AN INTEGRATED PAVEMENT DATA MANAGEMENT AND FEEDBACK SYSTEM (PAMS)

Evaluation of Pavement Condition Rating Procedure

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ABSTRACT

This report describes an evaluation of a method for use in the Highway Needs Study pavement condition rating. The methods by which the Department generates and manages pavement condition data in the overall process of providing a network of highways for the traveling public were reviewed.

Eighteen projects were selected from a three-district area for rating purposes. The projects selected consisted of six rigid (jointed concrete) pavements, six composite pavements and six flexible (asphalt-surfaced) pavements.

The various projects were rated by conducting Mays Ride Meter tests and by subjective evaluation of pavement distress. The evaluation, through visual inspection, included the notation of distress type, severity and extent.

The report relates that the method evaluated is valid, practical, quick and safe for use in an inventory mode.

METRIC CONVERSION FACTORS*

To Convert from	To	Multiply by
	Length	
foot	meter (m)	0.3048
inch	millimeter (mm)	25.4
yard	meter (m)	0.9144
mile (statute)	kilometer (km)	1.609
	Area	
square foot	square meter (m^2)	0.0929
square inch	square centimeter (cm^2)	6.451
square yard	square meter (m^2)	0.8361
	Volume (Capacity)	
cubic foot	cubic meter (m^3)	0.02832
gallon (U.S. liquid)**	cubic meter (m^3)	0.003785
gallon (Can. liquid)**	cubic meter (m^3)	0.004546
ounce (U.S. liquid)	cubic centimeter (cm^3)	29.57
	Mass	
ounce-mass (avdp)	gram (g)	28.35
pound-mass (avdp)	kilogram (kg)	0.4536
ton (metric)	kilogram (kg)	1000
ton (short, 2000 lbs)	kilogram (kg)	907.2
	Mass per Volume	
pound-mass/cubic foot	kilogram/cubic meter (kg/m^3)	16.02
pound-mass/cubic yard	kilogram/cubic meter (kg/m^3)	0.5933
pound-mass/gallon (U.S.)**	kilogram/cubic meter (kg/m^3)	119.8
pound-mass/gallon (Can.)**	kilogram/cubic meter (kg/m^3)	99.78
	Temperature	
deg Celsius (C)	kelvin (K)	$t_K=(t_C+273.15)$
deg Fahrenheit (F)	kelvin (K)	$t_K=(t_F+459.67)/1.8$
deg Fahrenheit (F)	deg Celsius (C)	$t_C=(t_F-32)/1.8$

*The reference source for information on SI units and more exact conversion factors is "Metric Practice Guide" ASTM E 380.

**One U.S. gallon equals 0.8327 Canadian gallon.

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IMPLEMENTATION

As a result of the field tests performed and the results reported herein, the Highway Needs personnel should consider use of this method of deriving a pavement condition rating and incorporate it into the existing procedure for determination of the sufficiency rating. The procedure, which is based on the type, severity and extent of pavement distress, is anticipated to provide a broad data base concerning the condition of the road network and subsequent use of this data base for application of various strategies for maintenance and/or rehabilitation.

INTRODUCTION

The Louisiana Department of Transportation and Development (DOTD) conducts a Highway Needs and Priorities study each year to provide a basis for its proposed construction programs (1)*. Each year from August through October, the DOTD district personnel survey the highway network and report on roadway condition, traffic capacity-related service and safety. Based on these three aspects, an overall sufficiency rating ranging from zero to one hundred for each subsection of highway is developed. Scores are determined which range from zero to fifty points for rural highways and from zero to forty points for urban highways.

Roadway condition score is a summary of subjective ratings of surface, base-subbase, subgrade, and drainage, mechanistic rating of road roughness, and analytical rating of remaining years of service life using AASHTO pavement design-analysis methods. All six of these roadway condition sub-elements are based upon, or at least related to, pavement distress and ride.

The Integrated Pavement Data Management and Feedback System (PAMS) (2) recommended that the roadway condition portion of the sufficiency rating be modified so as to be based entirely on pavement ride and on the type, severity and extent of pavement distress characterizing each subsection. Such modification would enhance the Department's pavement data management and feedback system, as follows:

1. A direct and disciplined, easily attainable, measurement of pavement performance and ride would add relevance to the roadway condition score.

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*Underlined numbers in parentheses refer to list of references.

2. A roadway condition score developed from information on pavement distress and ride would provide a more comprehensive knowledge of the condition of our highways: What is actually happening out there to our network of highways?

3. Pavement condition information is essential in the determination of what projects require specific action in order to properly plan alternative rehabilitation strategies, such as in the distribution of 4-R funds.

Hence, a need arose for a field trial of the procedure for determining roadway condition as outlined in the PAMS feasibility report. This report documents the results of the field trial.

PURPOSE

The purpose of this field study is to determine if the procedure to determine roadway condition rating recommended in the PAMS feasibility report (2) is practical for use in the Highway Needs inventory and if so, to incorporate this procedure as modification to the currently used pavement sufficiency rating procedure.

SCOPE

A sample of 18 projects in various districts was reviewed in the study. Pavement distress and ride were determined on the projects. The validity and practicality were evaluated with the thrust of improving the process if needed.

METHODOLOGY

District maintenance personnel furnished a list of candidate projects based upon traffic level, pavement surface type and relative condition. The listing contained projects that were surveyed by the district as part of their routine yearly evaluation for the Needs study.

The various projects were reviewed to determine which would be applicable for this study. Surface types, length and condition were of primary concern in the selection.

Table 1 presents a total of eighteen pavements selected for evaluation in the study. These eighteen projects were broken into smaller entities known as subsections to correspond with the Department's Highway Needs method of inventory and analysis.

Field Identification of Subsections

The field survey began by logging the project from start to end for a cursory review of the various subsections. Based on this evaluation, it was decided to run a Mays test near the center of each subsection. However, if a subsection exhibited a change in a pavement type (concrete surface versus hot mix) and/or a change in pavement condition (e.g., "good" pavement versus "torn up" pavement), an additional Mays test location was marked accordingly. All Mays test sites were marked 0.5 mile in length except in the case of a very short subsection or a congested area, in which case a length of 0.2 mile was designated and marked for a test. In extremely congested areas the PSI had to be estimated.

TABLE 1

OUTLINE OF PROJECTS

PAVEMENT TYPE	CONTROL SECTION	DISTRICT	LENGTH IN MILES	NUMBER OF SUBSECTIONS	JOINTED CONCRETE	HOT-MIX	COMPOSITE
	247-02	03	11.30	2	7.24	4.06	----
	248-02	03	7.41	3	5.68	0.93	0.80
RIGID	247-03	03	7.74	2	4.12	----	3.62
	855-07	03	4.72	1	4.72	----	----
	855-06	03	7.33	3	1.98	5.35	----
	450-06	03	9.93	3	9.93	----	----
	004-07	03	11.44	4	----	----	11.44
	080-04	03	5.14	3	----	----	5.14
COMPOSITE	248-03	03	5.33	1	----	----	5.33
	064-06	03	9.43	3	1.00	----	8.43
	080-01	03	10.54	4	----	----	10.54
	057-02	03	9.15	2	----	----	9.15
	375-02	07	1.39	1	----	1.39	-----
	254-06	62	7.14	1	----	7.14	-----
FLEXIBLE	846-11	62	5.70	1	----	5.70	-----
	279-04	62	13.44	2	----	13.44	-----
	059-01	62	6.58	6	----	6.58	-----
	415-04	62	6.04	1	----	6.04	-----

Method of Determining Pavement Condition Rating

After completing a cursory review of the entire project and its subsections, the rating team returned to the start of the project. After zeroing the odometer, they proceeded to perform an inspection of each subsection. Every 0.25 miles the team got out and surveyed both lanes 100 feet on each side of the stopped vehicle. A subjective, yet definitive, estimate of any distress and its severity and extent was made. The distress was recorded by circling the severity and extent level on the forms specifically designed for this condition evaluation. These forms are shown as Figures 1, 2 and 3 for asphaltic concrete, jointed concrete and composite pavement, respectively.

Rut measurements were taken with an AASHO-type A-frame rut measure device (Figure 4). A minimum of three readings was taken in each wheel path at each selected location to ensure an accurate and true reading. These measurements were recorded on the forms. Along with the actual measurements, rut estimates were also made on the projects to learn if rating personnel could accurately estimate severity of rut deficiencies.

The Mays Ride Meter tests were conducted either before or after the distress inspection. Each test consisted of five (5) runs in order to obtain an accurate average reading. The Mays ride rating (RR) was obtained by multiplying the Mays PSI by five for rural roads and by four for urban roads in order to fit into DOTD's Highway Needs scheme for rating condition (1).

The deduct points for a given distress type were derived by multiplying the weight factors for distress type, severity and extent yields. The total deduct points were derived by adding the deduct points for each distress type. The raw pavement distress rating was then obtained by subtracting the total deduct points from 100. To determine the final pavement distress rating

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	________	PARISH	________	ROUTE	________
CONTROL	________	SECTION	________	SUBSECTION	________
LENGTH	________	C.S. LOG MILE	________	FUNCTIONAL CLASS	________
DATE	________	RATED BY	________		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW (WEIGHT FACTOR)	SEVERITY LEVEL MEDIUM (WEIGHT FACTOR)	SEVERITY LEVEL HIGH (WEIGHT FACTOR)	EXTENT LEVEL OCC (WEIGHT FACTOR)	EXTENT LEVEL FREQ (WEIGHT FACTOR)	EXTENT LEVEL EXT (WEIGHT FACTOR)	DEDUCT POINTS (SEE BELOW)
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	
CORRUGATIONS	5	NOTC. RIDE .4	DIS-COMFORT .8	SEVERE VIBRA. 1.0	<10%L .5	10%-30% .8	>30% 1.0	
EDGE CRACKING	5	<1/4"W .4	>1/4" .7	MULT. >1/4" 1.0	<20%L .5	20%-50% .7	>50% 1.0	
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W .4	MULT. <1/8"W .7	MULT. CRACK. SINGLE W/SPALL >1/8"W 1.0	<20%L .5	20%-50% .7	>50% 1.0	
PATCH	15	SLIGHT DETER. .3	NOTC. RIDE .6	REPLACE 1.0	<10%L .6	10%-30% .8	>30% 1.0	
POTHOLES	10	<6"W OR >6"W & <1"D .4	>6"W & 1-2"D .7	>6"W & >2"D 1.0	<20%L .5	20%-50% .8	>50% 1.0	
RANDOM CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3	MOD .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	
RUTTING	15	<1/4"D .3	1/4"-1" .7	>1" 1.0	<20%L .6	20%-50% .8	>50% 1.0	
SETTLEMENT	5	NOTC. RIDE .5	DIS-COMFORT .7	DIP>6" 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4	MULTI/ INTALL >1/8" .7	ALLIG >1/4" 1.0	<20% WPL .5	20%-50% .7	>50% 1.0	

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = ________

100 - TOTAL DEDUCT POINTS = ________

RURAL ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 4 = ________
MRR = (MAYS PSI) X 5 = ________

URBAN ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ________
MRR = (MAYS PSI) X 4 = ________

PAVEMENT CONDITION RATING = PDR + RR = ________

REMARKS : ________________________________

FIGURE 1

PAVEMENT CONDITION RATING FORM FOR JOINTED CONCRETE PAVEMENT

DISTRICT ________ PARISH ________ ROUTE ________
CONTROL ________ SECTION ________ SUBSECTION ________
LENGTH ________ C.S. LOG MILE ________ FUNCTIONAL CLASS ________
DATE ________ RATED BY ________

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLOW-UP	10	NOT CONSIDERED			<1/MI	1-3/MI	>3/MI	
		1.0	1.0	1.0	.5	.8	1.0	
CORNER BREAK	10	<1/4"W	1/4-1"	>1"	<1/MI	1-3/MI	>3/MI	
		.4	.8	1.0	.5	.8	1.0	
FAULTING	10	<1/4"	1/4-1/2"	>1/2"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.8	1.0	
JOINT SEAL DAMAGE	5	NOT CONSIDERED			<20%	20%-50%	>50%	
		1.0	1.0	1.0	.5	.8	1.0	
JOINT SPALLING	15	<2"W	2"-4"	>4"	<20%	20%-50%	>50%	
		.4	.7	1.0	.5	.8	1.0	
LONGITUDINAL CRACKING	5	TIGHT	1/4"-1"W	>1"	< 5% SLBS	5%-20%	>20%	
		.5	.7	1.0	.4	.9	1.0	
PATCH	5	SLIGHT DETER	NOTC. RIDE	REPLACE	< 5% SLBS	5%-20%	>20%	
		.4	.7	1.0	.5	.8	1.0	
POPOUTS	5	NOT CONSIDERED			<20%L	20%-50%	>50%	
		1.0	1.0	1.0	.4	.6	1.0	
PUMPING	15	STAIN	STAIN	FAULT	<10%L	10%-25%	>25%	
		.7	.7	1.0	.3	.7	1.0	
SCALING, CRAZING, MAP CRACKING	5	<1/4"D	1/4"-3/4"	>3/4"	<20%A	20%-50%	>50%	
		.4	.7	1.0	.6	.8	1.0	
SETTLEMENT	5	NOTC. RIDE	DIS-COMFORT	DIP>6"	1/MI	2-4/MI	>4/MI	
		.4	.7	1.0	.5	.8	1.0	
TRANSVERSE/DIAGONAL CRACKING	10	TIGHT	1/4-1"W	>1"	CS >15'	10'-15'	<10'	
		.3	.8	1.0	.4	.8	1.0	

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = ________
100 - TOTAL DEDUCT POINTS = ________

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = ________
MRR = (MAYS PSI) X 5 = ________

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ________
MRR = (MAYS PSI) X 4 = ________

PAVEMENT CONDITION RATING = PDR + RR = ________

REMARKS : ________

FIGURE 2

PAVEMENT CONDITION RATING FORM FOR COMPOSITE PAVEMENT

DISTRICT	________	PARISH	________	ROUTE	________
CONTROL	________	SECTION	________	SUBSECTION	________
LENGTH	________	C.S. LOG MILE	________	FUNCTIONAL CLASS	________
DATE	________	RATED BY	________		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL: LOW	MEDIUM	HIGH	EXTENT LEVEL: OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A	AGG/BIT	FREE BIT	<10%A	10%-30%	>30%	
		.8	.8	1.0	.6	.9	1.0	
BLOW-UP	5	<1/2" BUMP	1/2"-1" BUMP	>1" BUMP	1/MI	2-4/MI	>4/MI	
		.4	.6	1.0	.5	.8	1.0	
LONGITUDINAL CRACKING	10	<1/8"	1/8"-1"	>1"	<50' STA	50-100' STA	>100' STA	
		.2	.6	1.0	.4	.8	1.0	
PATCHING	10	SMALL	MEDIUM	LARGE	<10%L	10%-30%	>30%	
		.6	.8	1.0	.6	.8	1.0	
PUMPING	10	STAIN	STAIN	FAULT	<10%L	10%-25%	>25%	
		.7	.7	1.0	.3	.7	1.0	
RAVELING	10	AGGREGATE LOSS SLIGHT	MOD.	SEVERE	<20%A	20%-50%	>50%	
		.3	.6	1.0	.5	.8	1.0	
RUTTING	10	<1/4"D	1/4"-3/4"	>3.4"	<20%L	20%-50%	>50%	
		.3	.7	1.0	.6	.8	1.0	
SETTLEMENT	10	NOTC. RIDE	DIS- COMFORT	DIP>6"	1/MI	2-4/MI	>4/MI	
		.4	.7	1.0	.6	.8	1.0	
SHATTERED SLAB	10	TIGHT CRACKS	CRACKS >1/8"W	SLAB IN PIECES	> 2 AREAS	2-5 AREAS	> 5 AREAS	
		.6	.8	1.0	.7	.9	1.0	
DE-BONDING	5	<1"D <1SY	<1"D & >1SY >1"D & <1SY	>1"D >1SY	<20%L	20%-50%	>50%	
		.3	.6	1.0	.6	.8	1.0	
TRANSERVSE CRACKING	(R) 10 (I) 5	<1/8" CRACK	1/8"-1"	> 1"	<20%L	20%-50%	>50%	
		.2	.6	1.0	.4	.8	1.0	

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = ________

100 - TOTAL DEDUCT POINTS = ________

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = ________

MRR = (MAYS PSI) X 5 = ________

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ________

MRR = (MAYS PSI) X 4 = ________

PAVEMENT CONDITION RATING = PDR + RR = ________

REMARKS : ____

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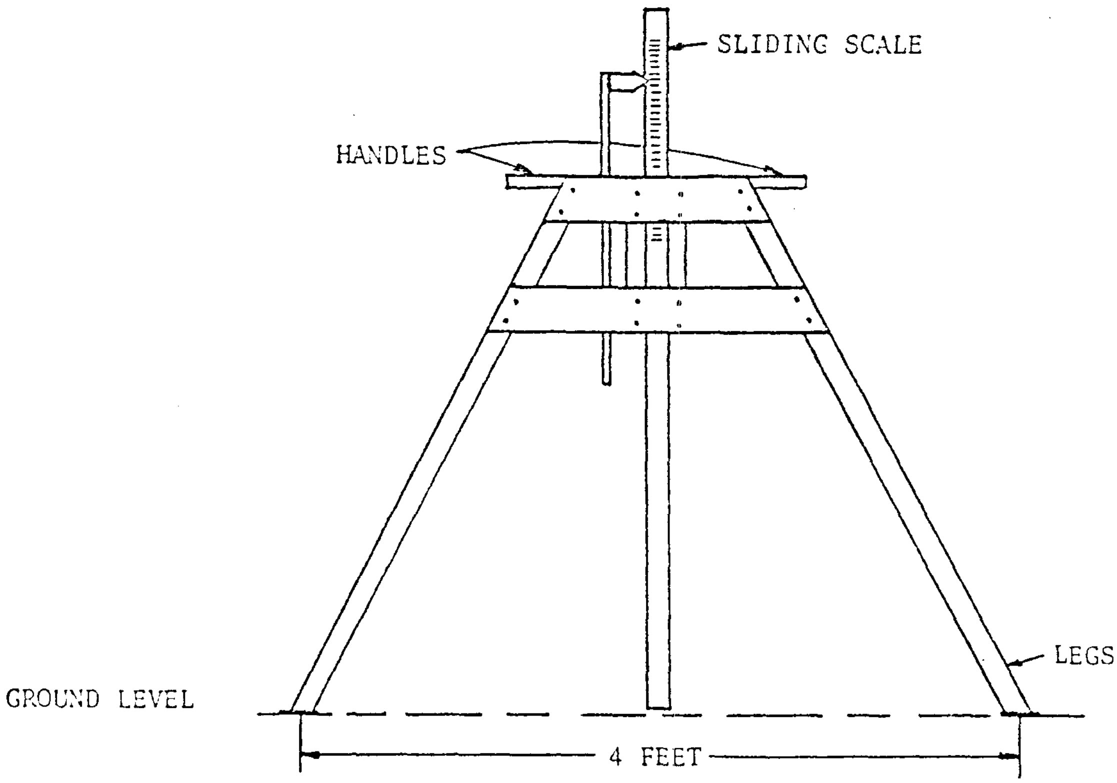
FIGURE 3



AASHO Road Test A-frame Rut Depth Device

FIGURE 4

(PDR) the raw rating was divided by a factor of four for rural roads and five for urban roads as shown in Figure 5.

The pavement condition rating (PCR) was then obtained by adding the pavement distress rating and the Mays ride rating (PDR + RR) as shown in Figure 5.

PAVEMENT CONDITION RATING FORM FOR COMPOSITE PAVEMENT

DISTRICT	03	PARISH	54	ROUTE	US 167
CONTROL	80	SECTION	01	SUBSECTION	02
LENGTH	8.34	C.S. LOG MILE	4.50	FUNCTIONAL CLASS	
DATE	3/10/83	RATED BY	ddH + EOM		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	SEVERITY LEVEL MEDIUM	SEVERITY LEVEL HIGH	EXTENT LEVEL OCC	EXTENT LEVEL FREQ	EXTENT LEVEL EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	
BLOW-UP	5	<1/2" BUMP .4	1/2"-1" BUMP .6	>1" BUMP 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	
LONGITUDINAL CRACKING	10	<1/8" .2	1/8"-1" .6	>1" 1.0	<50' STA .4	50-100' STA .8	>100' STA 1.0	4.8
PATCHING	10	SMALL .6	MEDIUM .8	LARGE 1.0	<10%L .6	10%-30% .8	>30% 1.0	4.8
PUMPING	10	STAIN .7	STAIN .7	FAULT 1.0	<10%L .3	10%-25% .7	>25% 1.0	
RAVELING	10	AGGREGATE LOSS SLIGHT .3	MOD. .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	
RUTTING	10	<1/4"D .3	1/4"-3/4" .7	>3.4" 1.0	<20%L .6	20%-50% .8	>50% 1.0	3.0
SETTLEMENT	10	NOTC. RIDE .4	DIS-COMFORT .7	DIP>6" 1.0	1/MI .6	2-4/MI .8	>4/MI 1.0	
SHATTERED SLAB	10	TIGHT CRACKS .6	CRACKS >1/8"W .8	SLAB IN PIECES 1.0	> 2 AREAS .7	2-5 AREAS .9	> 5 AREAS 1.0	
DE-BONDING	5	<1"D <1SY .3	<1"D & >1SY >1"D & <1SY .6	>1"D >1SY 1.0	<20%L .6	20%-50% .8	>50% 1.0	
TRANSERVSE CRACKING	(R) 10 (I) 5	<1/8" CRACK .2	1/8"-1" .6	> 1" 1.0	<20%L .4	20%-50% .8	>50% 1.0	3.0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 15.6

100 - TOTAL DEDUCT POINTS = 84.4

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 21.1

MRR = (MAYS PSI) X 5 = 22.0

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______

MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 43.1

REMARKS : ____________________

Pavement Condition Rating Derivation

FIGURE 5

RESULTS

Table 2 is a listing of pavement condition rating (PCR) values determined in this field study. It also lists condition ratings determined during the Highway Needs inventory in the late summer and early fall of 1982.

Validity of the Pavement Condition Rating Method

It is felt that a direct and disciplined, although concise, measurement of pavement distress and ride would add relevancy to the Condition portion of the Highway Needs Sufficiency Rating (HNSR). Such relevancy would help the Department monitor pavement life cycles and predict future trends in such cycles. The current data base provided by HNSR does not provide enough information to select alternate rehabilitation strategies for dispersion of 4-R funds on interstate pavements. A comprehensive sufficiency survey should provide a data base from which these types of decisions could be derived.

Figure 6 relates a comparison of Research Mays PSI with pavement condition rating (PCR). This PCR index is a combination of ride and distress information as denoted in Table 2. Hence, relatively high coefficient of determination $R^2 = 0.85$ is not surprising. Since ride is a key index of public satisfaction with a pavement, the term pavement condition rating would appear to be a valid means of expressing pavement condition in order to relate functional as well as structural adequacy.

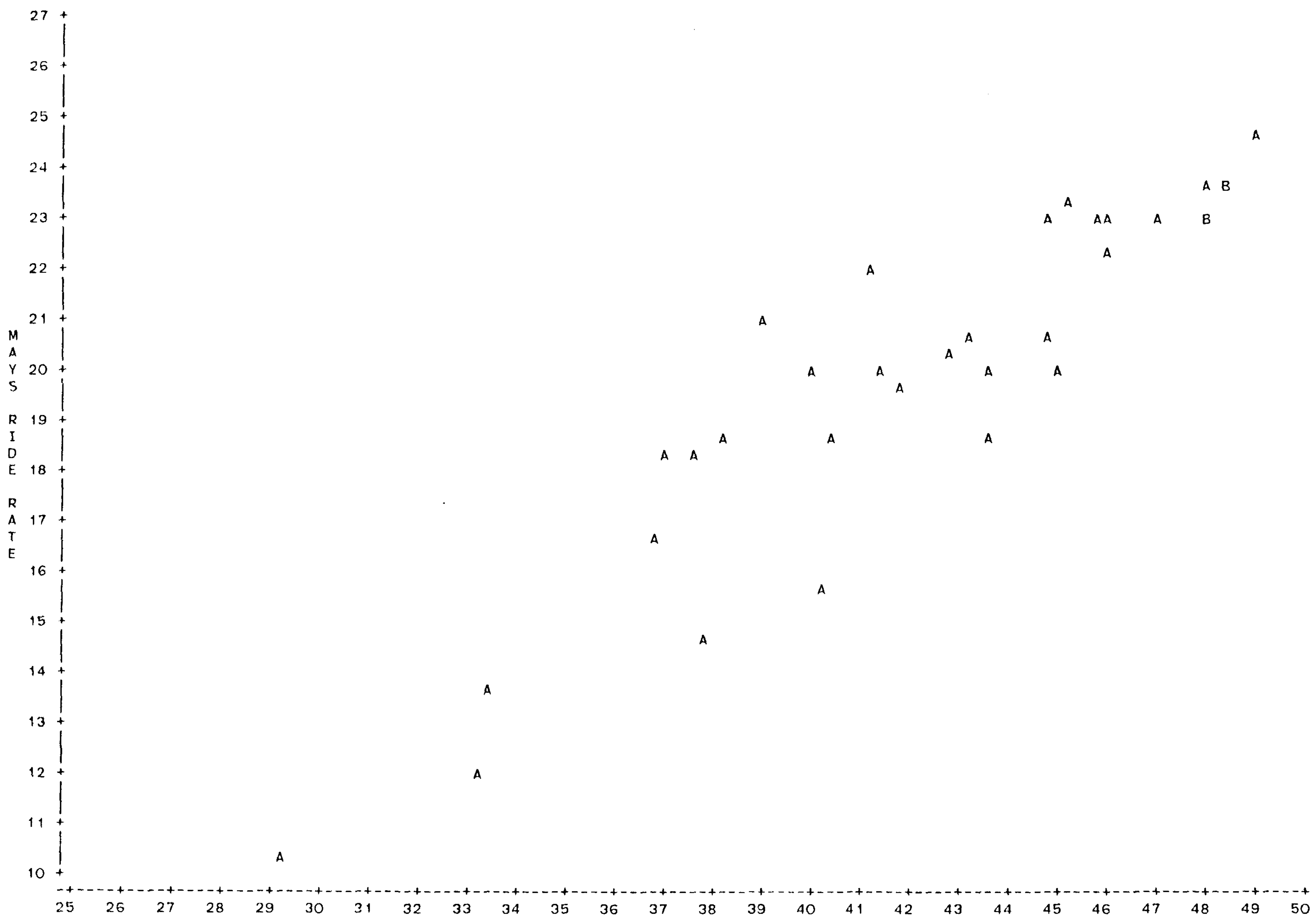
Table 3 presents a statistical analysis of the comparison of the measured versus estimated rut measurements. It is apparent from this analysis that a rater could accurately estimate the magnitude of rut depths.

TABLE 2

PAVEMENT CONDITION RATINGS

DIST	ROUTE NUMBER	CONTROL SECTION	SUBSET NO	SURFACE TYPE	LENGTH	CLASS	PAVEMENT DISTRESS RATING	MAYS RIDE RATE	PCR	HNCR	HN MAYS PSI
03	LA 56	247-02	01	HM	4.06	R	24.3	15.8	40.1	37.0	3.6
03	LA 58	248-02	03	HM	0.93	R	23.5	20.0	43.5	23.0	NA
03	LA 659	855-06	03	HM	5.35	R	18.9	10.3	29.2	5.0	0.3
07	LA 361	375-02	00	HM	1.39	R	18.0	21.0	39.0	11.0	0.3
62	LA 43	254-06	00	HM	7.14	R	25.0	23.0	48.0	39.0	3.6
62	LA1044	846-11	00	HM	5.70	R	24.3	20.5	44.8	47.0	3.5
62	LA 60	279-04	01	HM	7.38	R	24.4	24.5	48.9	32.0	2.8
62	LA 60	279-04	02	HM	6.06	R	24.2	21.5	45.7	32.0	2.8
62	LA 21	059-01	01	HM	0.64	R	21.7	23.0	44.7	35.0	4.1
62	LA 21	059-01	02	HM	2.52	R	22.7	23.0	45.7	32.0	2.2
62	LA1062	415-04	00	HM	6.04	R	23.9	21.0	44.9	41.0	3.4
03	LA 56	247-02	02	CONC	7.24	R	23.2	14.5	37.7	43.0	4.1
03	LA 58	248-02	04	CONC	5.68	R	23.6	22.3	45.9	NA	NA
03	LA 56	247-03	01	CONC	4.12	R	20.2	16.5	36.7	27.0	2.3
03	LA 660	855-07	01	CONC	4.72	R	22.3	19.5	41.8	28.0	3.7
03	LA 659	855-06	01	CONC	0.38	R	22.5	20.3	42.8	38.0	4.2
03	LA 659	855-06	02	CONC	1.60	R	22.6	20.5	43.1	30.0	2.8
03	I-10	450-06	01	CONC	7.89	R	24.5	23.8	48.3	42.0	3.8
03	I-10	450-06	02	CONC	1.20	R	24.2	23.8	48.0	41.0	3.6
03	I-10	450-06	03	CONC	0.84	R	24.6	23.8	48.4	41.0	3.6
03	LA 1	064-06	01	CONC	1.00	R	25.0	22.0	47.0	33.0	4.0
03	LA 58	248-02	05	COMP	0.80	R	20.0	20.0	40.0	25.0	NA
03	LA 56	247-03	02	COMP	3.62	R	19.2	22.0	41.2	33.0	2.3
02	LA 182	004-07	01	COMP	0.76	U	16.4	11.2	27.6	21.0	1.8
03	LA 182	004-07	02	COMP	0.24	U	20.0	16.2	36.2	34.0	1.8
03	LA 182	004-07	03	COMP	4.80	R	25.0	20.0	45.0	41.0	4.1
03	LA 182	004-07	04	COMP	5.64	R	21.1	12.0	33.1	39.0	3.5
03	LA 31	080-04	01	COMP	4.18	R	19.6	18.5	38.1	23.0	3.0
03	LA 31	080-04	02	COMP	0.33	R	25.0	18.5	43.5	32.0	2.8
03	LA 31	080-04	03	COMP	0.63	R	21.9	18.5	40.4	28.0	2.8
03	LA 55	248-03	00	COMP	5.33	R	21.8	23.3	45.1	44.0	2.8
03	LA 1	064-06	01	COMP	0.43	R	25.0	22.0	47.0	33.0	4.0
03	LA 1	064-06	02	COMP	4.50	R	21.4	20.0	41.4	32.0	3.5
03	LA 1	064-06	03	COMP	3.50	R	21.5	20.0	41.5	32.0	3.3
03	LA 167	080-01	01	COMP	0.75	U	19.6	17.6	37.2	40.0	4.6
03	LA 167	080-01	02	COMP	8.34	R	22.8	22.8	44.8	34.0	3.6
03	LA 167	080-01	03	COMP	0.78	R	17.0	17.6	34.6	30.0	1.7
03	LA 167	080-01	04	COMP	0.67	R	25.0	23.0	48.0	48.0	4.1
03	LA 13	057-02	01	COMP	8.50	R	19.8	13.5	33.3	33.0	3.1
03	LA 13	057-02	02	COMP	0.65	U	18.4	10.8	29.2	26.0	2.8

NA - NOT AVAILABLE
PCR - PAVEMENT CONDITION RATING
HNCR - HIGHWAY NEEDS CONDITION RATING



Research Mays Ride Meter Serviceability Rating

FIGURE 6

TABLE 3

STATISTICAL ANALYSIS - MEASURED VERSUS ESTIMATED RUT DEFICIENCY

PAVEMENT TYPE	CONTROL SECTION	NO OF OBS	MEASURED INCHES		ESTIMATED INCHES	
			MEAN	SD*	MEAN	SD*
	247-02	3	0.06	0.07	0.06	0.07
	247-03	4	0.14	0.10	0.09	0.08
RIGID	248-02	2	0.05	0.00	0.05	0.00
	450-06	5	0.00	0.00	0.00	0.00
	855-06	4	0.00	0.00	0.00	0.00
	855-07	4	0.00	0.00	0.00	0.00
	004-07	10	0.07	0.03	0.10	0.03
	057-02	5	0.07	0.05	0.05	0.05
COMPOSITE	064-06	5	0.15	0.02	0.11	0.04
	080-01	5	-0.06	0.06	0.05	0.06
	080-04	7	0.24	0.07	0.17	0.06
	248-03	3	0.03	0.01	0.01	0.02
	059-01	5	0.01	0.01	0.00	0.00
	254-06	4	0.00	0.00	0.00	0.00
FLEXIBLE	279-04	8	0.00	0.00	0.00	0.00
	375-02	2	0.03	0.01	0.02	0.03
	415-04	6	0.03	0.01	0.07	0.02
	846-11	6	0.00	0.00	0.00	0.00

* - STANDARD DEVIATION

Figure 7 relates Mays PSI with total "Condition Rating" as input into the Highway Needs Sufficiency Rating using current procedure. This index "Condition Rating" is a combination of surface, base-subbase, subgrade, drainage, ride and remaining years of service life information. From the limited sample of data, the other five pieces of information seem to add little to the impact of surface condition on the variation in ride as indicated by R^2 of 0.56. The data for the figure is shown in Table 2.

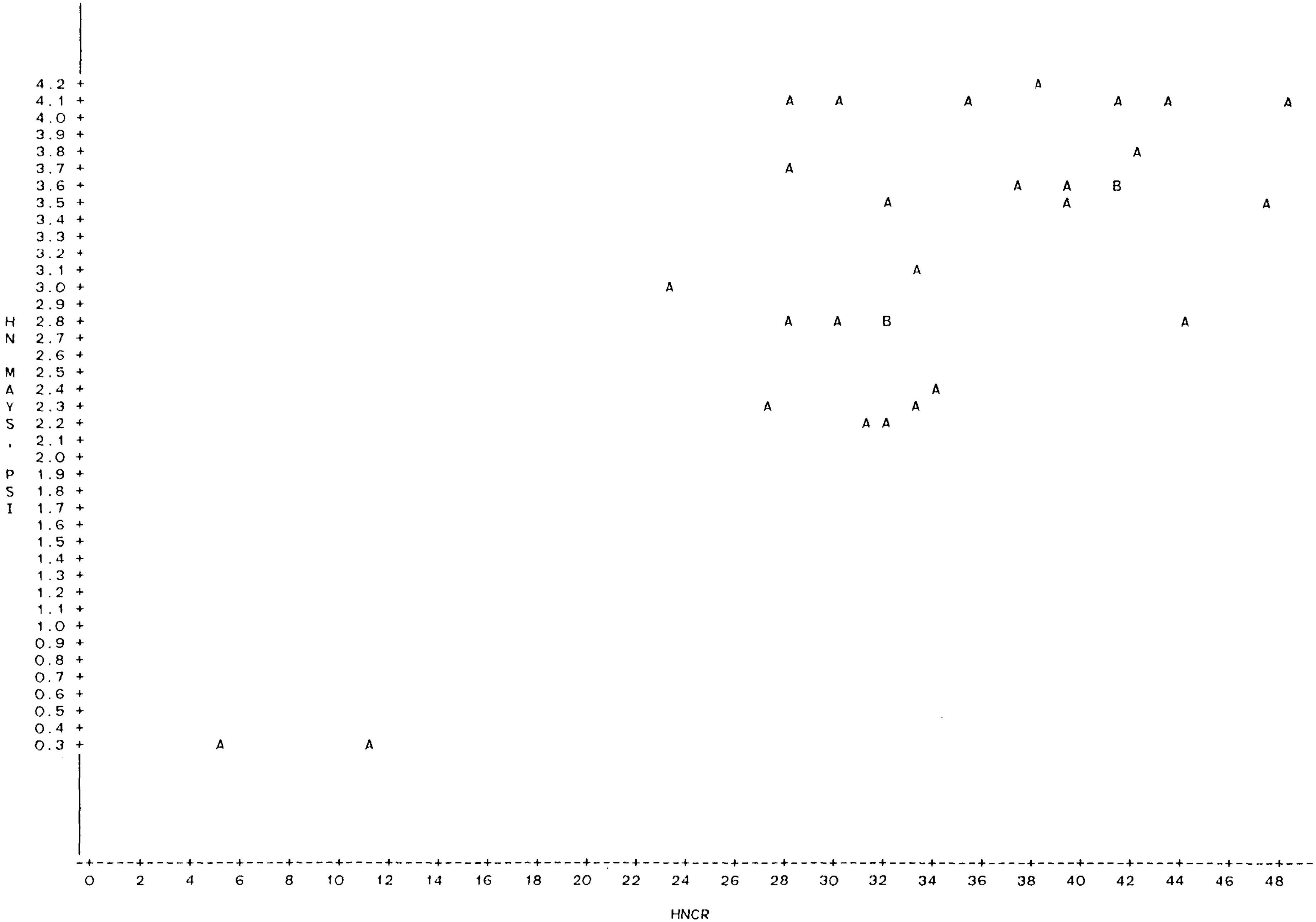
Figures 8 and 9 represent the mean and standard deviation, respectively, of the pavement distress ratings for the various subsections in 0.25-mile increments for one of the surveyed projects. The bar charts reflect computations of distance increments as follows:

0.25-mile increment = 0.25 mi., 0.50 mi., 0.75 mi., etc.
0.50-mile increment = 0.50 mi., 1.00 mi., 1.50 mi., etc.
0.75-mile increment = 0.75 mi., 1.50 mi., 2.25 mi., etc.
1.00-mile increment = 1.00 mi., 2.00 mi., 3.00 mi., etc.
2.00-mile increment = 2.00 mi., 4.00 mi., 6.00 mi., etc.

Table 4 is a synopsis of the comparison of measurements obtained at 0.25-mile versus 2.0-mile interval. It is, therefore, apparent when one reviews the charts that pavement distress could be measured at two-mile intervals throughout the length of the project. However, for projects of shorter lengths, the rater will have to use judgment in establishing the increments at which measurements should be made.

Practicality of the Pavement Condition Rating (PCR)

The method applied in this study has been shown to be practical in terms of simplicity of application and time required. A rating crew should be able to survey a project by spending no more than



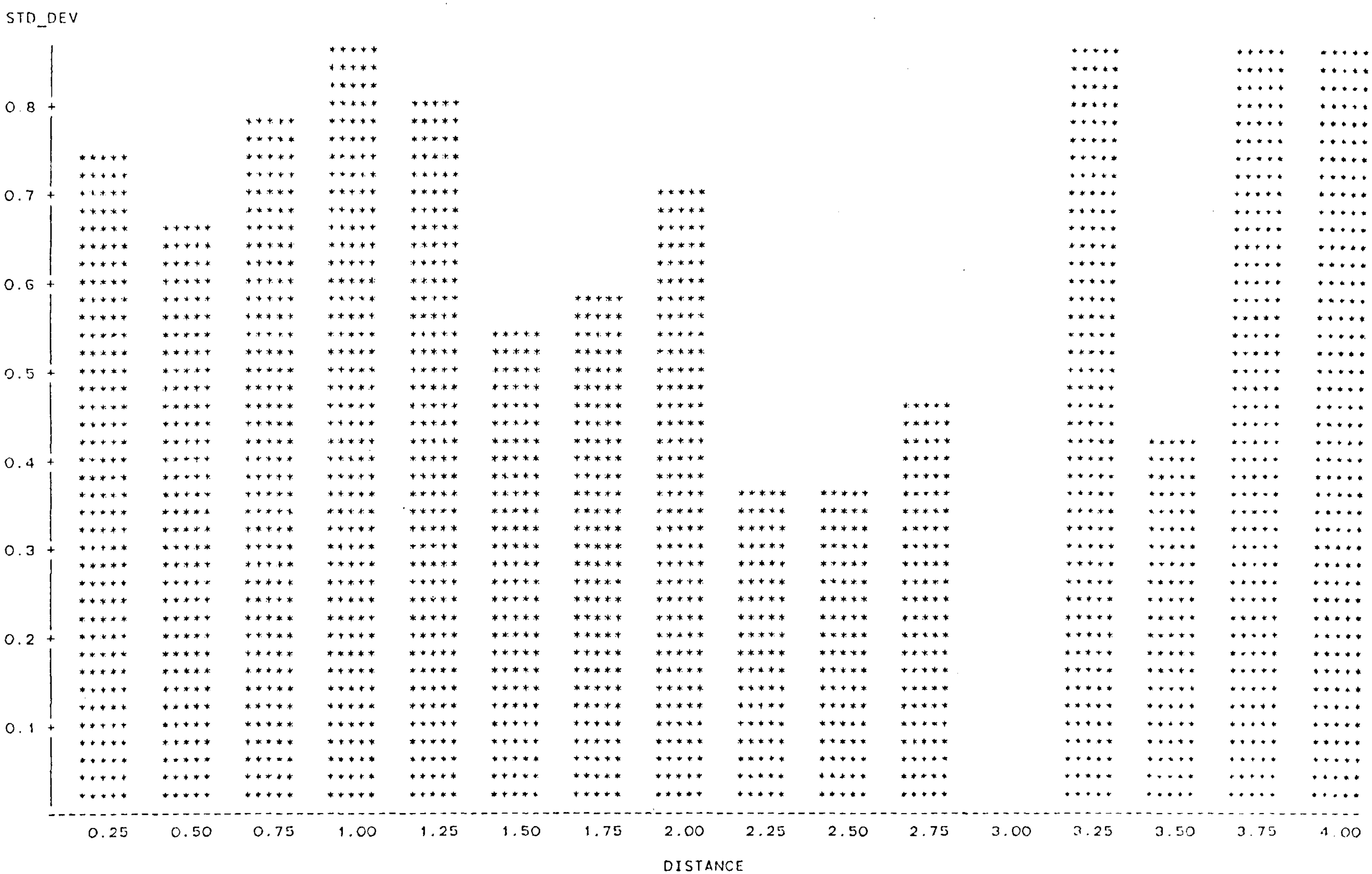
NOTE: 3 OBS HAD MISSING VALUES

Highway Needs Mays Ride Meter Serviceability Index Versus Highway Needs Condition Rating

FIGURE 7

Distress Rating Showing Mean Computed Over Each Quarter Mile Increment

FIGURE 8



Distress Rating Showing Variability Computed Over Each Quarter Mile Increment

FIGURE 9

TABLE 4

COMPARISON OF VARIABILITY OF DISTRESS MEASUREMENTS
AT 0.25 AND 2.00 MILE INTERVALS

PAVEMENT TYPE	CONTROL SECTION	MEAN		STD DEV	
		0.25 MILES	2.00 MILES	0.25 MILES	2.00 MILES
	247-03	20.00	18.0	2.50	1.8
RIGID	248-02	23.50	22.0	0.98	4.2
	450-06	24.50	25.5	0.90	0.0
	247-02	23.00	22.0	1.45	2.2
	080-01	23.00	23.0	0.74	0.7
	248-03	22.00	22.0	1.58	3.5
COMPOSITE	057-02	20.00	20.0	4.50	1.2
	064-06	21.50	21.0	0.48	0.8
	004-07	21.00	21.7	0.95	0.2
	080-04	19.50	20.2	1.25	0.4
	846-11	24.50	24.5	0.29	0.3
	279-04	24.25	24.0	0.55	0.2
FLEXIBLE	279-04	24.00	24.5	0.33	0.2
	855-06	19.00	16.0	3.40	0.5
	415-04	24.00	24.0	0.00	0.0

ten minutes per stop or a total of no more than one hour per ten miles of project. The rating results obtained under this method duly justify the duration of time required to rate projects.

Safety of the Pavement Condition Rating (PCR) Method

The method used in this study appears to be a safe one. A flashing light was used on the vehicle driven by a crew of two personnel. The safety was further enhanced by parking on the shoulders during a stop for observations and recording of distress.

For projects where there is not sufficient shoulder areas or an absence of shoulders, the rating crew could park at available proximal locations to the test section(s). Judgment should be used in those circumstances if available and proximal parking areas are nonexistent. The rating crew could, under these conditions, rate the surface conditions while driving at a safe speed throughout the project.

The study shows that a rating crew can operate in a safe, comfortable and efficient manner while remaining aware of the public's place on the roadway.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the study findings:

1. The pavement condition rating (PCR) index investigated in this field study is a valid index of roadway condition, would add relevance to the Highway Needs Sufficiency Rating, and would provide a usable pavement condition data base upon which rehabilitation strategies could be based and life cycles can be determined.

2. The pavement condition rating method is practical, quick and safe for field implementation.

3. The condition rating can be determined at two-mile intervals without sacrificing accuracy.

4. Rutting on hot mix jobs can be estimated with sufficient accuracy once the rater has gained experience in field evaluation work.

5. The rating procedure discussed in this report can be initially implemented on sample sections of the state's network of control sections. These sample sections could be those identified in the FHWA/Department's Highway Performance Monitoring System (HPMS).

REFERENCES

1. Highway Needs and Priorities Manual, Louisiana Department of Transportation and Development, June 1981.

2. Shah, S. C., Kinchen, R. W., and Rascoe, C. D., "A Feasibility Report: An Integrated PAvement Data Management and Feedback System (PAMS)," Report Number FHWA/LA-81/152, Louisiana Department of Transportation and Development, August 1981.