drainage or traffic service elements.

Lane Selection. The designation of the lane evaluated is designated by a letter code (3). Problems with determining when both lanes of a two lane roadway can be combined in one rating and when two lanes of a four lane road can be combined in one rating has created problems. It is not unusual to find different performance in travel lanes as opposed to passing lanes on four lane facilities. Thus, the lanes must be evaluated separately. If a question arises as to whether lanes should be separated for evaluation purposes, it is usually advantageous to separate the lanes.

Longitudinal and Transverse Cracking. Pavements with longitudinal and transverse cracking patterns create some problems particularly if the cracking is in blocks of say 4 to 6 feet across. This pattern does not represent a true transverse cracking pattern nor a true longitudinal pattern. Crack patterns of this type are often an indication that alligator cracking will begin forming in the near future. The present visual rating form does not have an entry for block cracking; therefore, it must be appropriately indicated by transverse and longitudinal cracking.

Sealed or Not Sealed. Determination of whether longitudinal and transverse cracks are sealed, partially sealed or not sealed is sometimes a difficult determination. If the vast majority of these cracks have been sealed, a "sealed" condition can be indicated. A 100 percent sealing is not required.

Failures. The definition of failures per mile is apparently open to

a number of interpretations. The present definition utilized for failures is as follows:

"A section of pavement, usually confined to less than 20 feet, where the surface has been eroded or is badly cracked and depressed. The area may contain loose pieces of material and creates a hazardous driving condition". The last sentence of the definition should be emphasized and utilized by the rating teams to define failures.

Definitions. Definitions for shoulder, roadside, drainage and traffic service items to be rated should be carefully reviewed by the rating teams prior to initiating the visual survey. As noted on Figure 1, vegetation is entered on the form under paved shoulder and roadside features. "Vegetation" under paved shoulder heading refers to the presence of vegetation in the paved shoulder area and not roadside vegetation. Vegetation under the heading of "roadside" refers to the general condition of the highway section with respect to condition and amount of vegetation.

Definition of items listed under the heading of "drainage" should be reviewed. Culverts are structures less than 20 ft. in length. Bridges are greater than 20 ft. and are evaluated by a bridge rating system which is presently not a part of the maintenance rating system described by Research Study 2-18-71-151. "Ditches and channels" are drainage features that cross roadways and "roadside drainage" refers to drainage features which are parallel to the roadway.

"Auxiliary markings" listed under the heading of "traffic services" refers to a wide range of markings including stop lines, turn markings, route direction markings, curb markings, channelization markings and various types of raised lane markings.

URBAN RATING SYSTEM

Development of Urban Rating System

The visual survey technique developed on Research Study 2-18-71-151 was developed primarily for roadways in rural areas. The vast majority of information obtained to date has been on rural flexible pavement roadway sections. The few surveys conducted in urban areas have identified some deficiencies in these areas with the use of the existing maintenance rating form. These deficiencies are outlined below.

1. Lane designation is sometimes difficult particularly when acceleration and merging lanes are added to the main lanes for short distances.

2. The length of the roadway section to be evaluated may have to be shortened say to 2 miles regardless of changes in pavement condition.

3. Heavy traffic volumes create difficulties during the visual rating operation.

4. Safety and aesthetics are probably more important items to evaluate in urban areas than in rural areas because of high public visibility.

5. The number of traffic services items should be expanded as more are utilized on these high traffic volume facilities.

6. The number of bridges in urban areas per mile of roadway normally exceeds that in rural areas. An indication of the bridge condition is therefore more important from a facility operational standpoint and should be evaluated by the maintenance rating form rather than the present bridge rating system.

7. Night visibility of signs and markings is very important in urban areas.

8. Urban areas with their high traffic volumes should be more critically evaluated and thus more items should be evaluated.

A maintenance rating form has been developed for urban areas. This form was prepared through a series of three meetings among Texas State Department of Highways and Public Transportation personnel from District 15 (San Antonio) and the central office (File D-18, Maintenance Operations) and personnel from the Texas Transportation Institute. The form utilized for the field visual survey is shown in Figures 5 and 6. The two page form utilizes identical headings as those presently utilized for the visual maintenance rating system defined in reference 3 for the following items shown on Figure 5.

1. Location,
2. Pavement and
3. Shoulder.

Figure 6 shows the items to be evaluated under the headings used for roadside, drainage, bridges, traffic services and night survey. Items under the headings of roadside, drainage and traffic services have been expanded from those utilized on the maintenance rating form presently utilized. In addition headings and their associated evaluation items have been added for "bridges" and "night survey". Items suggested for evaluation under each heading are given below.

A. Roadside
    1. Litter
    2. Mowing
    3. Plantings
    4. Vegetation

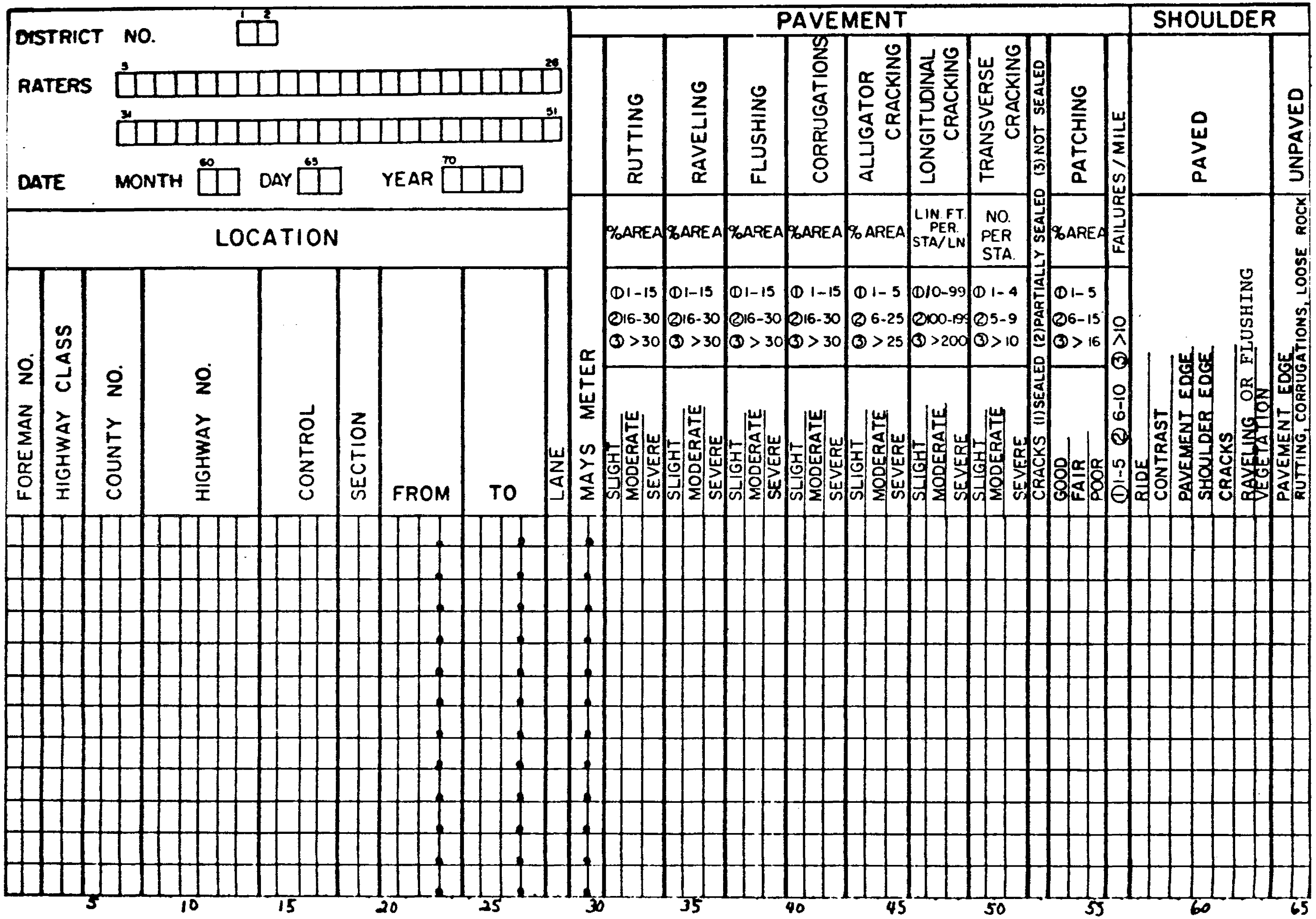


FIGURE 5. URBAN RATING SYSTEM

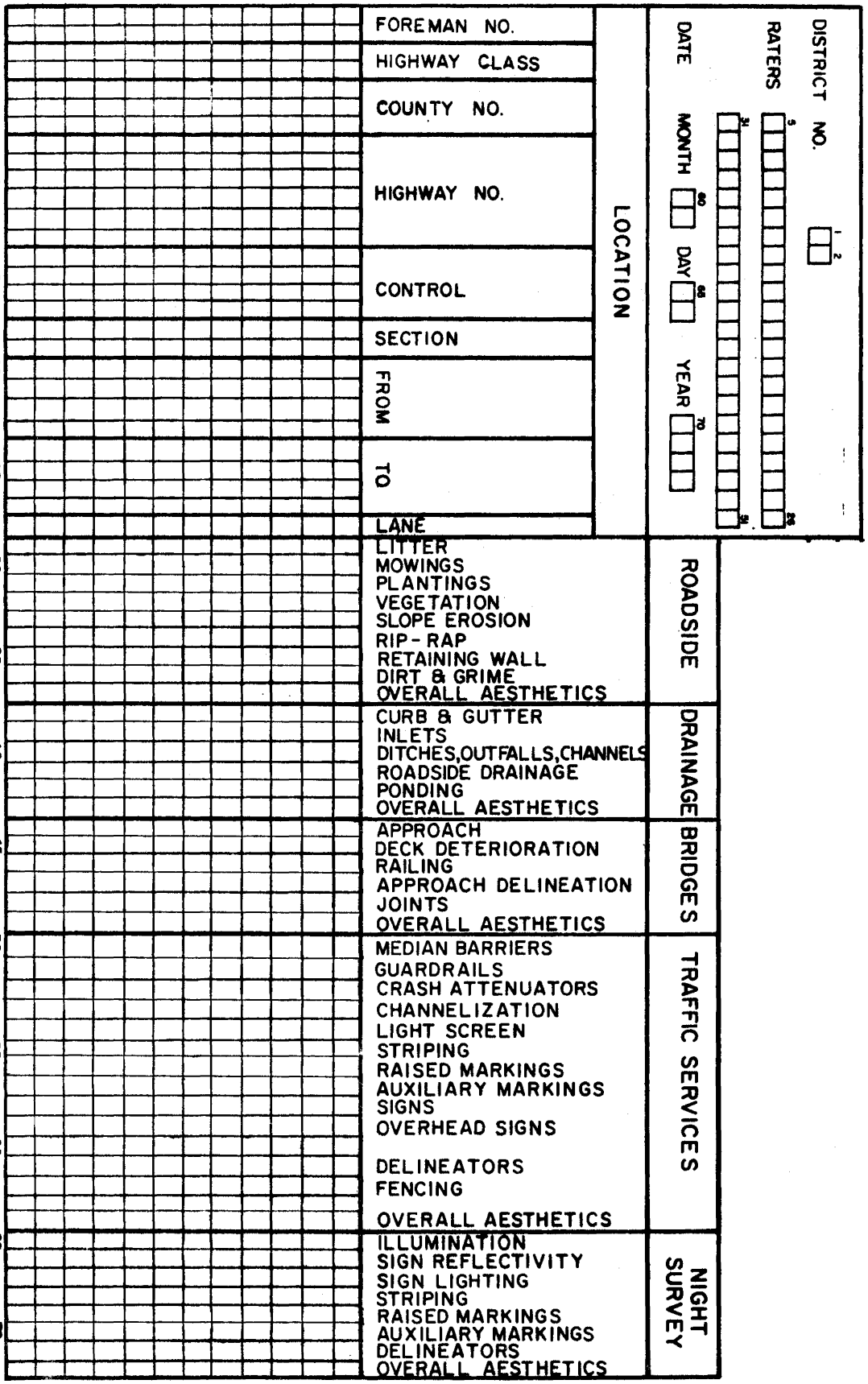


FIGURE 6. URBAN RATING SYSTEM (CONTINUED)

5. Slope Erosion

6. Rip-rap

7. Retaining Wall

8. Dirt and Grime

9. Overall Aesthetics

B. Drainage

1. Curb and Gutter

2. Inlets

3. Ditches, Outfalls, Channels

4. Roadside Drainage

5. Ponding

6. Overall Aesthetics

C. Bridges

1. Approach

2. Deck Deterioration

3. Railing

4. Approach Delineation

5. Joints

6. Overall Aesthetics

D. Traffic Services

1. Median Barriers

2. Light Screen

3. Guardrails

4. Crash Attenuators

5. Channelization

6. Striping
7. Raised Markings
8. Auxiliary Markings
9. Signs
10. Overhead Signs
11. Delineators
12. Fencing
13. Overall Aesthetics

E. Night Survey

1. Illumination
2. Sign Reflectivity
3. Sign Lighting
4. Striping
5. Raised Markings
6. Auxiliary Markings
7. Delineators
8. Overall Aesthetics

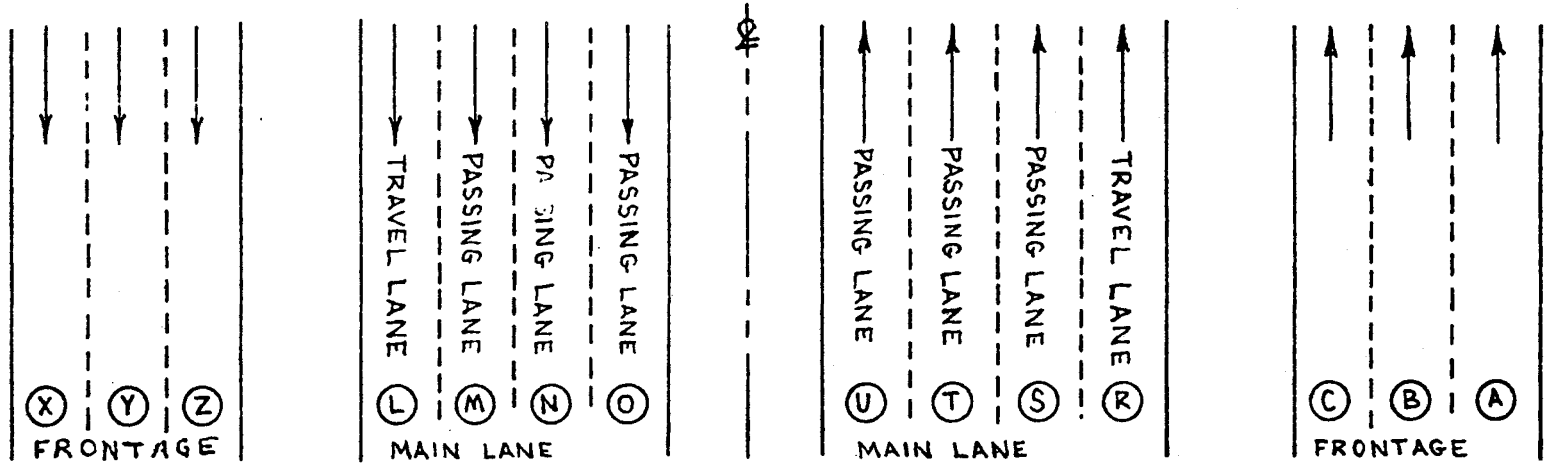
Appendix A defines each of the items to be evaluated.

Field Trials. During very limited field trials problems were noted with lane designation and definition of roadside and drainage items associated with various lanes. The lane designation system utilized for the existing maintenance rating system and shown on Figure 7 is suggested for use with the urban rating system. However, some special consideration must be recognized.

Acceleration and deceleration lanes at interchanges can be coded by using the letter of the alphabet that precedes the letter utilized for

FACE IN DIRECTION OF INCREASING MILE POSTS

A. Interstate or Major Highway - 8 Lanes with frontage roads



B. Interstate or Major Highway - 6 Lanes with frontage roads.

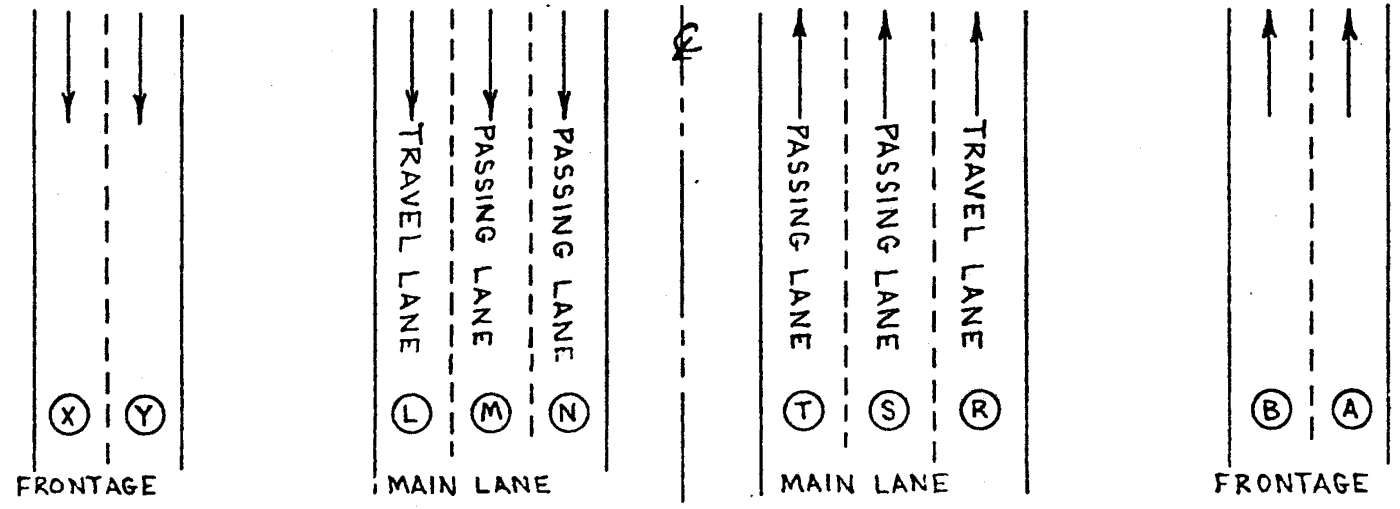
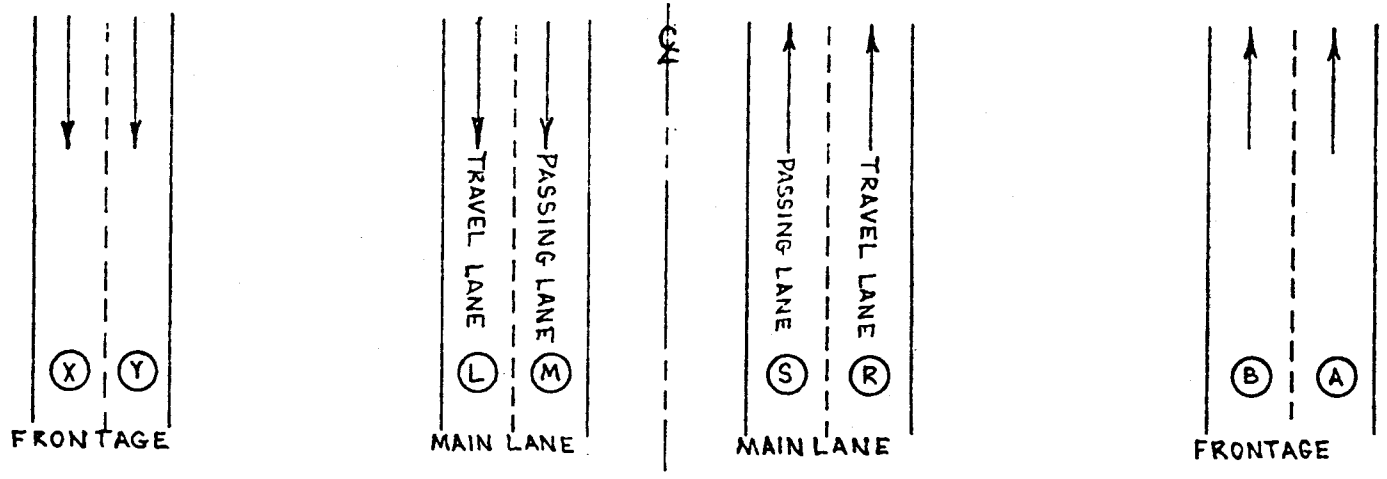
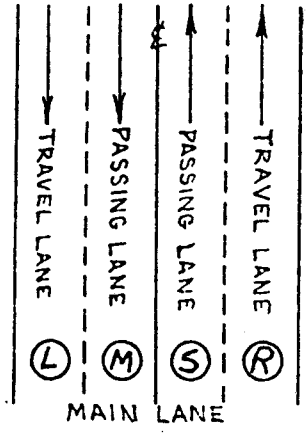


Figure 7. Lane Designation System

C. Interstate or Major Highway - 4 Lanes with frontage roads.



D. Highway - 4 Lanes without frontage roads.



E. Highway - 2 Lanes without frontage roads.

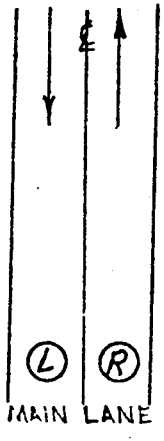


Figure 7 (continued)

the outside most main lane. For example, if the rater is facing in the direction of increasing mile posts, the right most main lane is designated lane "R" (Figure 7). An acceleration or deceleration lane adjacent to this lane would be designated by the letter Q or P and Q if two lanes were utilized as acceleration or deceleration lanes.

For situations where ramps are utilized between major intersecting highways without the use of frontage roads to carry traffic, these ramps can use a coding system as described above considering the major roadway to have the governing main lanes and mile post system. For example, if an Interstate Highway and a major U.S. Highway intersect, the Interstate Highway would be considered the major roadway. If two Interstate Highways intersect, the Interstate Highway assigned the lower route number would be considered the major highway.

Roadside and drainage features for a urban roadway will normally be assigned to the main lanes and frontage road lanes as follows. The roadside and drainage features between the center line of the highway and the fencing or depression between the main lanes and the frontage road will be assigned to the main lanes. The roadside and drainage features between the fencing or depression between the main lanes and frontage road and the ROW fence will be assigned to the frontage road lanes. Lanes L, R, A and X are the only lanes that will contain entries for roadside, drainage, bridges, traffic services and night survey features. Figure 8 shows typical data that could be obtained for a 6 main lane divided freeway with two lane frontage roads in an urban area. As noted on Figure 8, it is often advantageous to rate each lane of the facility separately. However, if the pavement condition of both lanes of the frontage road are similar, one rating is sufficient. Likewise, lanes

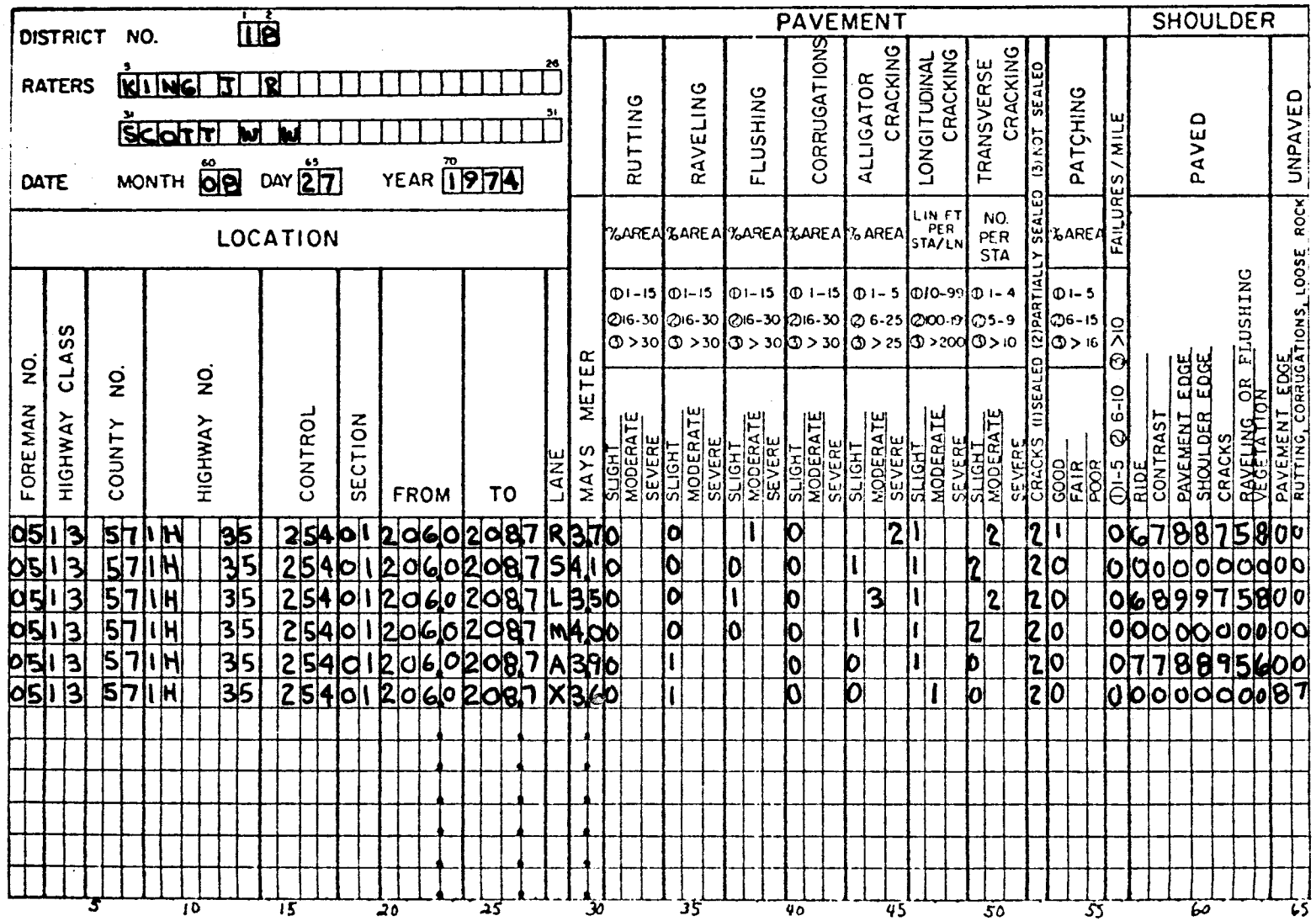


FIGURE 8. URBAN RATING SYSTEM

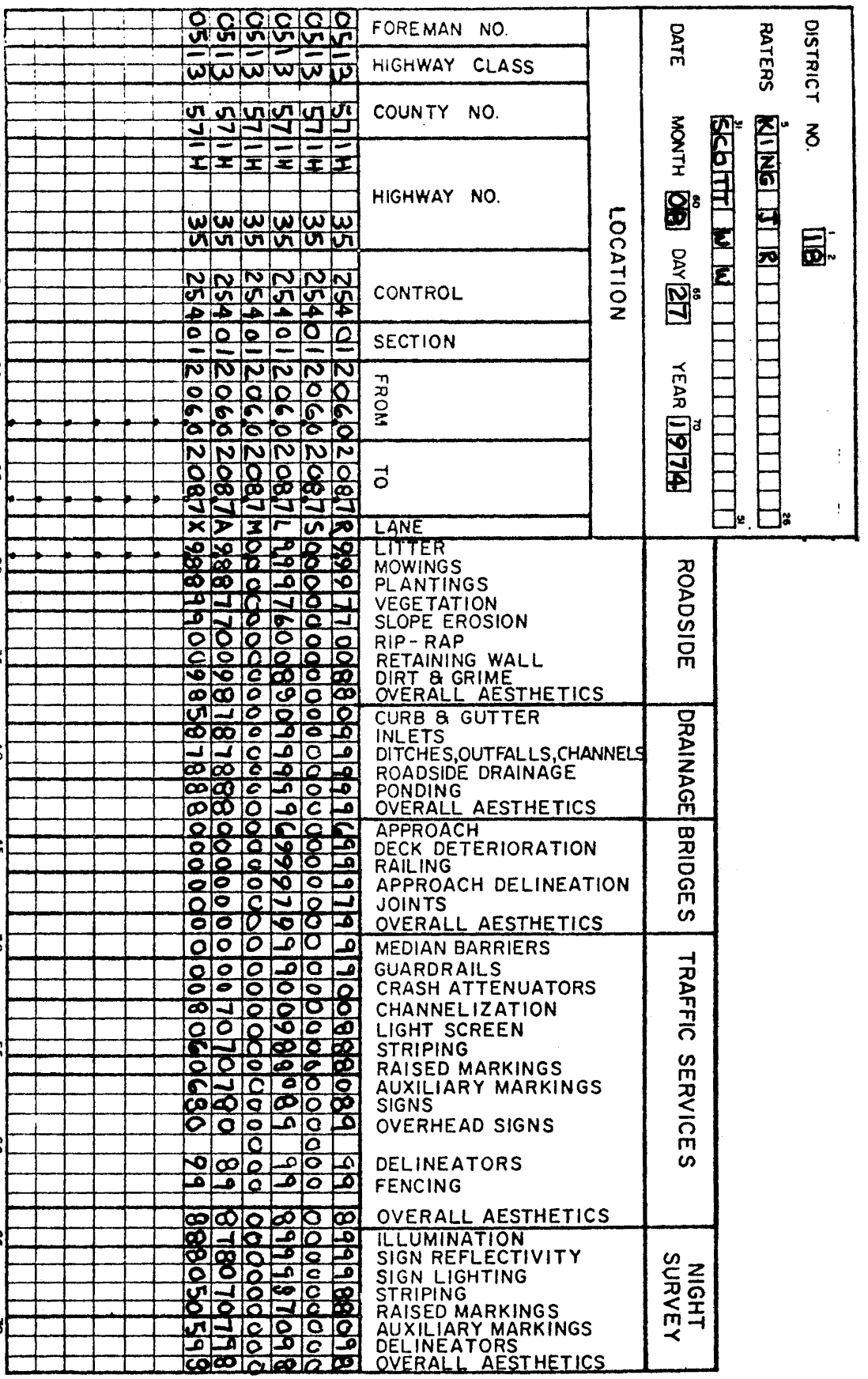


FIGURE 8. URBAN RATING SYSTEM: (CONTINUED)

of the main roadway can be grouped together if this condition is similar.

Although not shown on the proposed forms for the urban rating system, spaces are available to code other specific items which may need maintenance action. A list presently utilized with the existing maintenance rating system is shown on Table 7. This list can be expanded and the codes utilized in card columns 79 and 80 by the districts conducting the survey. It is also suggested that the individuals performing the rating take notes on items in need of maintenance that may not be specifically covered by this rating form.

Rating Scores

The determination of the rating scores for the pavement and shoulder are identical to that utilized in the existing maintenance rating system. Roadside, drainage, bridges, traffic services, night survey and overall aesthetic scores are determined utilizing the techniques shown in Appendix B. The overall aesthetics score as shown is obtained from the aesthetic scores assigned to roadside, drainage, bridges, traffic services and night survey features. Computer programs have not been prepared to reduce and display data from the urban rating forms.

The numerical rating scale to be utilized for describing the general condition of each of the items identified under the headings of shoulder, roadside, drainage, bridges, traffic services and night survey is shown on Table 6. It should be noted that a 0 indicates that the item designated is not present on the roadway section.

Table 6: Rating Scale for Shoulder, Roadside, Drainage and Traffic Services

General Description of Condition	Numerical Scale
Very good	1-2
Good	2-4
Fair	4-6
Poor	6-8
Very Poor	8-9
Item not present on roadway section	0

Table 7: Code Numbers for Other Items to be Evaluated

Code Number	Description
10	Encroachment
11	Automobile encroachment
12	Agricultural encroachment
13	Advertisement encroachment
20	Signal
21	Improper operating signal
22	Improper operating flashing signal
30	Geometrics
31	Improper speed signing of curve
32	Improper striping of no passing zone
40	Roadside hazard
41	Dangerous sign support
42	Dangerous tree
43	Dangerous slope
50	Bridge
51	Narrow bridge
52	Damaged bridge railing
53	Damaged bridge superstructure
60	Pest control

Present Status of Urban Rating System

As noted above limited field data has been collected utilizing the proposed form. Additional field ratings should be attempted in one to three districts prior to statewide use. These trials should be made only after the Texas State Department of Highways and Public Transportation administration makes a commitment to utilize the maintenance rating system as a part of the maintenance management system presently being developed.

CONCLUSIONS

Seven maintenance rater training schools have been conducted. These schools have trained a maximum of 3 individuals in each district to utilize the maintenance rating form for both flexible and rigid pavements. Data collected during the conduct of these training schools indicate the magnitude of data scatter among individual raters. For example, 68 percent of a group of individuals will obtain maintenance rating scores (PRS, SRS, RRS, DRS and TRS) within $\pm$ 10 points of each other after attending the rater training school. It should be noted that these are scores of individual raters and not two man teams as suggested for roadway inventory purposes.

A comparison of the mean instructor pavement rating score and the mean student rating score indicated that 73 percent of pavements evaluated on the third rating session were within $\pm$ 5 points and 100 percent of the pavements evaluated were within $\pm$ 10 points. If two man crews are utilized as is suggested for inventory purposes, it would not be unlikely that agreement among rating groups could be obtained within $\pm$ 10 points on about 90 percent of all pavements rated. Specific data however, has not been developed to illustrate this point.

An urban rating system has been proposed to include additional safety and aesthetic items. The pavement and shoulder items identified for rating are identical to those presently utilized on the maintenance rating form.

Items under the headings of roadside, drainage, and traffic services have been increased over the number presently utilized. Night survey items have also been included on the survey form. Limited field trials

have been conducted with this form. Implementation is not suggested until additional field survey work is completed in one to three districts.

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APPENDIX A

Definitions Associated with Maintenance Rating Form for Roadside, Drainage, Bridges, Traffic Services and Night Survey Items

NOTE: Definitions associated with Pavement and Shoulder Items can be found in Appendix A, B and C of reference 3. These definitions remain unchanged for use with the Urban Rating System.

DEFINITIONS OF ROADSIDE CONDITIONS

ROADSIDE: Roadsides are the areas between the outside edges of the shoulders and the right-of-way boundaries. On multi-lane highways the median and/or outer separations are included. The roadside areas in half of the median and from the main lane shoulders to the fence or depression separating the frontage road from the main lanes should be rated with lane R and/or L of the main lane. The remainder of the roadside area should be evaluated with frontage lane X and/or A.

1. LITTER: General condition of the highway section with respect to the presence of litter. Litter consists of paper, tires, bottles, tin cans, fallen branches, remains of animals and various other items which may give the right-of-way an unsightly appearance.
2. MOWING: General condition of the highway section with respect to mowing. Mowing standards have been formalized and evaluation should be made with respect to these standards. In urban areas the turf should be maintained in a neatly trimmed condition to present a pleasing appearance as expected by the public.
3. PLANTINGS: General condition of the highway section with respect to plantings. Plantings consist of all shrubs, trees and select ground cover purposely placed along the right-of-way. The general condition of plantings should be evaluated.
4. VEGETATION: General condition of highway section with respect to condition and amount of vegetation. Vegetation shall be considered as consisting of all grass. Trees, shrubs and select ground cover is considered plantings. The general condition and type of vegetation and the extent of ground coverage should

be evaluated relative to the natural vegetation of fields adjacent to the right-of-way.

5. SLOPE EROSION: General condition of highway section with respect to erosion of cut and fill slopes. The removal and deposition of soil by the action of water and wind which makes routine roadside maintenance difficult or impossible. The probability of future erosion should be considered when evaluating this item.

6. RIP-RAP: General condition of highway section with respect to the condition of the rip-rap. Rip-rap shall be considered as that slope protection made with rigid construction materials such as concrete and stone. The structural soundness of the rip-rap should be considered as well as its ability to perform its function of preventing erosion.

7. RETAINING WALL: General condition of highway section with respect to retaining walls. Retaining walls are nearly vertical structures intended to retain earth masses. The structural soundness of the retaining wall shall be considered as well as its appearance.

8. DIRT and GRIME: General condition of the highway section with respect to the presence of dirt and grime. This item includes all loose materials other than litter that can be maintained by mechanized sweepers.

9. OVERALL AESTHETICS: This item refers to the general conditions of the roadway with respect to the appearance of all roadside features including litter, mowing, plantings, vegetation, slope erosion, rip-rap, retaining walls, and dirt and grime.

DEFINITIONS OF DRAINAGE CONDITONS

DRAINAGE: Drainage concerns the removal of water from the highway right-of-way area and includes culverts, ditches, outfalls, channels and other drainage structures.

1. CURB and GUTTER: General condition of the highway section with respect to curbs and gutters. Curbs and gutters shall consist of all raised and/or shaped drainage facilities located at the edge of the pavement or shoulder and made with portland cement concrete or asphalt concrete mixtures. The structural soundness of the curb and gutter section as well as its ability to drain water will be evaluated.
2. INLETS: General condition of highway section with respect to inlets. Inlets shall consist of all structures intended to remove the water from the surface of a pavement, shoulder or roadside area to a level below that grade. The structural soundness of the inlet shall be evaluated together with its contribution to the roadway safety.
3. DITCHES, OUTFALLS, CHANNELS: General condition of all drainage facilities not including culverts, bridges and roadside drainage ditches. Erosion and vegetation in ditches and channels that intersect the highway should be evaluated in this item.
4. ROADSIDE DRAINAGE: General condition of drainage ditch which normally is parallel to the roadway. Erosion and vegetation should be evaluated in this item.
5. PONDING: General condition of highway section with respect to the ponding of water on the pavement, at the pavement edge or on the shoulder.

6. OVERALL AESTHETICS: This item refers to the general condition of the roadway with respect to the appearance of all drainage features including curbs and gutters, inlets ditches, outfalls, channels, and roadside drainage features.

DEFINITION OF BRIDGE FEATURES

BRIDGES: Bridges are structures which provide for passage of highway traffic over, through or under obstacles. A bridge is twenty feet and over in span measured from face to face of the abutments or, in case of backwalls, from face to face of backwalls and multiple span structures of twenty feet and over in length, measured between inside faces of end walls along the center line of the road.

1. APPROACH: This item refers to the general condition of the area immediately adjacent to the bridge. This area includes the bridge approach slab when utilized. The structural condition and the smoothness of this area should be evaluated.
2. DECK DETERIORATION: This item refers to the general condition of the bridge deck. Deterioration in the form of pot holes, scaling and delamination caused by water and/or salt and traffic loads.
3. RAILING: This item refers to the general structural condition and adequacy of the bridge railing. The railing may be made with metallic materials, portland cement concrete or wood products.
4. APPROACH DELINEATION: This item refers to items such as delineators, guardrails, paint stripes, raised markers, etc., and are used to adequately delineate the presence of a bridge and to protect the raised bridge ends.

5. JOINTS: This item refers to the general condition of bridge expansion and contraction joints. These joints should be free of debris and thus free to move in a horizontal plane.
6. OVERALL AESTHETICS: This item refers to the general condition of the roadway with respect to appearance of the bridge approaches, railing, approach delineation, joints and deck deterioration.

DEFINITIONS FOR TRAFFIC SERVICES

TRAFFIC SERVICES: Devices, materials, methods and procedures used to maintain traffic flow at the desired level of service. Items included are guardrails and barriers, signs, delineators, striping, auxiliary markings and signals.

1. MEDIAN BARRIERS: This item refers to the general condition of median barriers or barrier system installed in the median in a continuous fashion. These barriers may be of a wide variety. Items to be noted include corrosion, painting, straightness, and post spacing.
2. GUARDRAILS: General condition of highway section with respect to guardrails and barrier fences. Items to be noted include corrosion, painting, straightness, post spacing, minimum length of section, anchoring system and turned down ends.
3. CRASH ATTENUATORS: General condition of highway section with respect to crash attenuators. Items to be noted include corrosion, painting and adequacy of location.
4. CHANNELIZATION: General condition of highway section with respect to channelization. Location of channelization devices is of major inportance in evaluating this item as well as the

selection of the proper type of channelization.

5. LIGHT SCREEN: This item refers to the general condition of the light screen and includes corrosion, straightness and location. This screen is intended to prevent headlight glare between opposing traffic.

6. STRIPING: General condition of highway section with respect to striping. Striping includes center line striping, lane line striping and edge striping. Items to be noted include visibility, paint build-up and crazing.

7. RAISED MARKINGS: Raised markings include all pavement markings that are significantly protruding above the pavement surface with the exception of curbing. Ceramic buttons and plastic reflectors are examples of raised markings. Items to be evaluated include reflectivity and adherence to the pavement.

8. AUXILIARY MARKINGS: General condition of highway section with respect to auxiliary markings. Auxiliary markings include turn markings, stop lanes, crosswalk lanes, route direction markings, pavement width transition and curb markings. Items to be noted include visibility in both day and night operating condition, paint build-up, crazing, fractured raised markings.

9. SIGNS: General condition of highway section with respect to all signs except overhead signs. Items to be noted in the evaluation include alignment, placement, cleanness, and legibility during day and night operating conditions.

10. OVERHEAD SIGNS: General condition of highway section with respect to overhead signs. Item to be noted in the evaluation include alignment, placement, cleanness and legibility.

11. DELINEATORS: General condition of highway section with respect to delineators. Items to be noted in the evaluation include appearance in terms of corrosion, painting, straightness, reflectors and reflective coating.

12. FENCING: General condition of the highway section with respect to fencing located between the main lanes and frontage road and on or near the right-of-way line. The fencing should be evaluated with lane A or X of the frontage roads.

13. OVERALL AESTHETICS: This item refers to the general condition of the roadway with respect to appearance of traffic service features such as barriers, guardrails, crash attenuators, channelization devices, striping, markings, signs, delineators and fencing.

DEFINITIONS OF NIGHT SURVEY CONDITIONS

NIGHT SURVEY: As the name implies, this survey is to be conducted at night and is concerned primarily with the illumination and reflectivity of selective traffic service features.

1. ILLUMINATION: This item refers to the adequacy of overhead illumination of the roadway for safety purposes.

2. SIGN REFLECTIVITY: This item refers to the adequacy of the reflectivity of signs without auxiliary illumination along the section being rated.

3. SIGN LIGHTING: This item refers to the adequacy of auxiliary lights utilized on certain signs and in particular overhead signs.

4. STRIPING, RAISED MARKINGS, AUXILIARY MARKINGS, DELINEATORS: These items refer to the adequacy of these traffic service

elements to adequately delineate lanes, hazards, turning movements, pavement width transition, curbs, channelization and the roadway edge.

5. OVERALL AESTHETICS: This item refers to the general condition of the roadway with respect to appearance of illumination devices, signs, striping, raised markers and other traffic services devices.

APPENDIX B

Determination

of

Rating Scores

for

Urban Rating System

APPENDIX B

DETERMINATION OF RATING SCORES

The equation utilized for the computation of the rating scores obtained as a part of the roadway evaluation are described below.

Pavement Rating Score (PRS)

The pavement rating score is obtained by subtracting "deduct values" associated with the various forms of pavement distress from 100. A score of 100 indicates a pavement without observable distress. Deduct values for flexible pavements are shown in Table B-1 and for rigid pavements in Table B-2.

$$PRS = 100 - \Sigma D$$

where:

PRS = pavement rating score

ΣD = summation of deduct scores

Other Rating Scores

Other rating scores are obtained by one of the equations listed in Table B-3. The words utilized in the equation refer to the categories noted in the evaluation for the particular scores in question.

TABLE B-1 Deduct Values for Flexible Pavement

Type of Distress	Degrees of Distress	Extent or Amount of Distress (1)	(2)	(3)
Rutting	Slight	0	2	5
	Moderate	5	7	10
	Severe	10	12	15
Raveling	Slight	5	8	10
	Moderate	10	12	15
	Severe	15	18	20
Flushing	Slight	5	8	10
	Moderate	10	12	15
	Severe	15	18	20
Corrugations	Slight	5	8	10
	Moderate	10	12	15
	Severe	15	18	20
Alligator Cracking	Slight	5	10	15
	Moderate	10	15	20
	Severe	15	20	25
Patching	Good	0	2	5
	Fair	5	7	10
	Poor	7	15	20

Deduct Points for Cracking

Longitudinal Cracking

	Sealed			Partially Sealed			Not Sealed		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Slight	2	5	8	3	7	12	5	10	15
Moderate	5	8	10	7	12	15	10	15	20
Severe	8	10	15	12	15	20	15	20	25

Transverse Cracking

Slight	2	5	8	3	7	10	3	7	12
Moderate	5	8	10	7	10	15	7	12	15
Severe	8	10	15	10	15	20	12	15	20

Failures				20		30		40	
		50	40	30	20	10	5	0	
Mays Meter	Deduct Points								
	SI	2.4	2.7	2.9	3.1	3.3	3.5	4.7	

TABLE B-2 Deduct Values for Rigid Pavement

Type of Distress	Degrees of Distress	Extent or Amount of Distress (1)	(2)	(3)
Pumping		20	40	60
Failures/Mile		20	30	40
Surface Deterioration	Slight	5	10	20
	Moderate	10	20	30
	Severe	20	40	60
Spalling	Slight	5	10	15
	Moderate	10	15	20
	Severe	20	40	60
Longitudinal Cracking	Slight	5	10	15
	Moderate	10	15	20
	Severe	15	20	25
Patching	Good	0	2	5
	Fair	5	7	10
	Poor	7	15	20
Faulting	Moderate	5	15	
	Severe	15	40	
Crack Spacing	Closed	0	10	
	Open	15	40	
% Intersecting Cracks	Moderate	5	15	
	Severe	15	40	
Joint Spacing	Information Only			
Transverse Cracking If Joint Spacing is less than 20 feet.				
	Slight	5	10	20
	Moderate	10	20	30
	Severe	15	30	40
If Joint Spacing is greater than 20 feet.				
	Slight	0	5	10
	Moderate	5	10	20
	Severe	10	15	30
Joints	(Sealed)	0	10	20

Failures				20		30		40
Mays Meter	Deduct Points	50	40	30	20	10	5	0
	SI	2.4	2.7	2.9	3.1	3.3	3.5	4.7

TABLE B-3 Equations for Determining Rating Scores

Shoulder Rating Score - Paved
SRS = 100 - [1.428 (Ride + Contrast + Pavement edge + Shoulder edge + Cracks + Raveling + Vegetation)]
Shoulder Rating Score - Unpaved
SRS = 100 - [5.00 (Pavement edge + Rutting, corrugations, loose rock)]
Roadside Rating Score
RRS = 100 - [1.25 (Litter + Mowing + Plantings + Vegetation + Slope erosion + Rip-rap + Retaining wall + Dirt & Grime)]
Drainage Rating Score
DRS = 100 - [2.00 (Curb and Gutter + Inlets + Ditches, outfalls, channels + Roadside drainage + Ponding)]
Bridge Rating Score
BRS = 100 - [2.00 (Approach + Deck deterioration + Railing + Approach delineation + Joints)]
Traffic Services Rating Score
TRS = 100 - (.83 (Median barriers + Guardrails + Crash attenuators + Channelization + Light screen + Striping + Raised markings + Auxiliary markings + Signs + Overhead signs + Delineators + Fencing)]
Night Survey Rating Score
NRS = 100 - [1.43 (Illumination + Sign reflectivity + Sign lighting + Striping + Raised markings + Auxiliary markings + Delineators)]
Aesthetics Rating Score
ARS = 100 - [2.00 (Roadside overall aesthetics + Drainage overall aesthetics + Bridge overall aesthetics + Traffic services overall aesthetics + Night survey overall aesthetics)]