CRACKING AND SEATING TO RETARD REFLECTIVE CRACKING - HAMILTON COUNTY

FINAL REPORT
IOWA HIGHWAY RESEARCH BOARD
PROJECT HR-277

MARCH 1993

Highway Division

Iowa Department of Transportation

Final Report
Iowa Highway Research Board
Project HR-277

CRACKING AND SEATING TO RETARD REFLECTIVE CRACKING - HAMILTON COUNTY

By

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March 1993

TECHNICAL REPORT TITLE PAGE

1. **REPORT NO.** HR-277	2. **REPORT DATE** March 1993
3. **TITLE AND SUBTITLE** Cracking and Seating PCC Pavement Prior to Resurfacing to Retard Reflective Cracking - Hamilton Co.	4. **TYPE OF REPORT & PERIOD COVERED** Final 9-86 to 3-93
5. **AUTHOR(S)** Gary Harris Secondary Rd Research Coordinator	6. **PERFORMING ORGANIZATION ADDRESS** Iowa Department of Transportation Material Department 800 Lincoln Way Ames, Iowa 50010

7. **ACKNOWLEDGEMENT OF COOPERATING ORGANIZATIONS**

Performed in cooperation with the Hamilton County Secondary Road Department

8. **ABSTRACT**

The crack and seat (C & S) method of rehabilitating concrete pavements has been proposed to reduce the incidence of reflective cracking in asphalt overlays. These cracked pieces help reduce the thermal effects on lateral joint movement while the seating of slab pieces reduces vertical movement.

This 1986 project demonstrated that a 0.6 m x 0.9 m (2 ft x 3 ft) cracking pattern was optimal to retard reflective cracking in an asphalt overlay. The best performance among three C & S test sections was section 4 with a 0.6 m x 0.9 m (2 ft x 3 ft) cracking pattern and 7.6 cm (3 in) overlay. Structural ratings determined from the Road Rater™ indicated little difference between each C & S section with varying AC thicknesses and crack spacings. Although reflection cracking is reduced in the early years after construction, the effectiveness of the C & S method diminishes over time.

9. **KEY WORDS** Crack & Seat, AC Overlay, Break & Seat, PCC, Reflective cracking	10. **NO. OF PAGES** 33

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DISCLAIMER

INTRODUCTION

Reflective cracking in asphalt overlays placed on portland cement concrete (PCC) pavement has been a major problem in Iowa. Reflective cracks are a duplication of the cracks and joints of the underlying PCC pavement. These cracks develop mainly by thermal and traffic stresses. By reducing the amount of cracking in an asphalt overlay, the amount of maintenance required would be reduced and the pavement service life would be extended.

The purpose of cracking the pavement is to produce pieces small enough to significantly reduce joint movement and reflective cracking in the overlay, yet large enough to retain aggregate interlock between pieces in order to retain as much structural strength in the PCC pavement as possible.

To date, approximately 24 states have done cracking and seating with an asphalt overlay.

OBJECTIVE

The objective of this research project was to evaluate the effectiveness of various cracking sizes and patterns with different thicknesses of asphalt cement concrete (ACC) overlays.

PROJECT LOCATION AND DESCRIPTION

A 2.4 km (1.5 mi) section of Hamilton County road R-33 was selected for this project (Figure 1). The 15 cm (6 in) PCC

HAMILTON COUNTY
IOWA

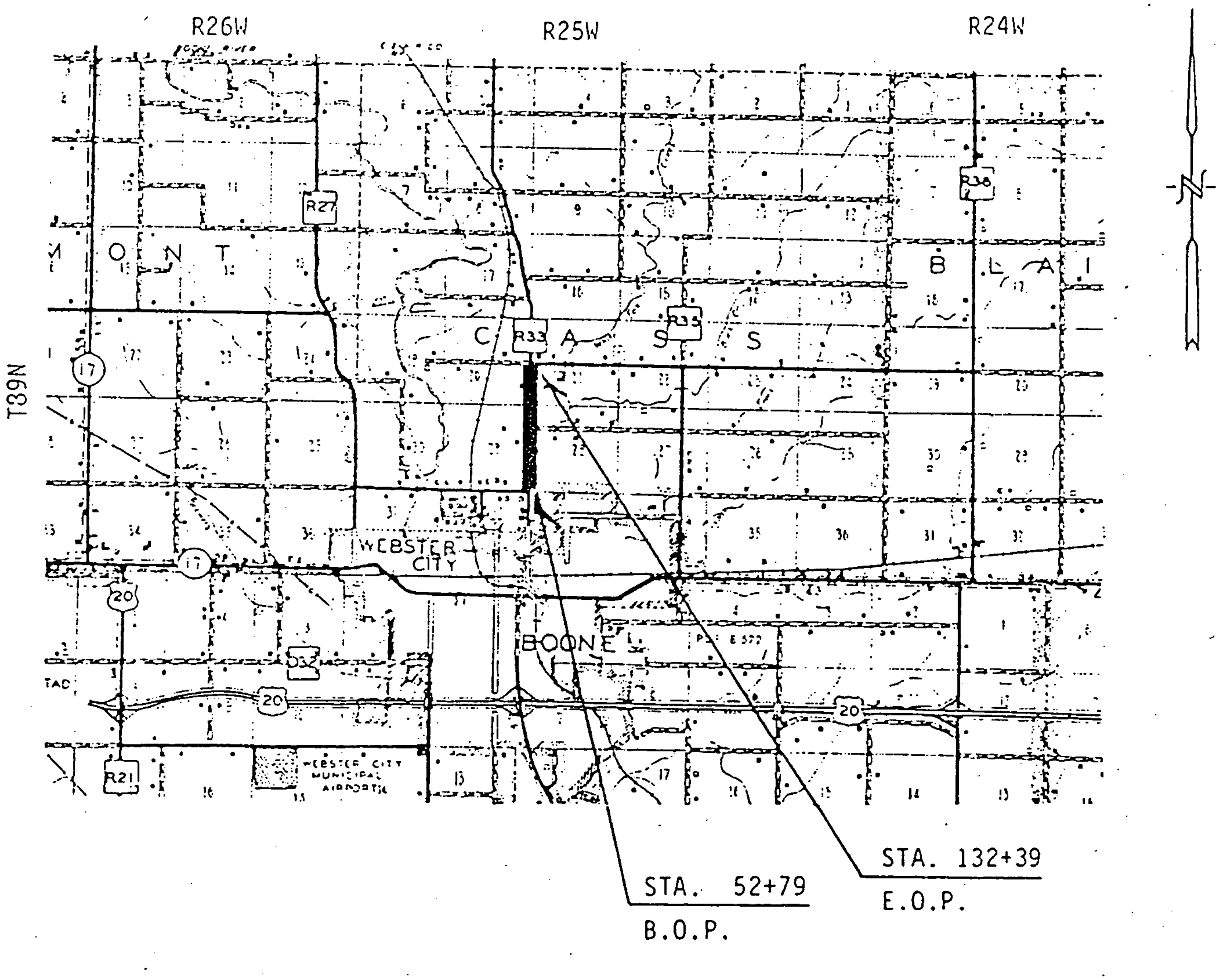


Figure 1

pavement on a 10 cm (4 in) soil aggregate subbase was constructed in 1956. It was 6.7 m (22 ft) wide with contraction joints at 24 m (80 ft) intervals.

The 1983 average daily traffic of 950 vehicles per day was considered in the design of the test sections. The 1991 average daily traffic was 1430 vehicles per day, nearly a 50 percent increase.

ASPHALT CEMENT CONCRETE RESURFACING

Type B, Class I asphalt cement concrete, containing not less than 30% crushed limestone particles with a 13 mm (0.5 in) final mix size was specified on the plans. The final mix design approved by the Iowa DOT District 1 Office of Materials contained 55% gravel and 45% crushed limestone. Also, an asphalt cement of 6.5% was used. The typical aggregate gradation and sources are shown in Table I.

CONSTRUCTION

The project was constructed June 12, 1986 through June 25, 1986. Mathy Construction Company of Onalaska, Wisconsin was the prime contractor. Special Provisions are given in Appendix B.

CRACKING AND SEATING

Antigo Construction Company of Antigo, Wisconsin did the cracking with a Wirtgen Breaker (Figure 2). Mathy Construction Company used a 45,400 kg (50 ton) Bros proof roller to do the seating (Figure 3).

Table I

Typical Combined Aggregate Gradation

Sieve Size	Percent Passing
19 mm (3/4 in)	100.0
12.5 mm (1/2 in)	100.0
9.5 mm (3/8 in)	91.0
4.75 mm (#4)	66.0
2.36 mm (#8)	50.0
1.18 mm (#16)	37.0
600 μm (#30)	22.0
300 μm (#50)	12.0
150 μm (#100)	8.2
75 μm (#200)	6.5

Laboratory Density (50 Blow Marshall): 2.340

Aggregate was furnished from the following sources:

1. Gravel - Weaver's Grandgeorge Pit, located in Hamilton County, Iowa

2. Crushed limestone - Weaver's Moberly Mine, located in Hamilton County, Iowa

Figure 2a - Wirtgen Breaker

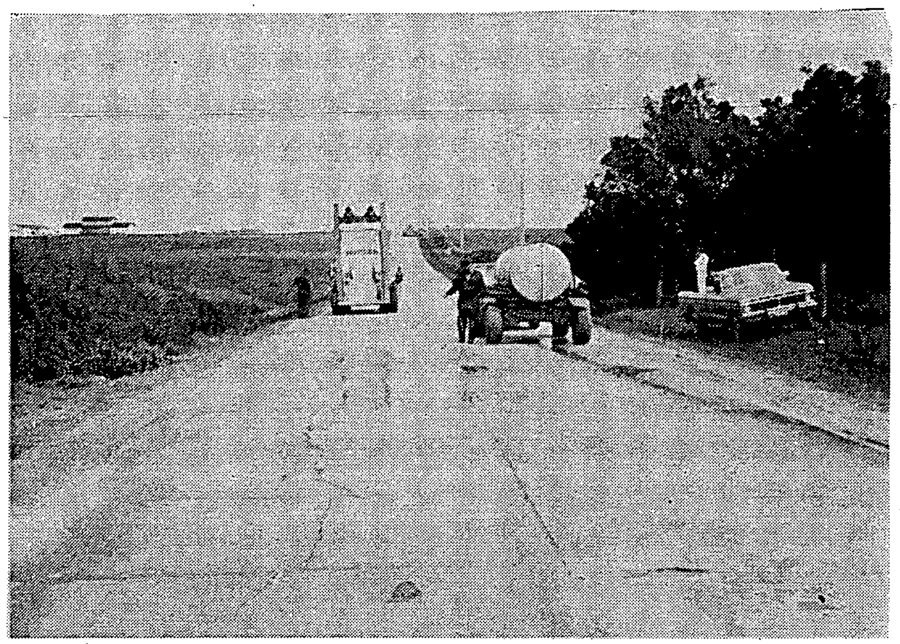


Figure 2b - Crack Verification Using Water

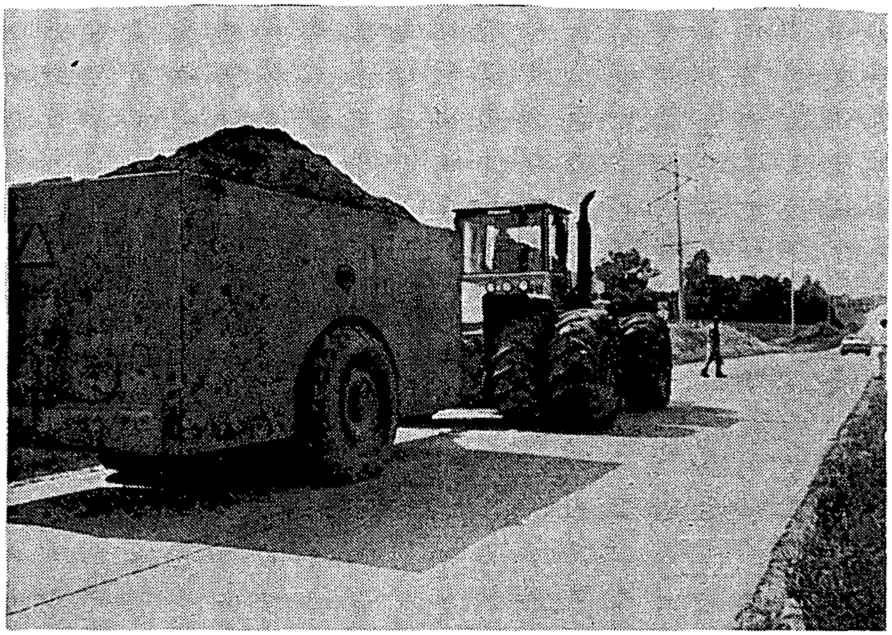


Figure 3 - Bros Proof Roller Used For Seating

Table II

Research Sections

Section	Cracking Size	Overlay	Sta. to Sta.	Length
1	1.2 m x 1.5 m (4 ft x 5 ft)	10 cm (4 in)	52+79 - 60+59	238 m (780 ft)
2	None	7.6 cm (3 in)	60+59 - 70+59	305 m (1000 ft)
3	None	5 cm (2 in)	70+59 - 80+59	305 m (1000 ft)
4	0.6 m x 0.9 m (2 ft x 3 ft)	7.6 cm (3 in)	80+59 - 106+49	789 m (2590 ft)
5	1.2m x 1.5m (4 ft x 5 ft)	7.6 cm (3 in)	106+49 - 132+39	789 m (2590 ft)

The three test sections were cracked and seated into additional subsections as follows (see Table II):

5A. Sta. 132+39 to Sta. 116+00: two passes per lane with breaker, 39.4 cm (15.5 in) drop, 1.8 m (6 ft) space between drops to obtain 1.2 m x 1.5 m (4 ft x 5 ft) pieces. This produced continuous longitudinal cracks (Figure 4).

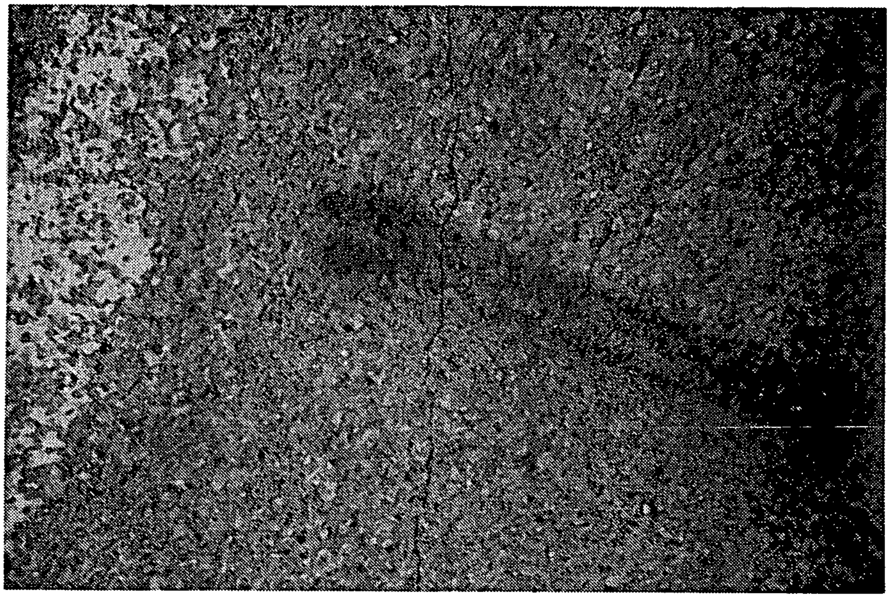


Figure 4 - Cracking Pattern
Sta. 132+39 to Sta. 116+00

5B. Sta. 116+00 to Sta. 106+49-SB lane: one pass with breaker, 46 cm (18 in) drop, 1.7 m (5.5 ft) to 1.8 m (6 ft) space between drops to obtain 1.2 m x 1.5 m (4 ft x 5 ft) pieces. There were some problems with longitudinal cracking and crack uniformity for the entire 1/2 lane.

4A. Sta. 116+00 to Sta. 106+49-NB lane: one pass with breaker, 39.4 cm (15.5 in) drop, 1.7 m to 1.8 m (5.5 ft to 6 ft) space between drops to obtain 1.2 m x 1.5 m (4 ft x 5 ft) pieces. The pavement did not crack uniformly at centerline.

4B. Sta. 106+49 to Sta. 106+00-NB lane: two passes with breaker, 61 cm (24 in) drop, 1.1 m (3.5 ft) space between drops to obtain 0.3 m x 0.3 m (1 ft x 1 ft) pieces. The intended size was 0.6 m x 0.9 m (2 ft x 3 ft) pieces.

4C. Sta. 106+00 to Sta. 95+00-NB lane: two passes with breaker, 44.5 cm (17.5 in) drop, 1.2 m (4 ft) space between drops to obtain 0.6 m x 0.9 m (2 ft x 3 ft) pieces. This produced continuous longitudinal cracks.

4D. Sta. 95+00 to Sta. 80+59-NB lane, and Sta. 106+49 to Sta. 100+00 SB lane: two passes with breaker per lane, 34.3 cm (13.5 in) drop, 1.2 m (4 ft) space between drops to obtain 0.6 m x 0.9 m (2 ft x 3 ft) pieces. Piece size fell below the intended 0.6 m x 0.9 m (2 ft x 3 ft) size in some areas.

4E. Sta. 100+00 to Sta. 80+59-SB lane: one pass per lane and one pass on centerline with breaker, 34.3 cm (13.5 in) drop, 1.2 m (4 ft) space between drops to obtain 0.6 m x 0.9 m (2 ft x 3 ft) pieces. This produced very good results.

1A. Sta. 60+59 to Sta. 52+79-both lanes: one pass per lane and one pass on centerline with breaker, 34.3 cm (13.5 in) drop, 1.8 m (6 ft) space between drops to obtain 1.2 m x 1.5 m (4 ft x 5 ft) pieces. Depth of cracking in this area was verified by core samples (Figure 5).

Figure 5 - Cores Taken From Sta. 60+59 to Sta. 52+79

PREPARATION OF BASE

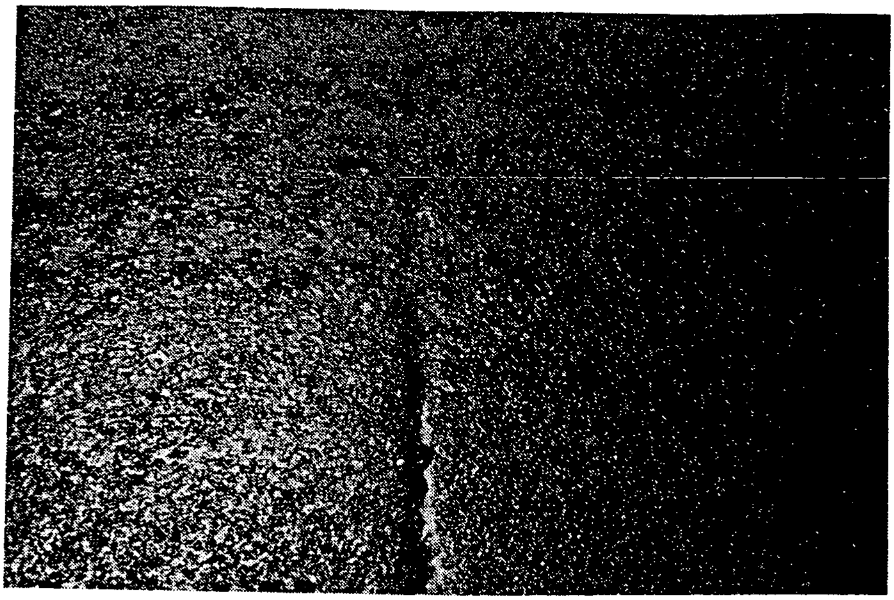
After cracking and seating, all existing asphalt surface patches were removed. The base was then swept and all cracks were blown out with an air compressor to remove all loose foreign material.

PATCHES, ASPHALT CEMENT CONCRETE 10 mm (3/8 in) MIX

The contractor applied a RC-70 tack coat on the PCC pavement at the rate of 450 cm^3/m^2 (0.10 gal per sq yd). The contractor then placed 48 metric tons (53 tons) of asphalt cement concrete (ACC) 10 mm (3/8 in) mix with a motor patrol and compacted it with two pneumatic-tired rollers. The 10 mm (3/8 in) mix was applied to fill all existing cracks and depressions (Figure 6). This interlocks the pieces in the existing PCC pavement and reduces the amount of movement of the irregular pieces of broken concrete. It also reduces the expected depressions over existing transverse cracks created by the vibratory roller on the new surface.

Figure 6

Cracks filled with 10 mm (3/8 in) mix on existing PCC surface



TYPE B, CLASS I ASPHALT CEMENT CONCRETE RESURFACING

The contractor placed the ACC overlay in two lifts varying in depth from 3.8 cm (1.5 in) to 5 cm (2 in), except from Sta. 70+59 to Sta. 80+59, which was placed in one 5 cm (2 in) lift. The asphalt overlay was placed full width 6.7 m (22 ft) with a Blaw-Knox paver. One vibratory and one static steel roller was used to obtain the required 97% of lab density.

ROAD RATER SUMMARY

Road Rater™ testing has been conducted annually on the entire project. The Road Rater is a dynamic deflection measuring device used to determine the structural adequacy of pavements (Figure 7). The difference in pavement structural ratings from year to year may be explained by the fact that annual testing is performed in the outside wheeltrack during the months of April and May when the roadway exhibits the greatest instability. Thus, the structural rating can vary from one year to the next depending upon the amount of moisture in the soil at the time of testing. For the most part, a high structural rating will correspond with a thicker overlay.

There are different ways of analyzing this data. Table III shows the average annual structural rating as well as the overall average per test section. The difference in results seems to be statistically insignificant.

Table III

Road Rater Summary

Section	1987	1988	1989	1991	1992	Ave.
1	2.94	2.90	2.90	2.68	2.32	**2.75**
4	2.89	2.87	2.80	2.59	2.22	**2.67**
5	2.85	2.65	2.68	2.28	2.06	**2.50**

The data may also be analyzed with the cracking pattern and frequency of cracking taken into account. Figure 8 indicates a higher structural rating when only 1 pass per lane is made with the breaker unit for the 0.6 m x 0.9 m (2 ft x 3 ft) cracking pattern. The same holds true for the 1.2 m x 1.5 m (4 ft x 5 ft) cracking pattern in Figure 9.

Another important aspect worth noting is the average loss in structural capacity as a result of the crack and seat process. Deflection measurements were taken both before and after the C & S process for analysis (Table IV). The data indicates an average loss of structural capacity between 34 and 38 percent when comparing cracking patterns or the frequency of cracking per lane.

Figure 7

Table IV

Structural Capacity

Frequency	Cracking Pattern	Before C & S	After C & S	After Overlay	% Loss
1 pass/lane & on ℄	.6m x .9m (2 ft x 3 ft)	2.70	1.75	2.30	35
1 pass/lane & on ℄	1.2m x 1.5m (4 ft x 5 ft)	2.43	1.54	2.11	37
2 pass/lane	.6m x .9m (2 ft x 3 ft)	2.56	1.51	2.03	41
2 pass/lane	1.2m x 1.5m (4 ft x 5 ft)	2.68	1.88	2.22	30
1 pass/lane	1.2m x 1.5m (4 ft x 5 ft)	2.22	1.41	1.88	36

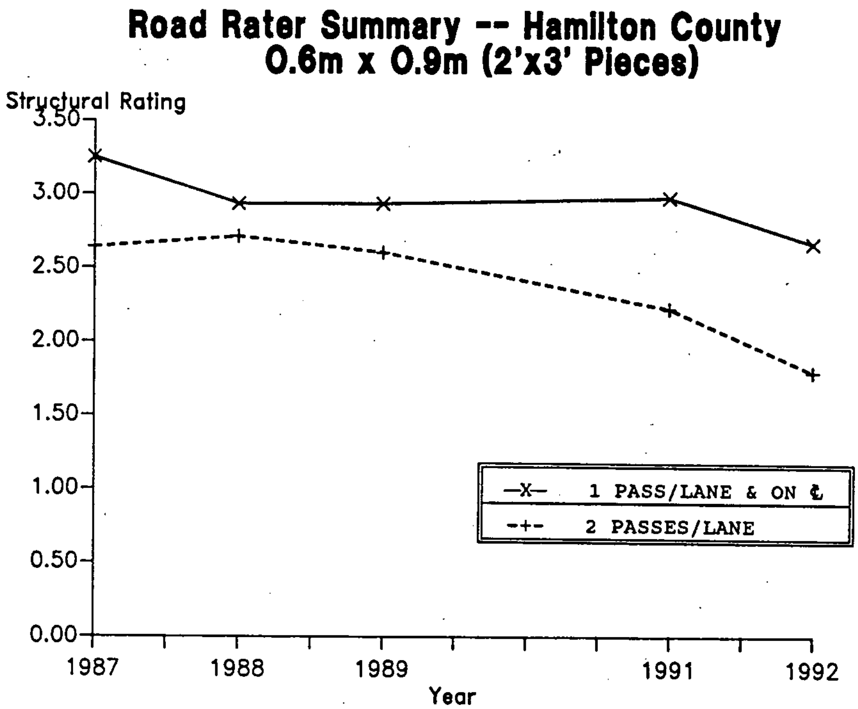


Figure 8

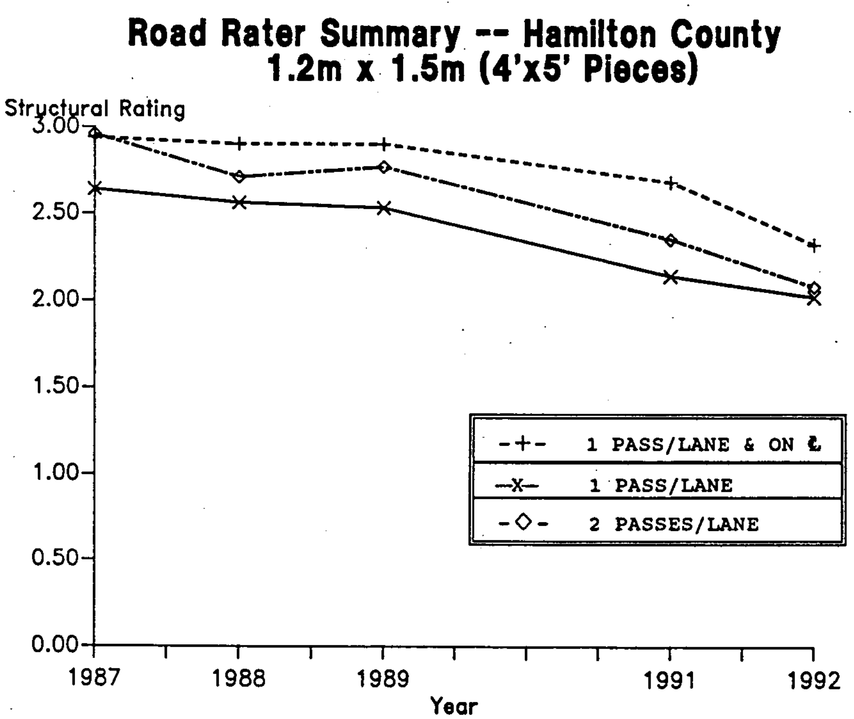


Figure 9

CRACK SURVEY

A detailed crack survey of the underlying PCC pavement was conducted prior to the overlay, as were annual surveys since the completion of the project in 1986. Table V shows the comparison between sections of total meters of cracks and joints per road station.

Table V

Total Meters of Cracks and Joints per Road Station

Section	Transverse	Longitudinal
1	15	66
2	20	62
3	12	62
4	15	54
5	17	52

The annual crack surveys were analyzed and the percentage of reflected cracks (joints as well as the percentage of new cracks per road station) were determined.

Figure 10 indicates that test section 4 experienced the least severity of reflective transverse cracking even out-performing section 1 with a 10 cm (4 in) ACC overlay. Accordingly, the control section 3 with only a 5 cm (2 in) overlay exhibited the greatest severity of reflective and new transverse cracking.

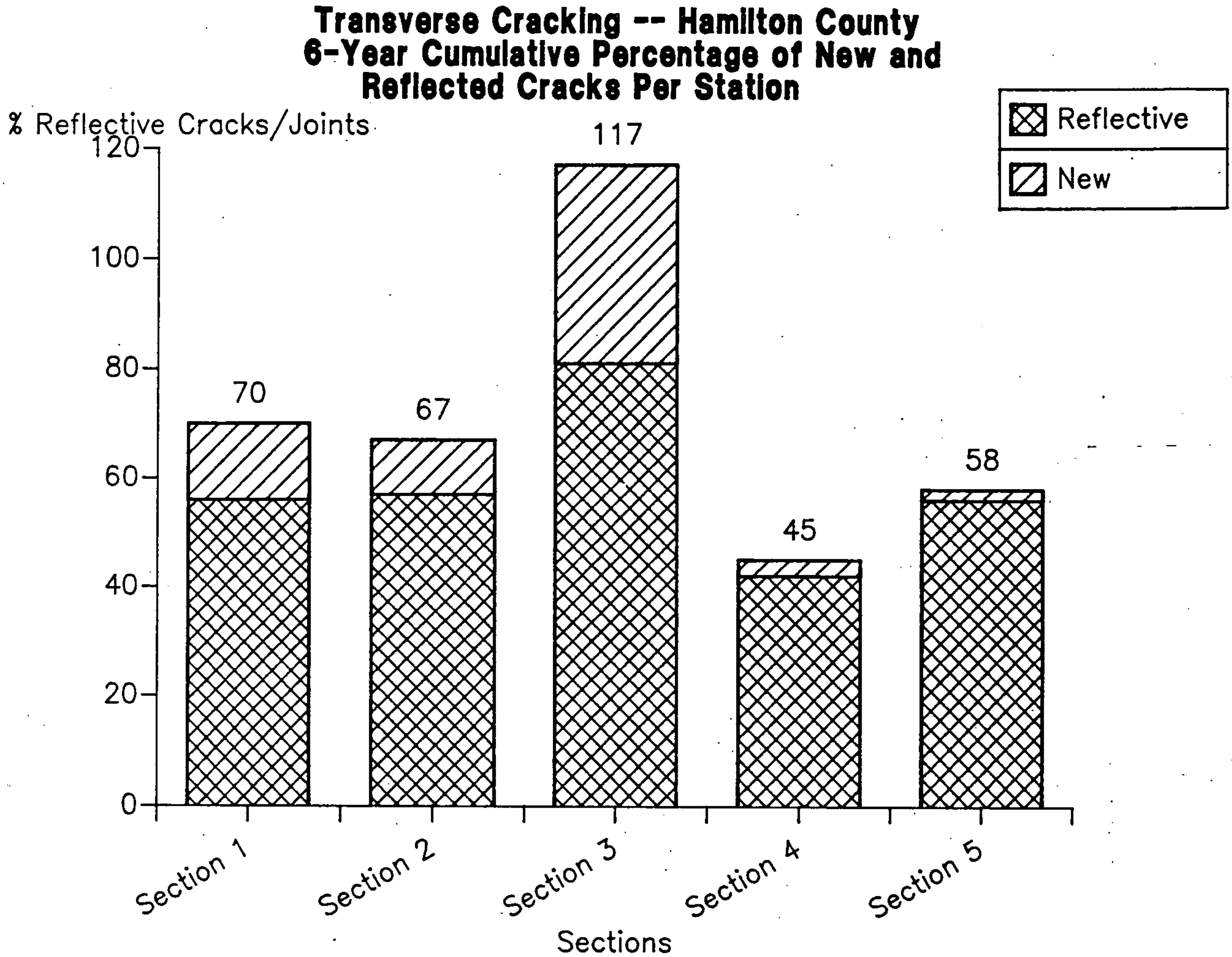


Figure 10

Figure 11 shows that test section 4 also experienced the least severity of reflective longitudinal cracking. Again, control section 3 exhibited the greatest severity of reflective longitudinal cracking. It is interesting to note that test section 1 with a 10 cm (4 in) ACC overlay fared slightly worse than section 4 with a 7.6 cm (3 in) overlay.

Longitudinal Cracking -- Hamilton County
6-Year CumulativePercentage of New and
Reflected Cracks per Station

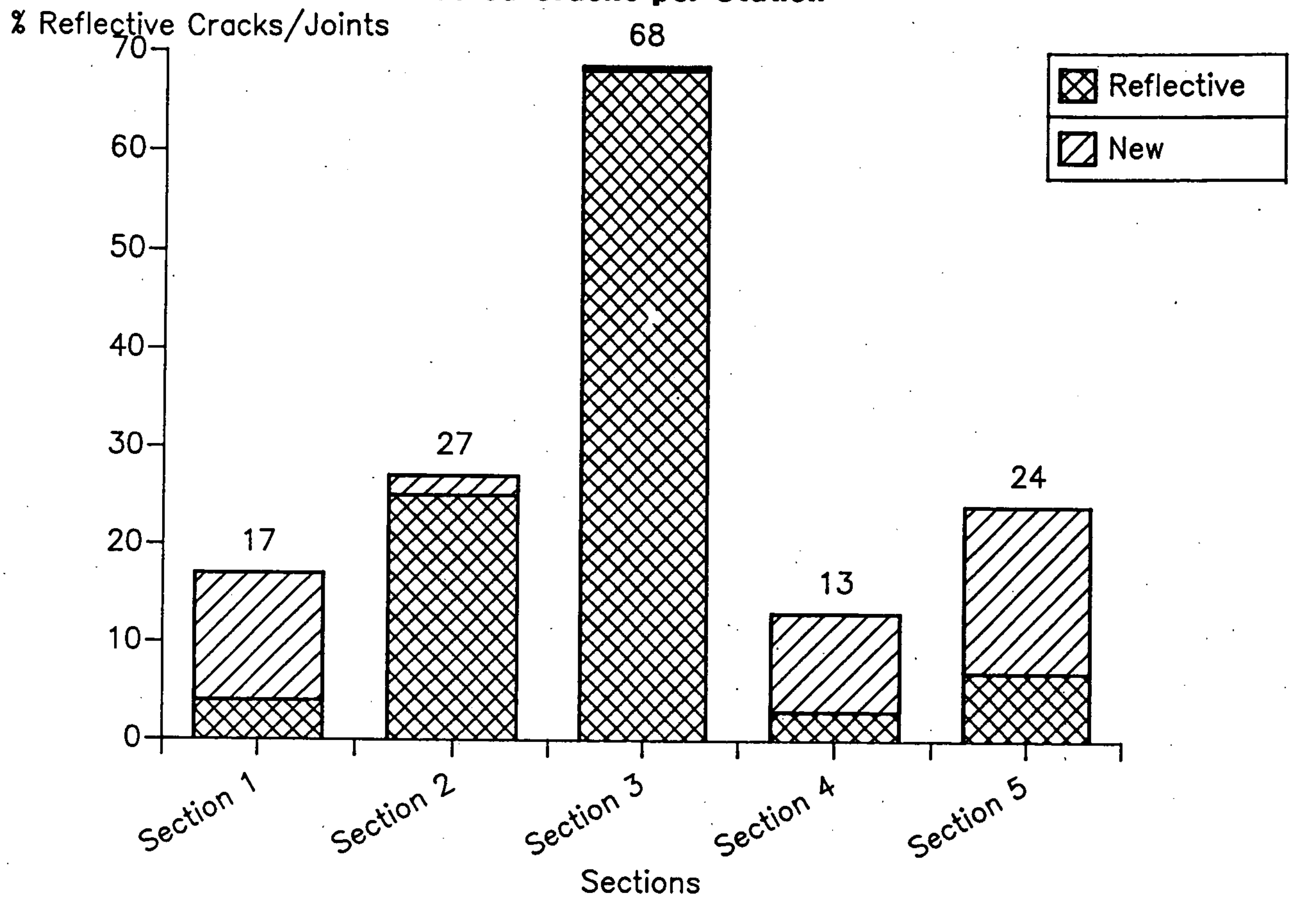


Figure 11

DISCUSSION

The C & S method of pavement rehabilitation, at the time of construction, lacked an established structural design criteria. Since that time, however, a new design guide was put out by the American Association of State and Highway and Transportation Officials (AASHTO) in 1986 to address this rehabilitation technique. The overlay thicknesses chosen for this project, however, were based on engineering judgement and experience derived from previous overlay projects.

A major design consideration was the optimum size of cracked pieces. Typically, smaller pieces reduce the amount of reflection cracking due to thermal effects. However, cracked pieces that are too small may reduce the overall structural strength of the concrete. The objective of this research project was to evaluate the effectiveness of various cracking sizes and patterns with different thicknesses of ACC overlays.

It is interesting to note that C & S test section 1 with the 10 cm (4 in) overlay thickness had actually a higher percentage of reflected cracks over the joints than section 4 with a 7.6 cm (3 in) ACC overlay. The significant difference is that section 4 had nominal 0.6 m x 0.9 m (2 ft x 3 ft) pieces compared with nominal 1.2 m x 1.5 m (4 ft x 5 ft) pieces in section 1. This seems to support empirical data from other C & S projects nationally that cracked slab lengths of 60 cm (24 in) to 107 cm (42 in) are most effective in reducing initial reflective cracks. Note that the control section 2 had less severe transverse overall cracking than test section 1 with a 10 cm (4 in) overlay thickness.

The Iowa DOT Road Rater™ results for structural capacity further support empirical data concerning the optimum range or size of slab pieces. A glance at Table III indicates that even though both section 4 and 5 have a 7.6 cm (3 in) ACC overlay, section 4 with the 0.6 m x 0.9 m (2 ft x 3 ft) pieces had consistently higher structural ratings than section 5 with

1.2 m x 1.5 m (4 ft x 5 ft) pieces. Only section 2 had a significantly higher structural rating. A 7.6 cm (3 in) ACC overlay coupled with adequate subgrade support may explain this higher structural value.

The actual cost for the crack and seat procedure on this project was a reasonable $0.66 per square meter ($0.55/sq. yd.). The cost for other projects may be higher according to the experience of the contractor. The cost effectiveness of additional overlay thickness over cracked and seated PCC pavements may be determined with more years of observation.

CONCLUSIONS

1. The best cracking pattern to retain aggregate interlock was obtained with one pass per lane and one pass on centerline with the breaker. The optimum drop height was 34 cm (13.5 in) with a spacing between drops of 1.2 m to 1.8 m (4 ft to 6 ft) depending upon the piece size desired. This cracked the 15 cm (6 in) PCC pavement full depth but left the aggregate interlocked.

2. The most effective cracking size in retarding reflective cracking was the area of 0.6 m x 0.9 m (2 ft x 3 ft).

3. Crack and seat section 4 with 0.6 m x 0.9 m (2 ft x 3 ft) pieces and a 7.6 cm (3 in) ACC overlay exhibited an average 33 percent reduction in new and reflective transverse cracking per road station after 6 years when compared to

control section 2 with the same overlay thickness. However, roughly 42 percent of the underlying cracks/joints still reflected through after 6 years.

4. Crack and seat section 4 also exhibited an average 52 percent reduction in new and reflective longitudinal cracking per road station after 6 years when compared to control section 2 with the same overlay thickness. Additionally, only 3 percent of the underlying longitudinal cracks/joints reflected through after 6 years.

5. The crack and seat procedure resulted in an average 34-38 percent loss of pavement structural capacity prior to overlaying. This was true whether comparing between cracking pattern sizes or frequency of passes with the pavement breaker.

6. In all instances, the crack and seat procedure did delay or reduce reflection cracking when compared to the control sections.

RECOMMENDATIONS

1. Try thicker ACC overlays placed over C & S sections with a minimum 10 cm (4 in) thickness.

2. Use a softer grade asphalt cement (i.e., AC-5) on low volume roads to reduce reflection cracking due to climatic effects.

3. A separate test section should be constructed to validate the specified cracking pattern desired before proceeding with the entire project.

4. Traffic should not be allowed to travel over the cracked and seated pavement where subgrade support is poor. This may cause unseating of the pieces.

5. Cracked sizes of 0.6 m to 0.9 m (2 ft to 3 ft) seem to be most effective at delaying reflective cracking. However, the environment, age of the pavement, and traffic all need to be considered for each individual project.

ACKNOWLEDGEMENT

The author wishes to extend appreciation to the Hamilton County Board of Supervisors and the Iowa DOT Highway Division for their support in developing and conducting this project. Thanks also go to Hamilton County personnel for the extra effort put forth; the Mathy Construction Company and the Antigo Construction Company, Inc. for their cooperation; and Vernon Marks and Kathy Davis of the Iowa DOT Materials Research Office for their assistance in preparation of this report.

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2. Carpenter, Samuel H. and Darter, Michael I., Field Performance of Crack and Seat Projects, Transportation Research Record 1215, January 1989.

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4. Stark, Larry M., Cracking and Seating PCC Pavement Prior to Resurfacing to Retard Reflection Cracking, Construction Report, Iowa Highway Research Board, 1987.

APPENDIX A

Project Contract

FORM 650019 8-77 H-384

CONTRACT

NO. 25105

TYPE OF WORK ASPH. CEMENT CONC. RESURF. PROJECT NO SN-3492(2)--51-40

MILES 1.508 COST CENTER 801000 OBJECT 860

COUNTY HAMILTON

ON SECONDARY ROAD R33 FROM APPROXIMATELY 0.5 MILES NORTH OF WEBSTER CITY NORTHERLY 1.5 MILES TO THE JCT OF SECONDARY ROAD D20.

THIS AGREEMENT MADE AND ENTERED BY AND BETWEEN THE COUNTY OF HAMILTON, IOWA

PARTY OF THE FIRST PART, AND

MATHY CONST. CO. OF ONALASKA, WISCONSIN 28500

PARTY OF THE SECOND PART.

WITNESSETH, THAT THE PARTY OF THE SECOND PART, FOR AND IN CONSIDERATION OF $ ****109,459.01 PAYABLE AS SET FORTH IN THE SPECIFICATIONS CONSTITUTING A PART OF THIS CONTRACT, HEREBY AGREES TO CONSTRUCT VARIOUS ITEMS OF WORK AND, OR, VARIOUS MATERIALS OR SUPPLIES IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS THEREFORE, AND IN THE LOCATIONS DESIGNATED IN THE NOTICE TO BIDDERS AS FOLLOWS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	INCLUDES CRACKING AND SEATING OF P.C.C. PAVEMENT				
1	CRACKING AND SEATING OF P.C.C. PAVEMENT, AS PER PLAN	14,569	SQ. YDS.	.55	8,012.9
2	MOBILIZATION		LUMP SUM		2,900.0
3	PRIMER OR TACK-COAT BITUMEN	3,405	GALS.	1.00	3,405.0
4	BASE, TYPE B CLASS 1 ASPHALT CEMENT CONCRETE	3,145	TONS	13.16	41,388.2
5	ASPHALT CEMENT	196	TONS	201.34	39,462.6
6	SHOULDERS, GRANULAR SURFACING OF	1,338	TONS	9.00	12,042.0
7	BASE, CLEANING & PREPARATION OF	1.508	MILES	100.00	150.8
8	SAMPLES		LUMP SUM		400.0
9	PATCHES, ASPHALT CEMENT CONCRETE SURFACE	121	TONS	14.02	1,696.4
10	STOCKPILED MATERIALS	1	ONLY	1.00	1.0
			GRAND TOTAL		$109,459.0

PARTY OF THE SECOND PART CERTIFIES BY HIS SIGNATURE ON THIS CONTRACT, UNDER PAIN OF PENALTIES FOR FALSE CERTIFICATION, THAT HE HAS COMPLIED WITH 324.17(8) OF THE 1975 CODE OF IOWA AS AMENDED IF APPLICABLE

SAID SPECIFICATIONS AND PLANS ARE HEREBY MADE A PART OF AND THE BASIS OF THIS AGREEMENT, AND A TRUE COPY OF SAID PLANS AND SPECIFICATIONS IS NOW ON FILE IN THE OFFICE OF THE PARTY OF THE FIRST PART UNDER DATE OF JANUARY 10, 1986

THAT IN CONSIDERATION OF THE FOREGOING, THE PARTY OF THE FIRST PART HEREBY AGREES TO PAY THE PARTY OF THE SECOND PART, PROMPTLY AND ACCORDING TO THE REQUIREMENTS OF THE SPECIFICATIONS THE AMOUNTS SET FORTH, SUBJECT TO THE CONDITIONS AS SET FORTH IN THE SPECIFICATIONS

THE PARTIES HERETO AGREE THAT THE NOTICE AND INSTRUCTIONS TO BIDDERS, THE PROPOSAL FILED HEREIN, THE GENERAL SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION FOR 1984 TOGETHER WITH SPECIAL PROVISIONS ATTACHED, TOGETHER WITH THE GENERAL AND DETAILED PLANS, IF ANY, FOR SAID PROJECT SN-3492(2)--51-40 , TOGETHER WITH SECOND PARTY'S PERFORMANCE BOND, ARE MADE A PART HEREOF, AND TOGETHER WITH THIS INSTRUMENT CONSTITUTE THE CONTRACT BETWEEN THE PARTIES HERETO.

THAT IT IS FURTHER UNDERSTOOD AND AGREED BY THE PARTIES OF THIS CONTRACT THAT THE ABOVE WORK SHALL BE COMMENCED OR COMPLETED IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

APPROX. OR SPECIFIED STARTING DATE OR NUMBER OF WORKING DAYS	SPECIFIED COMPLETION DATE OR NUMBER OF WORKING DAYS
30 WORKING DAYS	AUG. 29, 1986

THAT TIME IS THE ESSENCE OF THIS CONTRACT AND THAT SAID CONTRACT CONTAINS ALL OF THE TERMS AND CONDITIONS AGREED UPON BY THE PARTIES HERETO.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE SET THEIR HANDS FOR THE PURPOSE HEREIN EXPRESSED TO THIS AND THREE OTHER IDENTICAL INSTRUMENTS AS OF THE 11th DAY OF February 19 86

COUNTY OF HAMILTON, IOWA

BY Marvin D. Johnson
PARTY OF THE FIRST PART

MATHY CONST. CO. OF ONALASKA, WISCONSIN

BY Steve C. Mathy Vice President
PARTY OF THE SECOND PART

Approved:

Robert N. Pratt FEB 12 1986

Asst Contracts Engineer Date

IOWA DEPT. OF TRANSPORTATION

APPENDIX B

1986 Special Provisions for PCC Cracking and Seating

SPECIAL PROVISIONS FOR PCC CRACKING & SEATING

1. DESCRIPTION: The work shall consist of cracking and seating existing concrete pavement as specified on the plans prior to the placement of a Type B, Class I asphalt cement concrete base overlay.

2. EQUIPMENT: The device to be used for cracking the concrete pavement will be an impact hammer. The hammer should be capable of producing enough energy to create hairline cracks throughout the full depth of the existing pavement. The hammer shall be equipped with a plate-type shoe designed to prevent penetration into the existing surface. Care shall be taken to prevent the formation of spalled areas and continuous longitudinal cracks.

   After breaking, the broken concrete shall be rolled with a pneumatic-tire proof roller weighing a minimum of 45,400 kg (50 tons). The roller shall be one of the following types:

   (1) The roller may be a pneumatic tire roller consisting of four rubber-tired wheels equally spaced across the full width and mounted in line on a rigid steel frame in such manner that all wheels carry equal loads, regardless of surface irregularities. Roller tires shall be capable of satisfactory operation at a minimum inflation pressure of 690 kPa (100 psi), and tires shall be inflated to the pressure necessary to obtain

proper surface contact pressure to satisfactorily seat pavement slabs. At the contractor's option, tires may contain liquid. The roller shall have a body weight suitable for ballasting to a gross load of 45,400 kg (50 tons), and ballast shall be such that gross roller weight can be readily determined and so controlled as to maintain a gross roller weight of 45,400 kg (50 tons). The roller shall be towed with a rubber-tired prime mover.

(2) The roller may be a two-axle self-propelled pneumatic-tired roller, providing the roller is equipped with no more than 7 tires, and the requirements in (1) above concerning tire inflation pressure, surface contact pressure, and 45,400 kg (50 ton) gross weight are met.

Rolling shall continue until surface material is well seated and is thoroughly and uniformly compacted as directed by the engineer.

3. <u>CRACK VERIFICATION</u>: The engineer will designate test sections. The contractor shall crack the test sections using varying energy and striking patterns until a satisfactory cracking pattern is established. The contractor shall furnish and apply water as directed by the engineer to verify that the specified crack pattern is being maintained.

Adjustments shall be made to the energy or striking pattern when the engineer deems it necessary, based on the check sections. The contractor is to furnish and apply water as incidental to cracking and seating.

4. <u>CLEANING</u>: Prior to the placement of 10 mm (3/8 in) asphalt mix, the pavement shall be cleaned by power sweeping and air blowing (including removal of loose material from joints, cracks and bituminous patched areas) with 690 kPa (100 psi) nominal air pressure.

5. <u>MEASUREMENT AND PAYMENT</u>: The area of existing PCC pavement acceptably cracked and seated will be measured in square yards. The width will be the actual width of the existing PCC pavement and the length will be measured horizontally along the centerline. Payment for the measured area at the contract unit price shall be full compensation for furnishing all labor, equipment, materials, water and incidentals necessary to acceptably crack and seat the existing PCC pavement.

APPENDIX C

1992 Crack and Seat Specification

Section 2216. Cracking and Seating Concrete Pavement

2216.01 DESCRIPTION.
This work shall consist of cracking and seating existing PCC pavement, prior to resurfacing with ACC. Associated work may include removal of an existing ACC overlay if present, subdrain construction, ACC resurfacing, and shoulder work.

2216.02 EQUIPMENT.
Cracking equipment shall be capable of producing the desired cracking pattern by providing a broad striking surface. Equipment that punches holes in the pavement or results in excessive spalling of otherwise sound sections shall not be used. A blade or spade type breaker is recommended and may be required.

Seating equipment shall be a roller meeting requirements of either Paragraph A or B, as follows:

A. The roller shall be a pneumatic tired roller consisting of four rubber tired wheels equally spaced across the full width and mounted in line on a rigid steel frame in such manner that all wheels carry equal loads, regardless of surface irregularities. Roller tires shall be capable of satisfactory operation at a minimum inflation pressure of 100 psi, and tires shall be inflated to the pressure necessary to obtain proper surface contact pressure to satisfactorily seat pavement slabs. At the Contractor's option, tires may contain liquid.

The roller shall have a weight body suitable for ballasting to a gross load of 50 tons, and ballast shall be such that gross roller weight can be readily determined and so controlled as to maintain a gross roller weight of 50 tons. The roller shall be towed with a rubber tired prime mover.

B. The roller shall be a two axle, self propelled, pneumatic tired roller, provided the roller is equipped with no more than seven tires, and the requirements in Paragraph A, above, concerning tire inflation pressure, surface contact pressure, and 50 ton gross weight are met.

Miscellaneous equipment shall include a means to dampen cracked pavement with water, a source of compressed air with 100 psi. pressure, a rotary broom described in Article 2001.14, and various hand tools as needed.

2216.03 REMOVAL OF EXISTING ASPHALT CEMENT CONCRETE OVERLAY.
All asphaltic and other bituminous material existing on the pavement surface shall be removed from the area to be cracked before cracking. Removal shall be a continuous operation, but removal of asphaltic full depth patches is not required. Removal shall be to the underlying PCC pavement and in accordance with requirements of Section 2214, excluding Article 2214.05.

Foamed material in existing pressure relief joints shall be removed prior to removal of the ACC overlay.

Scarification shall be to the full width of the lane, with a suitable runout at the end, before the lane is opened to public traffic. Scarification shall be planned and done so as to leave no vertical drop-off at the center line or lane line overnight. Where an overnight drop-off results from unforeseen conditions, the approaches shall be signed with a ROAD WORK AHEAD sign, and the drop-off shall be marked with vertical panels. The vertical panels shall be placed at 150 foot intervals in rural areas and at 50 foot intervals in urban areas, with a minimum of three vertical panels at each drop-off location.

Additional scarification of the existing PCC pavement may be required at bridge approaches and other fixed objects, as designated in the contract documents.

2216.04 PAVEMENT CRACKING.
The existing PCC pavement shall be cracked so as to produce full depth, generally transverse. hairline cracks at a nominal spacing designated in the contract documents. When not designated, the spacing shall be 1-1/2 feet to 3 feet. Induced cracking closer than 2-1/2 feet from an existing crack or joint or deteriorated concrete shall be avoided. Care shall be taken to prevent the formation of a continuous longitudinal crack.

When cracking operations begin, the Engineer will designate test sections of approximately 100 feet. The Contractor shall crack the test sections using varying energy and striking patterns until a satisfactory cracking pattern is established. This energy and striking pattern shall then be used for the remainder of the project unless the Engineer determines that a satisfactory cracking pattern is no longer being produced. Adjustments shall then be made to the energy and/or striking pattern as necessary to re-establish a satisfactory cracking pattern.

The Contractor shall furnish and apply water to the test area to dampen the pavement following cracking to enhance visual determination of the cracking pattern. The Contractor shall furnish and apply water to check stations, as directed by the Engineer, to verify that the specified crack pattern is being maintained. This will normally be once a day. Furnishing and applying this water will be incidental, and it will not be paid for separately.

Cracking equipment shall not be operated on a bridge, and areas in a bridge approach section or within 3 feet of a fixed object shall not be cracked.

Before opening to traffic, areas of cracked pavement shall be seated then cleaned of loose or spalled material by sweeping and by blowing joints and cracks with compressed air. This cleaning shall be repeated, as necessary, until the ACC resurfacing is placed.

2216.05 PAVEMENT SEATING.
Seating of the cracked pavement shall be done as shown in the contract documents and as required by the Engineer.

The cracked pavement shall be rolled until seating of the cracked pavement is assured to the satisfaction of the Engineer. The intentions are to weight the roller such that satisfactory seating can be reasonably assured by one complete coverage by the roller and to accomplish seating with a minimum damage to aggregate interlock at the cracks. The weight of the roller and the rolling pattern, including laps, will be established by the Engineer, based on one or more initial test sections.

2216.06 LIMITATIONS.
The Contractor shall use every reasonable means to protect persons and vehicles from injury or damage that might occur because the Contractor's operations. During the construction, the Contractor shall provide traffic control as required by the contract documents. Articles 1107.08 and 1107.09 shall also apply.

The road shall be kept open to traffic. Except when an accelerated work schedule is required, no work will be permitted on Sundays and holidays. The Contractor may restrict traffic to one lane from 1/2 hour after sunrise to 1/2 hour before sunset but shall permit traffic to pass safely at all times, except for occasional, unavoidable interruptions. Equipment shall not extend into a lane open to traffic except the minimum distance necessary to perform the required work in the closed lane.

This work should be carefully staged to minimize the time public traffic is to drive on pavement where the pavement work is only partially completed. The removal of existing ACC overlay shall not be started more than 2 weeks before the succeeding operation is scheduled to begin. The pavement cracking shall not be started more than 2 weeks before the overlay operation of the cracked and seated area is scheduled to begin.

Cracked and seated areas are to be overlaid with the full thickness of ACC, required by the contract, before a winter suspension.

The Contractor's attention is directed to Article 1105.12. If the operation of the seating roller over a culvert is to be restricted according to Paragraph G, this will be designated in the contract documents.

2216.07 METHOD OF MEASUREMENT.

The Engineer will calculate the area of cracking and seating, satisfactorily completed, from the length and the nominal width. For areas cracked and seated according to the contract documents, the quantity shown in the contract documents will be used.

2216.08 BASIS OF PAYMENT.

For the number of square yards of cracking and seating completed, the Contractor will be paid the contract price per square yard. This payment will be full compensation for cracking and seating and for furnishing all materials, equipment, and labor.