

HR-513

IOWA DEPARTMENT OF TRANSPORTATION

TO OFFICE: Materials

DATE: September 26, 1990

ATTENTION: B. C. Brown

REF. NO.: 435

FROM: Charles J. Potter *CJP*

OFFICE: Materials

SUBJECT: I-80 EB Pottawattamie County Bonded Overlay Study

The Special Investigations Section recently completed the final evaluation of the I-80 eastbound bonded overlay placed in 1979 between the Shelby and Avoca interchanges in Pottawattamie County. Attached find a work plan which was completed this past summer. Results were as follows:

Deflection

Table 1 shows all Road Rater measurements on the bonded overlay since it was constructed in 1979. The average Structural Rating (SR) 80th Percentile Structural Rating, and average Soil K (Westergaard's modulus of subgrade reaction) were fairly constant throughout the evaluation period. A new 11 inch thick pavement would be expected to have a new SR of 5.5 (11 inches x 0.50 SR per inch = 5.5 SR). This deteriorated 8 inch continuously reinforced concrete pavement with a bonded 3 inch overlay had a SR range of 4.00 to 4.75 which is expected. Individual deflections did correlate with pavement condition by cores in a Road Rater report written by Charles Potter and Kermit Dirks (1).

Smoothness

Smoothness was tested on the bonded overlay with the Iowa-Johannsen-Kirk (IJK) Ride Indicator. This information is illustrated in Table 2. The IJK ride measurement less the Crack and Patch Survey deduction equals the Present Serviceability Index (PSI). The South Dakota Profilometer was also used for a final reading and yielded an International Roughness Index (IRI) of 129.25 inches per mile.

(1) Potter, Charles J. and Dirks, Kermit L.,
Pavement Evaluation Using the Road Rater Deflection Dish, Final Report for MLR-89-2, May 1989, Highway Division, Iowa Department of Transportation, Pages 101-103, Cores 169-178

Crack & Patch Survey

The Crack & Patch Survey for the PSI deduction is performed every other winter. Table 3 shows this information per one-half mile test section as follows:

- # of Cracks - Number of cracks full width across the pavement 1/4 inch wide (over at least half the crack) or sealed
- Patch Area - Square feet of full or partial depth patch area
- C - Linear feet of cracks per thousand square feet of pavement
- P - Square feet of patching per thousand square feet of pavement
- PSI DED - PSI Deduction subtracted from the IJK Ride Indicator Longitudinal Profile Value (LPV) to yield PSI
- DOF - D-Cracking Occurrence Factor, 0-5 scale with 0 being the least D-Cracking
- Ave RD - Average Rut Depth in inches as measured by a four-foot gauge
- Ave Flt - Average faulting in inches one foot in from pavement edge

There was a dramatic increase in cracking, patching and PSI DED between 1987 and 1989 which led to pavement reconstruction.

Dick Smith of the Materials Research Section also conducted patching surveys on the entire project length as shown in Table 4. Here again, there was a large increase in the amount and percent of patching between 1987 and 1989, and also between 1989 and 1990.

Pavement distress trends are shown for PSI Deduction, Patched Area and Percent of Project Patched in Figures 1, 2 and 3, respectively.

4" Cores

Twenty-two 4" cores were drilled in the bonded overlay project for observation, compressive strength, and shear strength at bond line. Compressive strength and shear strength tests have not been performed as yet, but Table 6 shows the condition of cores. Thirteen of twenty-two (59%) of the cores were one piece and solid. The remaining nine cores were broken at one or several locations.

Delamination

In the work plan, it was noted that the results of previous 1,000 foot delamination test sections could not be found. I located this information for this report in Table 5, but not before testing was conducted this summer. Therefore, the test sections in 1982 and 1990 do not align, but generally there were few delaminations.

Videotape

The Special Investigation Section has a videotape of this bonded overlay project dated May 7, 1990.

Photos

Jim Grove has several color slides of the pavement as it was being broken and removed. He noted that the overlay stayed bonded and the pavement came out in large chunks through this operation.

Summary

All test data in the work plan was gathered. The bonded overlay performed satisfactorily for 11 years with an increased rate of deterioration toward the end of this time period.

CJP:kmd

ATTACHMENT

cc: O. J. Lane

J. Bergren

J. Grove

V. Marks

K. Jones

C. Potter
4-26-90

Work Plan to Evaluate 3" PCC Bonded Overlay
on I-80 EB in Pottawattamie County
From MP 35.15 to MP 39.23

Background

The 8" CRCP on I-80 EB from MP 35.15 to MP 39.23 was D-cracked and received a 3" PCC bonded overlay in 1979. This pavement section has required increased patching and will be reconstructed with a new PCC inlay in 1990 with a June 5 letting date. This will be the last chance to evaluate the 3" PCC bonded overlay performance prior to reconstruction.

Pavement Evaluation Tests and Schedule

Deflection - The Road Rater will test this pavement section prior to June 15, 1990 and has tested this bonded overlay periodically since 1982.

Smoothness - IJK Roadmeter testing will be conducted prior to June 15, 1990 and has been performed periodically since 1979.

Crack & Patch Survey - A patch survey was performed on March 1, 1990 and Dick Smith has performed this survey periodically since 1985. A crack & patch survey for PSI deduction was performed this past winter, and has been performed periodically since 1979.

4" Cores - Cores will be taken for bond strength by June 15, 1990, as directed by John Lane.

Delamination - Delamtect testing was performed previously, but neither Dick Smith nor I could find the results. Randomly selected 500-foot test sections could be tested per mile as close to the pavement edge as possible by June 15, 1990.

Videotape - The BPR Roughometer van will be used to videotape the pavement (similar to detours) by June 15, 1990.

Photos - Dick Smith, John Heggen and I will attempt to get some still photos when the pavement is broken out during summer months.

Availability of Test Personnel

Since all Special Investigations personnel and our safety vehicles are occupied with the 1990 Road Rater testing program, it is anticipated that most testing will be performed the first two weeks of June for this work plan.

CJP/kmd

cc: B. Brown
O. J. Lane
J. Heggen
K. Kellogg
V. Marks
D. Smith

Table 1
Road Rater
Control Section
I-80 EB MP 35.15 - MP 39.23

<u>Date</u>	<u>Ave SR</u>	<u>80th % SR</u>	<u>Ave Soil K</u>
5-7-90	4.57	3.68	143
4-10-89	4.61	3.80	129
4-7-88	4.60	3.86	124
4-22-87	4.20	3.51	127
4-15-86	4.75	4.01	138
5-17-84	4.00	3.27	176
3-2-83	4.32	3.55	176
11-10-82	4.45	3.49	138

Table 2
 IJK Ride
 I-80 EB
 MP 35.15 - MP 39.23

<u>Year</u>	<u>IJK Ride</u>	<u>C & P Deduction</u>	<u>PSI</u>
1980	4.05	0.00	4.05
1983	3.75	0.00	3.75
1986	3.53	0.15	3.38
1988	3.38	0.16	3.22
1990	3.41	0.64	2.77

South Dakota Profilometer

Tested 6-7-90 IRI = 129.25 Inches Per Mile

Table 3
Crack & Patch Survey

Control Section I-80 EB MP 35.15 - MP 39.23			Test Section (MP 38.00 - MP 38.50)					
<u>Date</u>	<u># of Crks</u>	<u>Patch Area</u>	<u>C</u>	<u>P</u>	<u>PSI DED</u>	<u>DOF</u>	<u>Ave RD</u>	<u>Ave Flt</u>
11-28-89	110	552	41.67	8.71	.64	0	.04	.00
12-16-87	7	32	2.65	.51	.16	0	.05	.00
1-21-86	7	0	2.65	.00	.15	0	.07	.00
1-24-84	0	0	.00	.00	.00	1	.04	.00
2-1-82	0	0	.00	.00	.00	0	.05	.00
1-5-80	0	0	.00	.00	.00	0	.00	.00

Table 4
Patch Survey

<u>Date</u>	<u>Survey Personnel</u>	<u>Patched Area (Sq. Yd.)</u>	<u>Patched % of Proj.</u>	<u>Broken Area (Sq. Yd.)</u>	<u>Broken % of Proj.</u>
7-22-82	J. Lane, R. Kennedy & R. Britson	250	0.4	---	---
8-14-84	R. Smith	496	0.80	---	---
9-19-85	R. Smith	710	1.14	3	.005
1-22-87	R. Smith	784	1.26	13	.021
10-21-87	R. Smith	847	1.37	3.6	.005
1-24-89	R. Smith	1668	2.69	123	0.200
3-1-90	R. Smith	2358	3.80	74	0.120

Table 5
Delamination

Date Tested: 7-19-82 by Kellogg & Potter

Test Location: 2 Feet From Outside Edge of Lane

1000 Foot Test Section Per Mile			
<u>FROM</u>	<u>TO</u>	<u>Delamination Length</u>	<u>Delamination Location</u>
1399+00	1409+00	3'	1400+55 At Patched Area
1453+00	1463+00		No Delaminations
1506+00	1516+00		No Delaminations
1548+00	1558+00		No Delaminations
1578+00	1588+00		No Delaminations

Date Tested: 5-7-90

1429+00	1434+00	5'	1431+00
		5'	1433+70
1483+00	1488+00		No Delaminations
1534+00	1539+00		No Delaminations
1587+00	1592+00		No Delaminations

Table 6
4" Core Descriptions

Core #	Milepost	Location	Lane	Thickness	Remarks
1	35.5	QP		10 1/2"	Solid
2	35.5	WT		10 3/4"	Solid
3	36.0	WT		10 1/2"	Broken, 1" from bottom
4	36.0	CL		11 1/4"	Solid
5	36.0	QP		11 1/2"	Solid
6	36.5	QP		11"	Solid
7	36.5	CL		4 1/4"	Broken from top
				2", 5"	
8	37.0	CL		7 3/8"	Broken from top
				3 1/2"	
9	35.5	CL 1'		5", 4", 2"	Broken from top
10	36.5	IWT		10", 1/2"	Broken from top
11	37.0	IWT		10 1/4"	Solid
12	37.0	QP		10 1/4"	Solid
13	37.5	CL		3 3/4"	Broken, rest of core missing
14	37.5	QP		4 3/4"	Broken from top
				4 1/2", 2"	
15	37.5	IWT		10 3/4"	Broken at steel
16	38.0	CL	PL	10 1/2"	Solid
17	38.0	QP	PL	10 1/4"	Solid
18	38.0	WT	PL	10 1/4"	Solid
19	37.5	CL		5", 2",	Broken from top
				2", 1 1/2"	
20	38.5	WT	PL	10 1/2"	Solid
21	38.5	CL	PL	10 1/2"	Solid
22	38.5	QP	PL	10 1/2"	Solid

QP = Quarter Point
WT = Wheeltrack
CL = Centerline
IWT = Inside Wheeltrack

PL = Passing Lane, all other cores
in driving lane

FIGURE 1
PSI DEDUCTION VS. YEAR TESTED

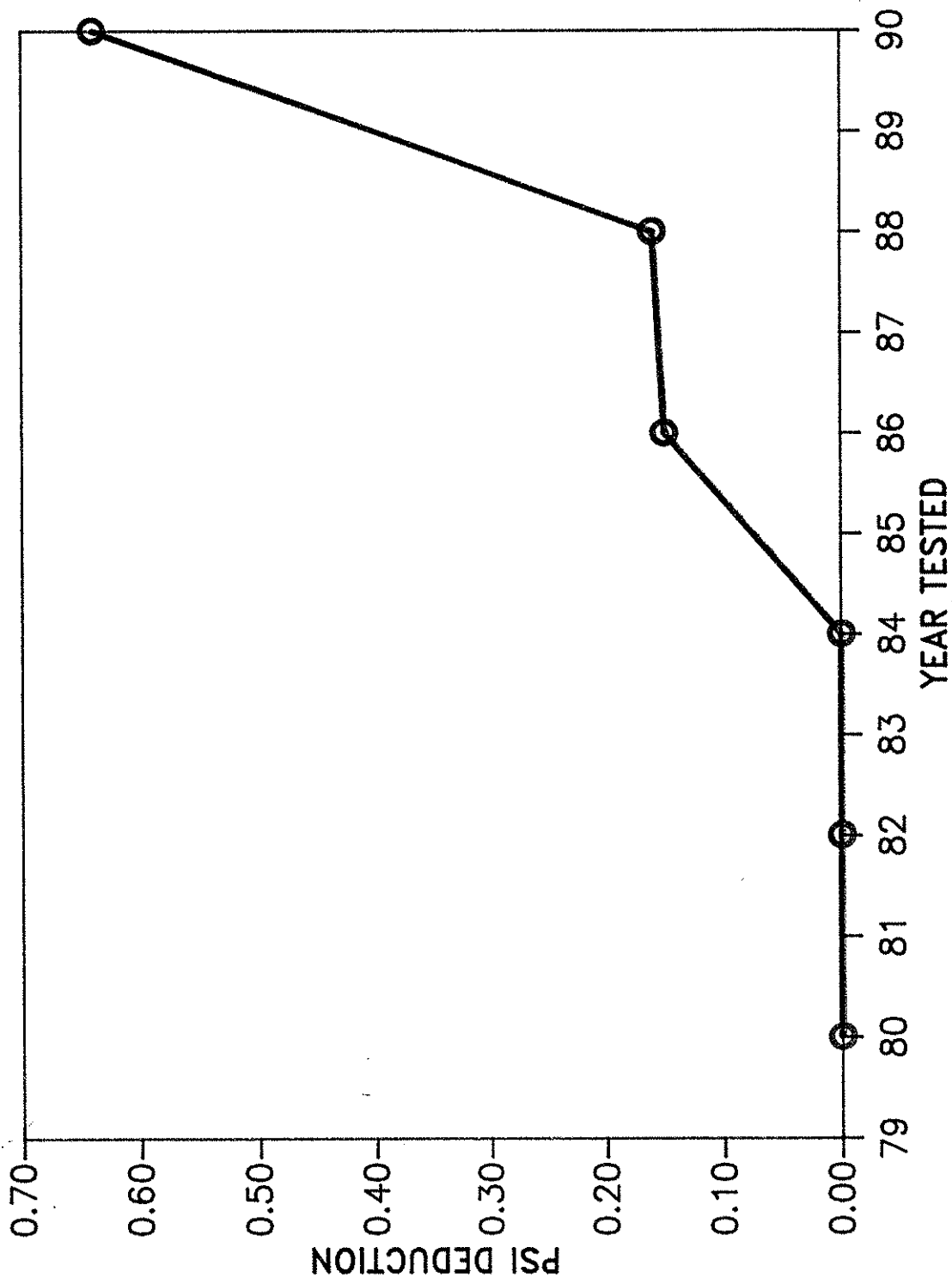


FIGURE 2
PATCHED AREA (SQ. YDS.) VS. YEAR TESTED

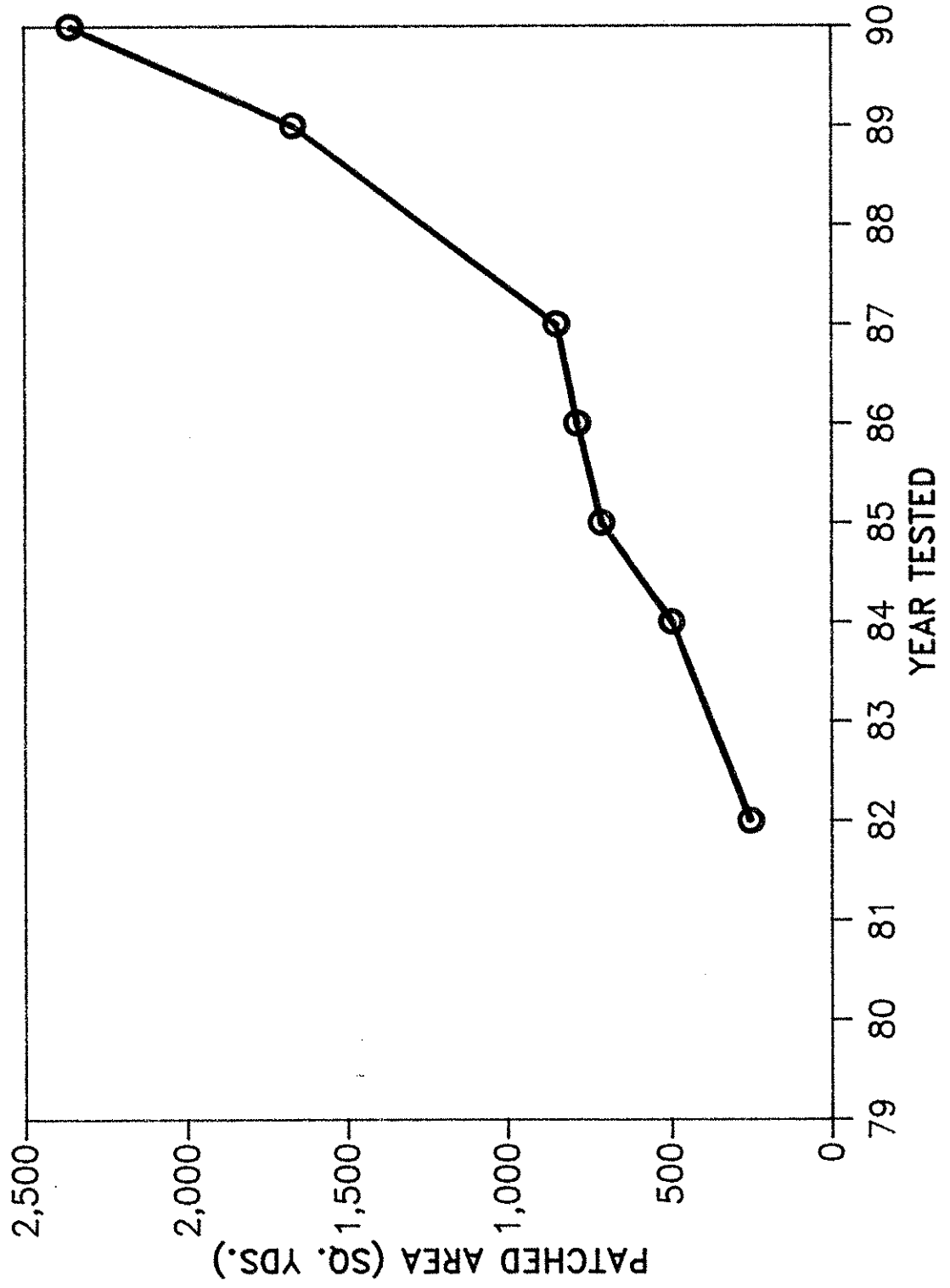


FIGURE 3
PERCENT OF PROJECT PATCHED VS. YEAR TESTED

