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Asphalt Emulsions for Highway Construction

Dubuque County, Iowa

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Initial Report

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CONSTRUCTION REPORT
IOWA HIGHWAY RESEARCH BOARD
PROJECT HR-216

ASPHALT EMULSIONS FOR HIGHWAY CONSTRUCTION
CONTRACT NO. DTFH71-80-55-IA-02
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION 15
DEMONSTRATION PROJECTS DIVISION
DEMONSTRATION PROJECT NO. 55

ASPHALT EMULSION BOUND MACADAM
DUBUQUE COUNTY PROJECT SN-4657(3)--51-31

BY

CHARLES L. BAULE, P.E.
DUBUQUE COUNTY ENGINEER

JANUARY, 1981

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ASPHALT EMULSION BOUND MACADAM
ASPHALT EMULSIONS FOR HIGHWAY CONSTRUCTION
DEMONSTRATION PROJECT NUMBER 55

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

INTRODUCTION

Recent years have presented a real financial challenge for highway departments. The energy shortage and rapid inflation have resulted in a severe reduction in proposed programs. The result has been an increased emphasis on investigating alternative roadway sections and construction procedures.

Many secondary roadway departments have utilized macadam base construction with varying degrees of success. Macadam base construction does appear to have a potential for providing the structural needs at a lower cost.

The recent macadam base projects have provided excellent drainage characteristics but there is an apparent lack of stability. Even when the base is properly rolled and keyed together, the large stones are easily displaced. The use of an asphalt emulsion binder may increase stability--while still providing a relatively low cost roadway base--and reduce energy consuming construction costs.

OBJECTIVE

The project objectives are:

1. Identify a cost effective asphalt emulsion bound macadam typical cross section.
2. Obtain useful data comparing seven typical cross sections.
3. Determine the effectiveness of engineering fabric placed under macadam roadbeds.
4. To evaluate the use of emulsions in surface seal coats. (See Appendix A)

PROJECT LOCATION

The project is located on Dubuque County Road D-53 from U.S. 151 south and easterly for 5.855 miles through Bernard, Iowa (See Appendix B). This highway serves as a feeder road from U.S. 151 to U.S. 61 and is a short cut across the country.

TRAFFIC DATA

Traffic counts vary on the roadway from 114 vehicles per day to 235 vehicles per day, with approximately 50% of the traffic being trucks. The growth rate of traffic will increase now that the roadway has been paved. The traffic prediction for 22 years hence is a 47.3% increase from 1978 traffic counts or a maximum of 346 VPD in the year 2000.

TEST SECTIONS

Test sections (See page 38) were the full width of the roadway base which was approximately 36 feet in width. Each test section was repeated along the 5.855 mile route. Under the first seven test sections, engineering fabric was placed in two 200 foot lengths. One fabric used was Bidim C22 (60 mils) and the other was True Tex MG-300 (110 mils).

Posts were placed near the fence to identify section and fabric locations.

Section 1: 2,400 feet and 2,100 feet of 2" Type B Class I asphaltic concrete 24 feet wide over a 6" asphalt treated base with granular shoulders that received a double seal coat for a shoulder surface.

Section 2: 2,405 feet and 2,100 feet of 2" Type B Class I asphaltic concrete, 24 feet wide over 6" of 3" x 3/4" asphalt emulsion bound macadam the full width of 36 feet and a double seal coat over the granular shoulders.

Section 3: 2,065 feet of 3" Type B Class I asphaltic concrete 24 feet wide over 6" emulsion bound macadam base the full width of the base area with a double seal coat on the granular shoulders. The intended repeat cross-section (1910 feet) was modified to 26 feet of emulsion bound macadam and plain macadam shoulders.

Section 4: 2,100 feet and 2,400 feet of 3" Type B Class I asphaltic concrete 24 feet wide placed over 2" of 3/4" choke stone the full width of the 6" macadam base section of the roadway, with a double seal coat on the granular shoulders.

Section 5: 2,100 feet and 2,400 feet of 3" asphalt emulsion bound choke stone 24 feet wide over 6" emulsion bound macadam the width of the base and granular shoulders. The final surface has a double seal coat from edge to edge of the roadway.

Section 6: 2,100 feet and 2,400 feet of 3" asphalt emulsion bound choke stone 24 feet wide over 2" of 3/4" Class A choke stone the full width of the 6" plain macadam base section with granular shoulders. There is a double seal coat over the entire surface from edge to edge of the roadway.

Section 7: 2,100 feet and 2,200 feet of 3" granular choke stone over the 6" plain macadam base with a double seal coat the width of the roadway.

ASPHALT TYPES USED

AC-10 asphalt was used for the asphaltic surface courses and the asphaltic base courses. Tack coats and prime coats were MC-70 liquid asphalts. Emulsions used were the High Float type HFE 150 for the emulsion bound macadam and the emulsion bound 3/4" choke stone. SS-1 emulsion was tried for the 3/4" choke stone and the 6" emulsion bound macadam with unsatisfactory results. High Float emulsion HFE 90 was used for all seal coating. All asphalt was obtained from Koch Asphalt Company Terminal at Dubuque, Iowa. The HFE 90 and HFE 150 fall in the AASHTO HFMS-2 range.

AGGREGATE USED

Aggregates were obtained from the following sources: Type B asphalt sand aggregate from Bellevue Sand and Gravel Co.; Crushed stone aggregate from Mar Jo Quarry, Beecher Quarries, Ltd., located at Sec. 5-88-3E Dubuque County.; Macadam aggregate was made by Beecher Quarries, Ltd. All macadam came from Sec. 22 and 23-87-1E Dubuque County. This aggregate was 3" to 3/4" in size. Three-fourths inch choke stone was made at the same quarry as the macadam aggregate. Granular shoulder stone and granular macadam choke stone was also made at the same quarry the macadam was manufactured. The washed aggregate limestone chips were manufactured at the quarry located in Sec. 35-87-2W in Dubuque County. See Appendix C for materials tests.

SEQUENCE OF CONSTRUCTION

The project started on August 14, 1980 and was completed on October 2, 1980. Tschiggfrie Excavating Company was the contractor. A copy of the contract is in Appendix D. The subgrade was prepared by Dubuque County maintenance forces. Three motor patrols shaped the 5.855 miles a week before the contractor started the project. The subgrade was checked by the Iowa Department of Transportation Road Rater for which data is shown in Appendix E. Special Provisions for the project are in Appendix F.

Section number 7 - Station 131+00 to 152+00 and 286+00 to 308+00 were started first. The 3" x 3/4" macadam was placed with a Jersey spreader attached to the front of a D7 Caterpillar tractor. The base was placed in 3 passes with the first two at the edges of the roadway. The center section was laid last, which caused a higher elevation of the center section. The contractor then bladed the center section with a motor patrol. This procedure was stopped because it caused segregation of the large and smaller rock and created voids larger than necessary on the surface of the macadam. This is not the recommended procedure to get the best results. The contractor changed the method of macadam placement after unsatisfactory results from the first few sections.

The contractor then placed the 3" x 3/4" macadam in three separate passes from left to right with no blading after placement with the Jersey spreader. This same procedure was used on the emulsion bound macadam to prevent segregation. After the 3" x 3/4" material was laid, the choke stone was placed on top, bladed, shaped and compacted. The top was primed with MC-70 asphalt and a double seal coat placed over the entire section. All base materials were placed from Station 214+00 to Station 308+00 before construction of the surface course in the respective sections.

In section number 6 - Station 111+00 to 131+00 and 262+00 to 286+00 the 3" x 3/4" macadam was placed the same as that in Section number 7. However, the 3/4" emulsion bound choke stone became a problem. A 3" lift of emulsion bound choke stone was placed in one lift with an asphalt paving machine. It was decided that this was too thick to allow the moisture to escape, so two lifts of 1-1/2" increments were used to achieve the desired design criteria. Both high float and SS-1 emulsions were tried, but neither successfully coated the choke stone. Therefore, the placement of the 3/4" emulsion choke material was stopped until a solution to the coating problem was found.

The final decision was to clean up the 3/4" stone which was screened from the 3" x 3/4" macadam stone. The specifications called for a maximum of 5% passing the #200 sieve; however, after field trials, it was determined that less than 4% passing the #200 sieve was required before the choke stone would coat properly.

It is very important that the material passing the #200 sieve is kept to a minimum. One percent can make a great deal of difference in the emulsion's coating ability. All emulsion bound materials were mixed in a Pioneer pug mill at the quarry site Sec. 22, 23-87-1E.

In Section number 5- Station 89+00 to 110+00 and 238+00 to 262+00 emulsion bound macadam--the 3" to 3/4" stone had the same coating problems as the 3/4" choke stone; the material passing the #200 sieve could not be more than 4%. The specifications had no limits on the #200 sieve but the more passing the #200 sieve, the worse the coating of the stone. Unusually high rainfall (page 32) during aggregate production substantially impaired screening efficiency resulted in problems of removing the fines from both the macadam and choke stone. This created a problem for the rock producer, Beecher Quarries, Ltd., where all large stones had to be screened to get the fines below 4% passing the #200 sieve. Once this was done, the coating was good on the large stone. High Float 150 was used on the large stone as was the SS-1. On this project, with the mixing procedures utilized, the better results were obtained with the high float emulsion. Based on laboratory results, increased moisture content of the aggregate (high rainfall) resulted in poorer aggregate coating. The emulsion bound macadam bases were laid with the Jersey spreader following the same procedure used with the plain macadam sections.

Section number 4 - Station 68+00 to 89+00 and 214+00 to 238+00 were placed the same as the plain macadam then choked off with 3/4" choke stone and surfaced with 3" of Type B Class I AC-10 asphaltic concrete. The granular shoulders were sealed with two coats of HFE 90 emulsion.

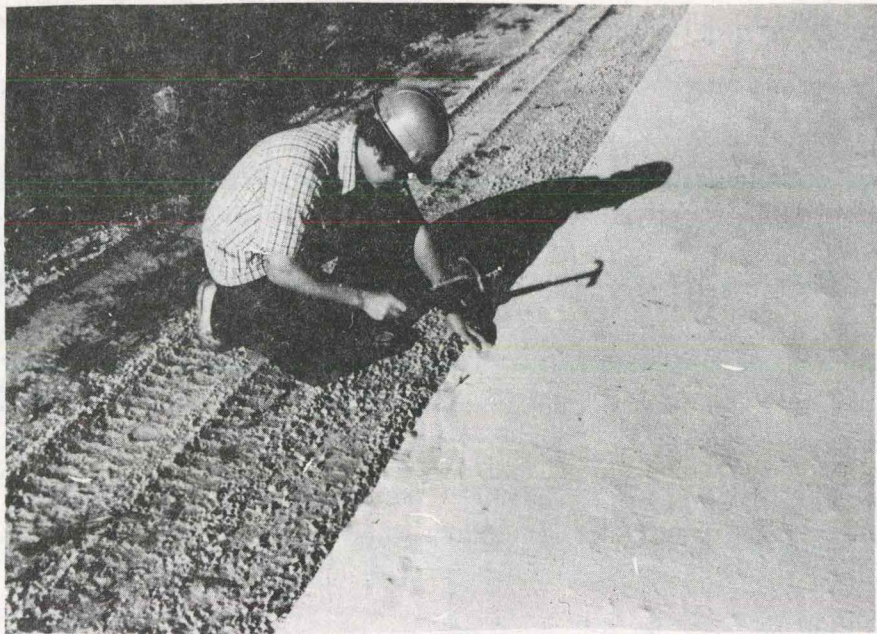
Section number 3 - Station 47+35 to 58+00 and 194+00 to 213+10 were designed to have a 3" Type B Class I AC-10 asphaltic concrete surface course. However, due to no choke stone on the emulsion bound macadam, it took approximately 4" of asphaltic concrete to obtain the 3" cover over the macadam. The Type B asphalt was placed with a standard asphalt paving machine.

Section number 2 - Station 23+00 to 47+05 and 173+00 to 194+00 were designed to have a 2" Type B Class I surface. It took about 3" of the Type B Class I AC-10 asphaltic concrete to cover the emulsion treated macadam.

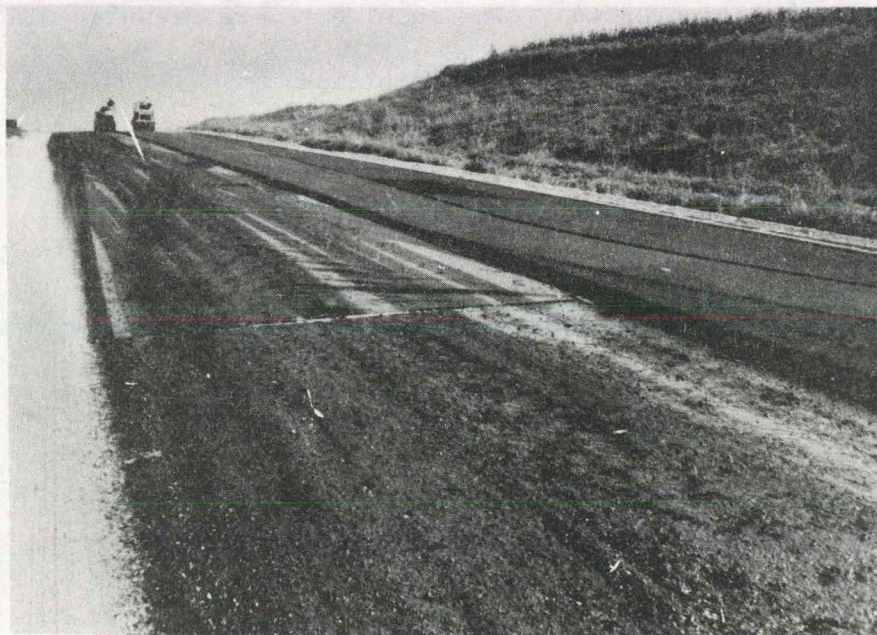
Section number 1 - Station 0+00 to 23+00 and 152+00 to 173+00 were 8" full depth asphalt construction. A 6" base was placed in 2-3" lifts and a 2" mat was placed on top. The shoulders were granular Class A stone and double seal coated with an HFE 90 emulsion.

PHOTOGRAPHS OF CONSTRUCTION

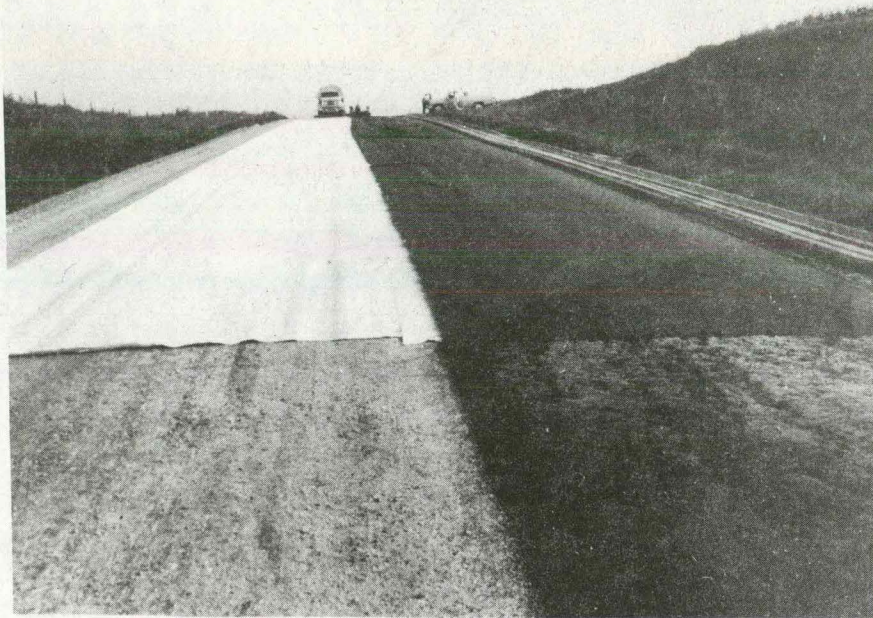
The following pages demonstrate the construction techniques used in the project.



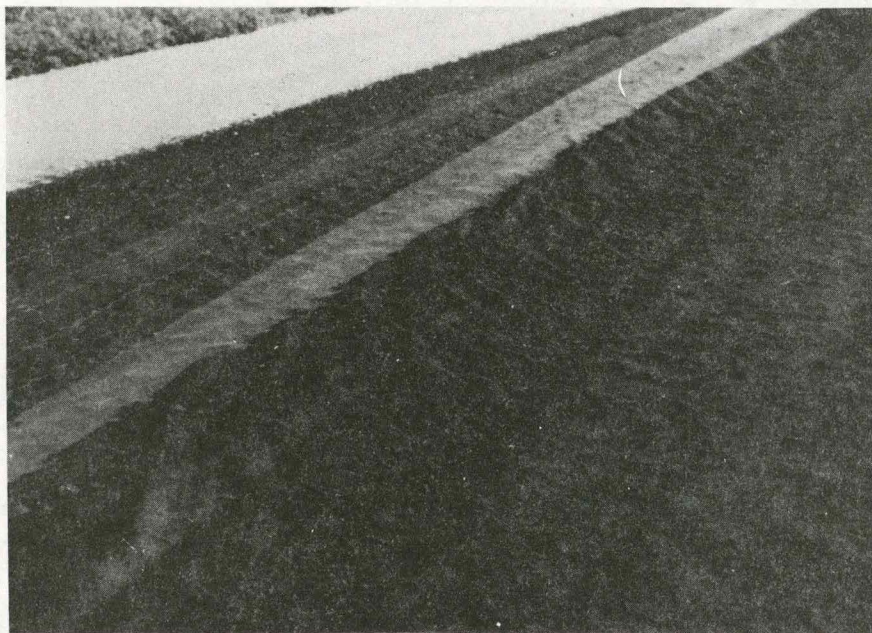
Iowa Department of Transportation employees placed the engineering fabric.



Engineering fabric at Station 10+00 to 12+00.



Spraying the fabric helped to hold it in place.



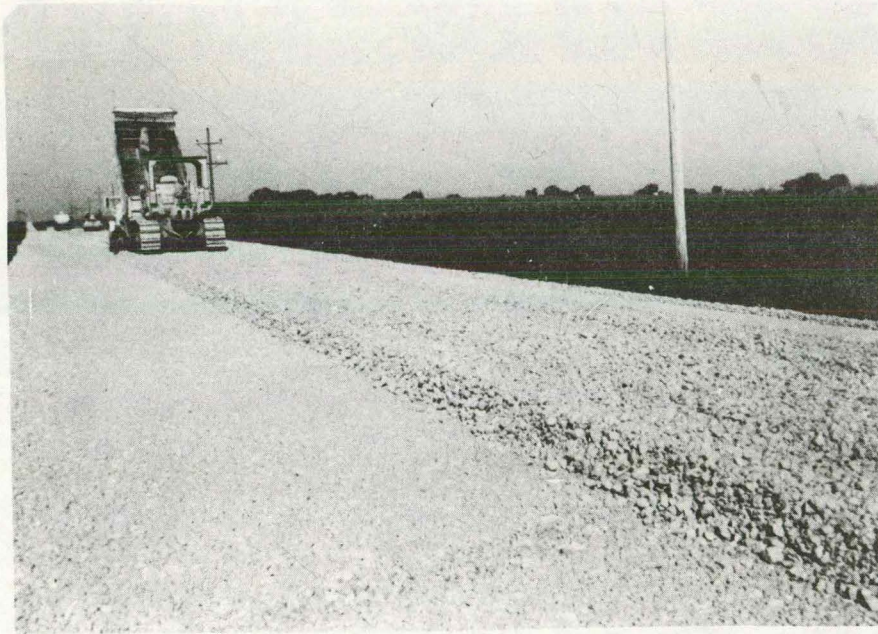
Fabric shows wrinkles due to trucks traveling at too great a speed. The wrinkles could not be removed.



Meloy Quarry in Sections 22 and 23, T87N-R1E where Beecher LTD crushed the 3" macadam, 3/4" chokestone and the 3/4" class A stone.



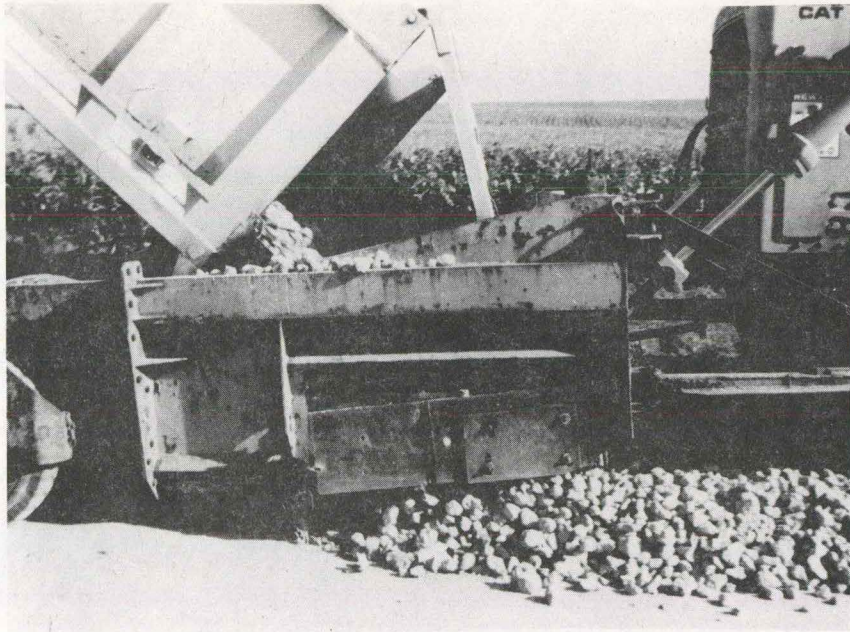
Plain macadam 6" base being placed.



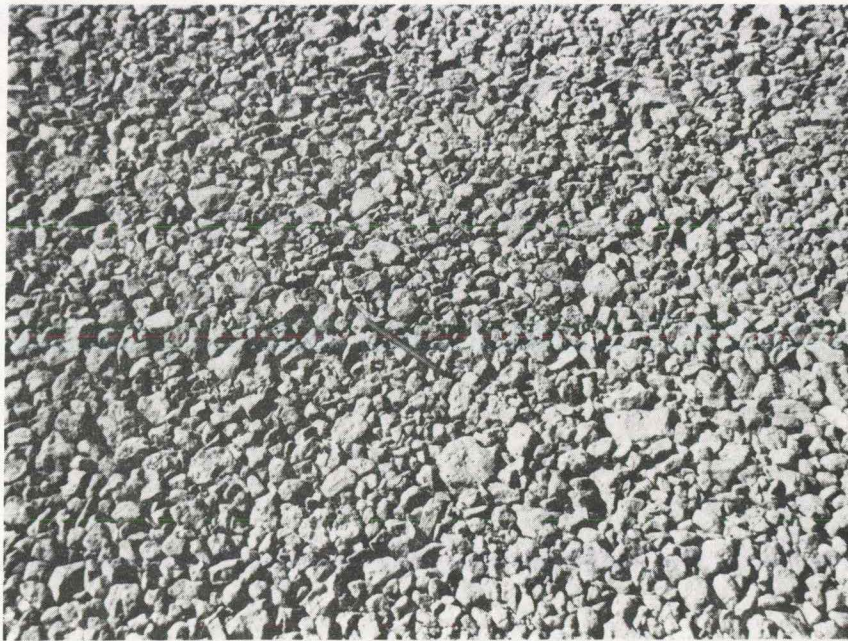
Jersey spreader finishing the center pass.



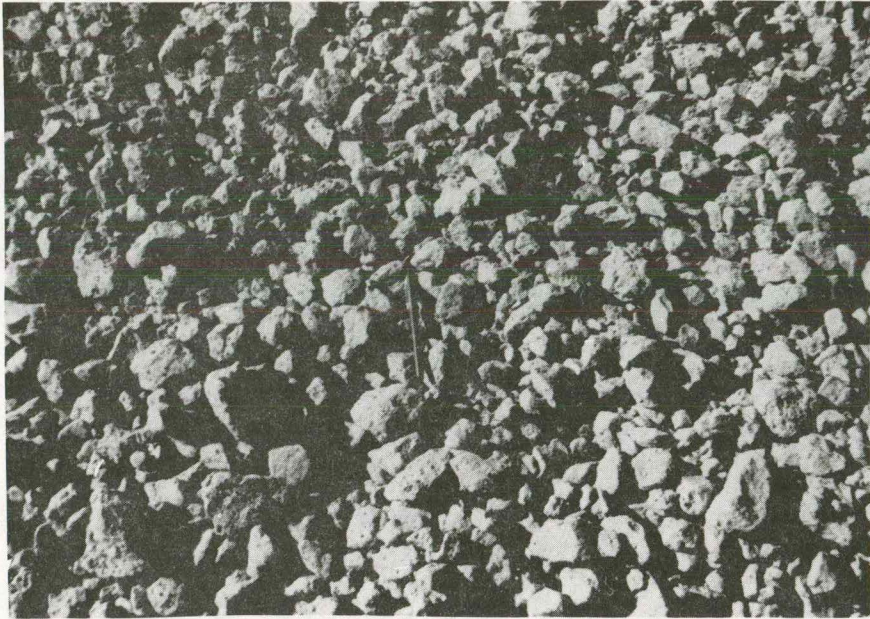
Motor grader working the excess macadam. This is not the recommended procedure since it causes segregation of the stone.



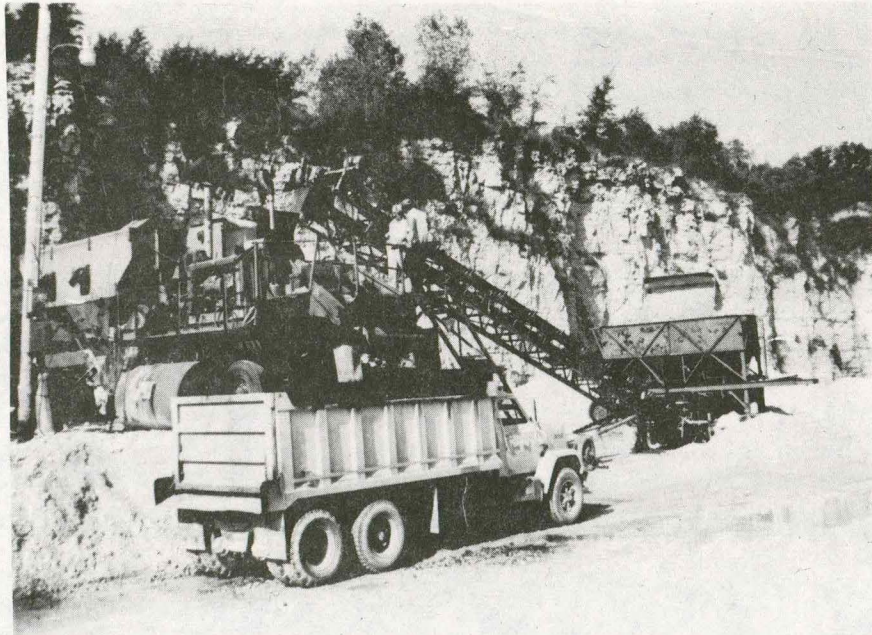
Jersey spreader laying the loose macadam.



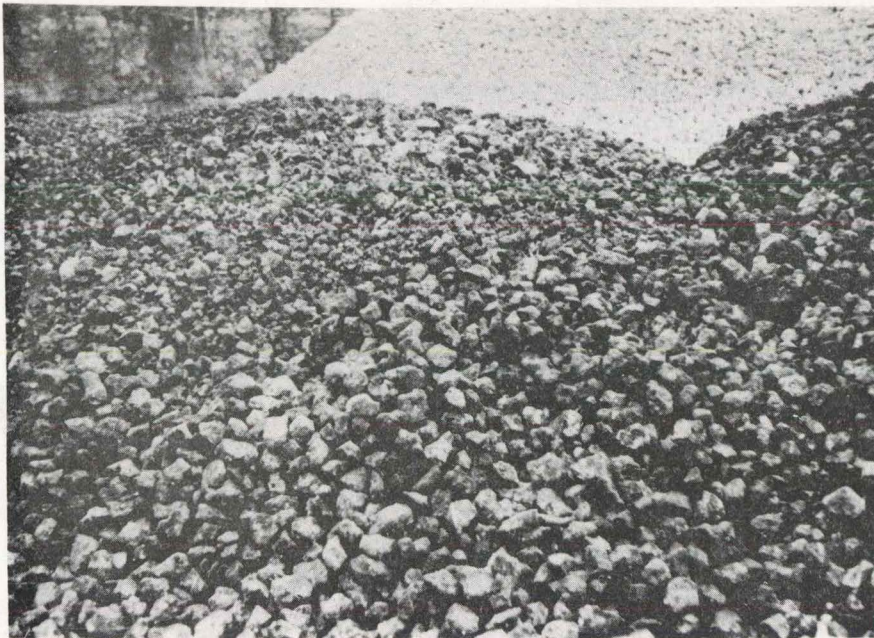
3" macadam, in place, showing the voids between the large rock.



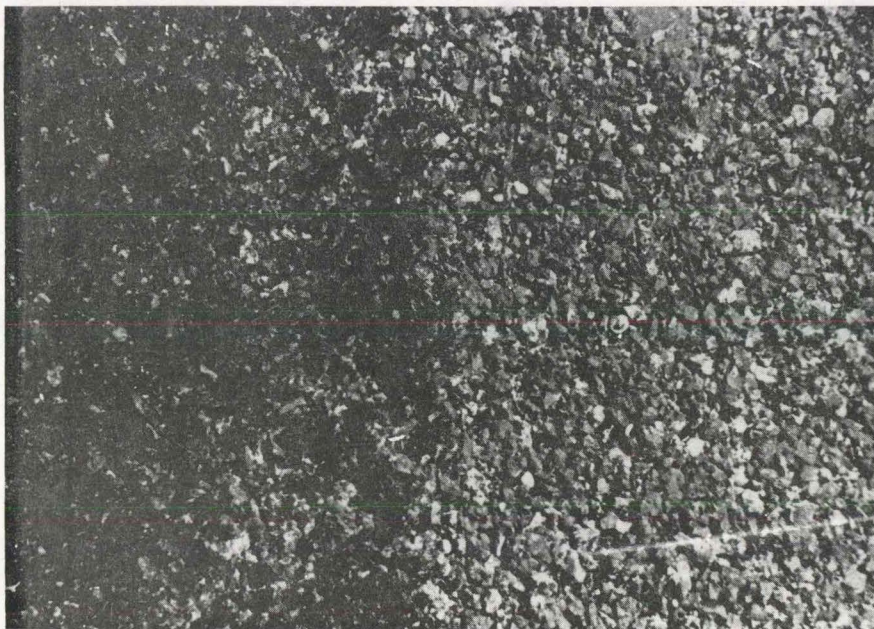
The picture shows the fines attached to the larger rock.



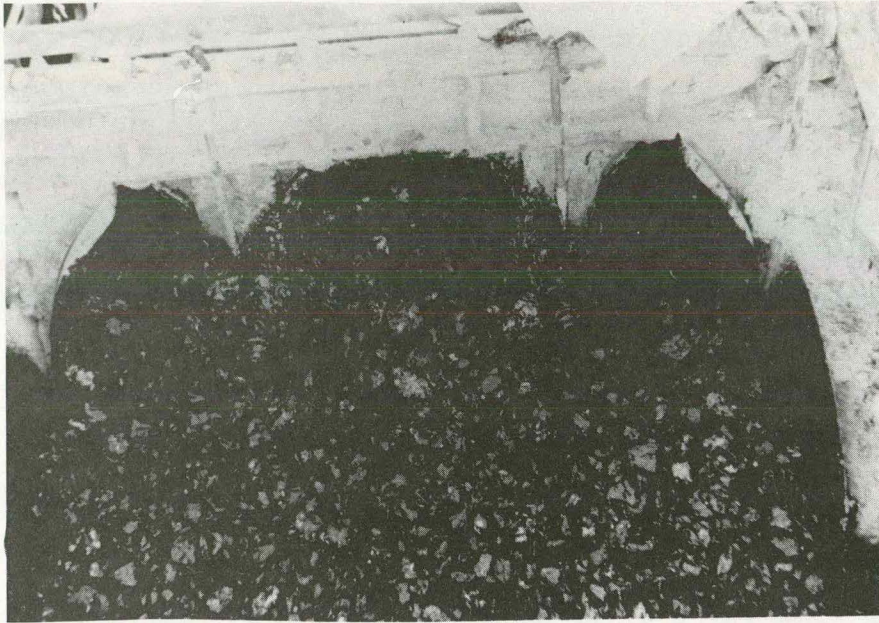
Tschiggfrie Excavating's Pioneer pugmill at Meloy Quarry.



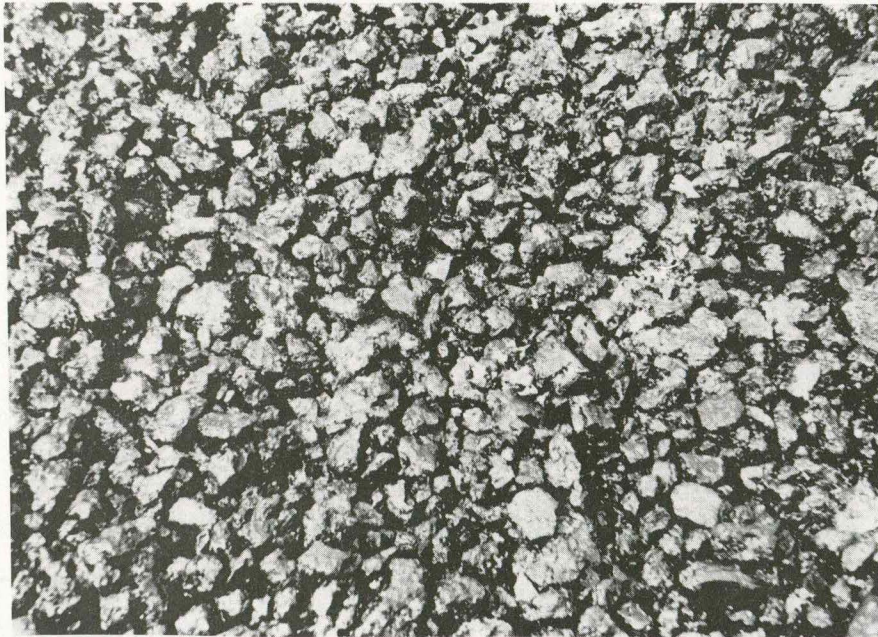
3" emulsion bound macadam rejected due to poor coating.



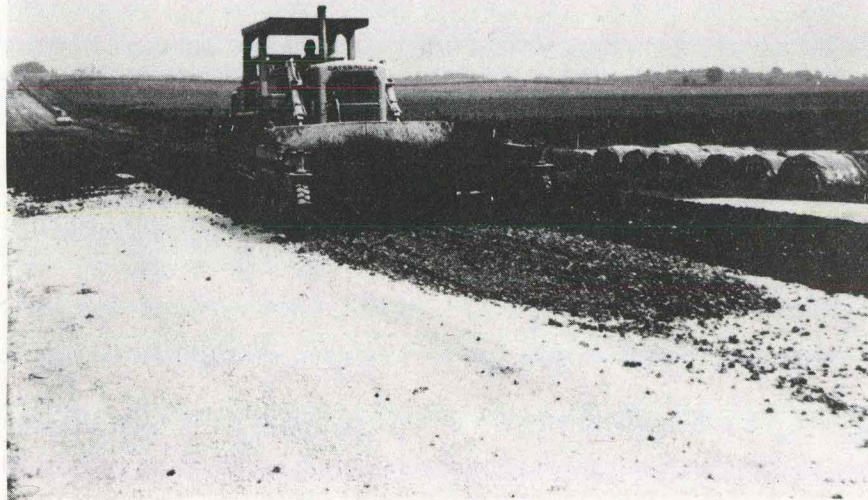
Good coating versus poor coating of the emulsion bound chokestone.



Good coating of the emulsion bound macadam at the pugmill.



Emulsion bound macadam with good coating on the roadway.



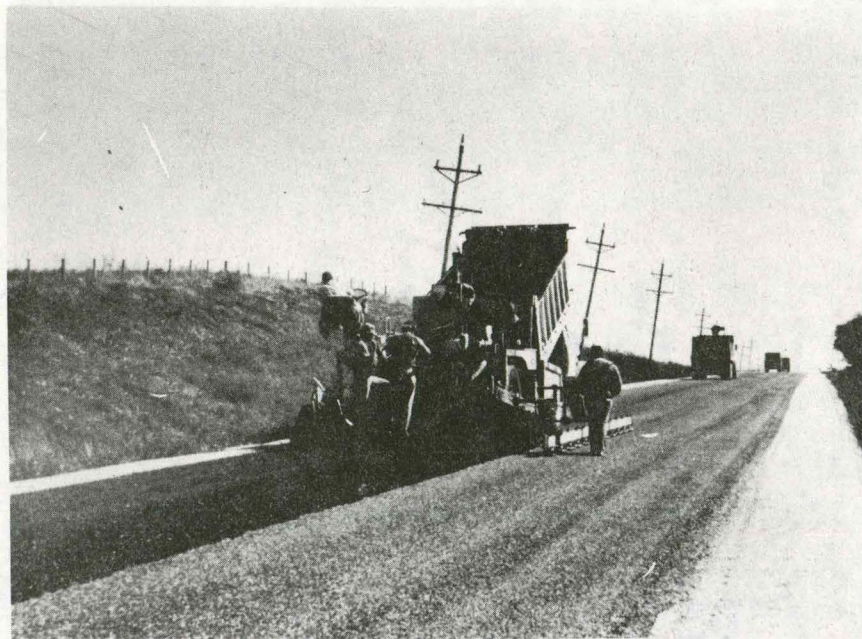
Jersey spreader with Cat tractor placing the 3" emulsion bound macadam in section 2.



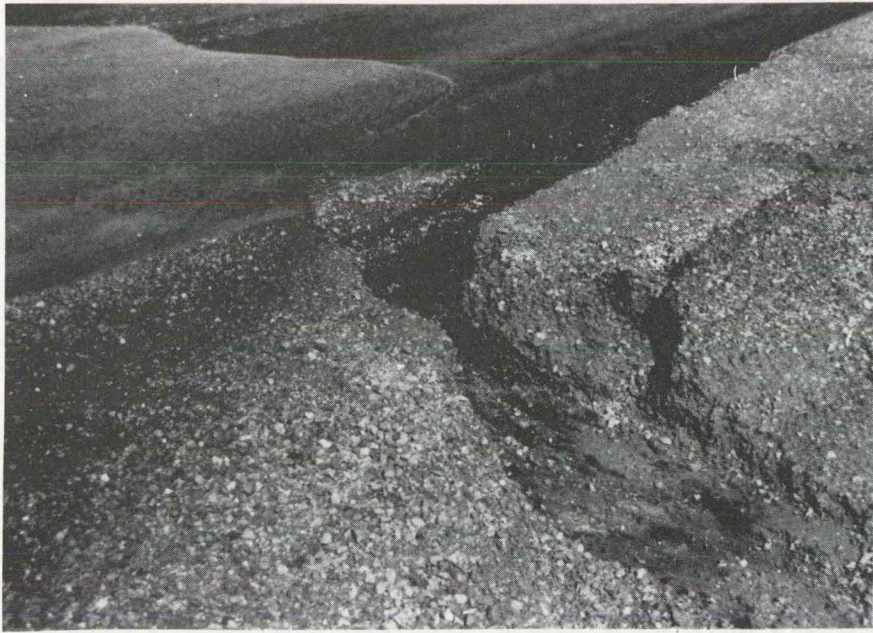
3" emulsion bound macadam base showing water running to the ditch.



Vibratory roller passing over the emulsion bound macadam. The roller had a tendency to break the larger rock at the surface.



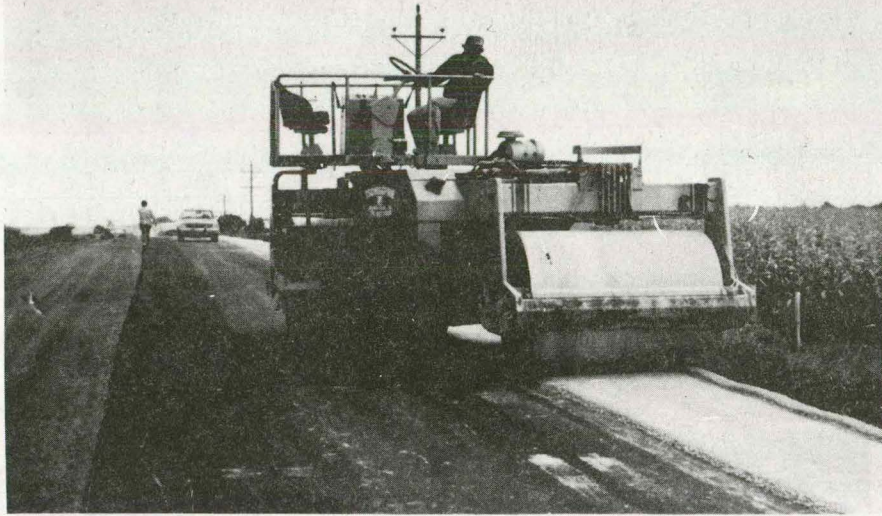
The final $1\frac{1}{2}$ " mat being laid over the initial mat of the $\frac{3}{4}$ " emulsion bound chokestone.



Shoulder erosion caused by heavy rains between stations 152+00 and 173+00.



Tschiffgrie's equipment placing the seal coat.



Offset roller compacting shoulder material.



Final roadway. Section 3 looking westerly at Station 68+00.



Section 6 with final seal coat looking easterly at station 131+00.

CONCLUSION

The 3/4" emulsion bound choke stone was unsatisfactory as a covering course for the macadam bases. It was difficult to lay down with a paving machine and was difficult to get a smooth surface.

The center pass of the Jersey spreader tended to take the crown out of the roadway when three passes were employed during construction. During construction, it was found that two passes with the Jersey spreader worked very well with the emulsion bound macadam. One pass on each side of the centerline was placed and rolled. The shoulders were placed using a shouldering machine with clean macadam. This is the way section number 3 from Station 194+00 to Station 213+10 was constructed.

The future of this type of construction will be based on the cost. If a similar project was to be constructed, not less than 6" of emulsion bound macadam base would be recommended and that would be placed in two passes side by side of the centerline for a width of 26 feet. The shoulder areas would be filled with plain macadam. This would eliminate the cost of emulsion to the shoulder areas.

Average Cost of the Various Sections One Through Seven:

No. 1	\$159,713.21	Total Length	4,500 feet
No. 2	\$140,368.71	Total Length	4,505 feet
No. 3	\$138,600.53	Total Length	3,975 feet
No. 4	\$119,135.21	Total Length	4,500 feet
No. 5	\$129,032.80	Total Length	4,500 feet
No. 6	\$108,561.32	Total Length	4,500 feet
No. 7	\$ 74,254.63	Total Length	4,300 feet

The final inspection found some areas where the first and second seal coats were not bonded together. This was evident in the seal coated Sections 4, 5, 6, and 7 and only occurred at various places: at Station 256+00 near the centerline, at 253+50 near centerline, 124+00 near centerline, and at

117+25 near the centerline. These areas were failures of the two seal coats to attach to each other. This may be due to loose clean rock which was not completely broomed off at these spots when the second seal coat was applied. These areas were broomed clean and resealed. Other than these spots, the entire roadway has no other failures except some base failure in the 6" macadam area in Section 14 near Station 296+00 near the center of the west bound lane. This area also has been resealed after evidence of the base failure.

ACKNOWLEDGMENTS

This research project was sponsored by the Iowa Department of Transportation through the Iowa Highway Research Board, Dubuque County and the U.S. Department of Transportation Federal Highway Administration. Special thanks to the Dubuque County Board of Supervisors - Wilfred Bahl, Donna Smith and Lloyd Hayes for giving their approval of the project; Pat Horsfield of Tschiggfrie Excavating; Robert Beecher of Beecher Quarries, Ltd.; Larry Schreiner, William Miteff and Jerry Reinke of Koch Asphalt, and the Dubuque County Highway Department Personnel involved in the project with noted appreciation to Lee Eisbach. Vernon Marks, Steven L. Tritsch and Richard D. Smith of the Iowa Department of Transportation provided valuable assistance.

The opinions, findings, and conclusions of this report are those of the author and not necessarily those of the Highway Division of the Iowa Department of Transportation or the Federal Highway Administration.

APPENDICES

Appendix A

Evaluation Plan

Asphalt Emulsions for Seal Coating for Highway Construction

EVALUATION PLAN

ASPHALT EMULSIONS FOR SEAL COATING FOR HIGHWAY CONSTRUCTION

CONSTRUCTION CRITERIA and PROCEDURE

A) Surface Preparation and Repairs

All new construction of subbase, 3" macadam, 3" emulsion bound macadam, 3/4" chokestone and 3/4" emulsion bound chokestone were rolled, dampened, and compacted then primed.

B) Climatic Condition during Construction

(Including roadway surface temperatures.)

<u>Date</u>	<u>Time</u>	<u>Temperatures</u>		<u>Sky</u>
		<u>Surface</u>	<u>Air</u>	
9-24	8:00	60	55	Clear
	12:00	64	65	Clear
	3:00	65	66	Clear
9-25	10:00	67	63	Cloudy
	1:00	63	58	Cloudy
	3:00	65	58	Cloudy
9-29	8:00	62	54	Clear
	12:00	74	75	Clear
	3:00	75	75	Clear
9-30	10:00	70	70	Clear
	12:00	70	70	Clear
	2:00	70	68	Clear
10-01	10:00	68	65	Clear
	12:00	70	71	Clear

C) Noted Changes in Material Properties at Jobsite

(1) Moisture content: 1 to 1.5%

(2) Gradation: 1/2" limestone chips

% Passing	<u>Date</u>	<u>3/4"</u>	<u>1/2"</u>	<u>3/8"</u>	<u>4</u>	<u>8</u>	<u>200</u>
	8-13	100	97.1	72.1	26.4	3.3	.8
	8-20	100	97.0	63.2	16.3	1.4	.6

Taken from Stockpile

(3) Asphalt: HFE 90 supplied by Koch Asphalt Dubuque terminal.

(4) Settlement: no settlement taken from suppliers tanks, the emulsion was distributed the same day of delivery.

D) Asphalt Spraying Operation

Intended amount of gallons per square yard:

1st Lift was .35 gal. s.y.

2nd Lift was .30 gal. s.y.

Average application rate per square yard

Date 9-24	Section 6	1st Lift	.40
		2nd Lift	.32

	Section 7	1st Lift	.32
		2nd Lift	.31
	Section 5	1st Lift	.29
		2nd Lift	.36
	Section 4	1st Lift	.36
		2nd Lift	.34
Date 9-25	Section 1	1st Lift	.31
		2nd Lift	.33
	Section 2	1st Lift	.31
		2nd Lift	.33
	Section 3	1st Lift	.34
		2nd Lift	.36
	Section 4	1st Lift	.36
		2nd Lift	.38
	Section 5	1st Lift	.33
		2nd Lift	.34
Date 9-29	Section 7	1st Lift	.33
		2nd Lift	.31
	Section 6	1st Lift	.36
		2nd Lift	.28
	Section 1	1st Lift	.36
		2nd Lift	.30
	Section 2	1st Lift	.36
		2nd Lift	.30
	Section 3	1st Lift	.36
		2nd Lift	.40
Date 9-30	ALL SECOND LIFTS		
	Section 3		.35
	Section 2		.35
	Section 1		.35
Date 10-1	1st and 2nd seals on driveways		

AVERAGE TEMPERATURES °F

<u>Dates</u>	<u>Emulsion</u>	<u>Air</u>	<u>Surface</u>
9-24	170	64	65
9-25	160	61	65
9-29	143	68	69
9-30	150	72	71
10-01	150	65	67

Spraying patterns varied according to roadway cross-sections. The shoulders were sprayed a width of 7' to help prevent shoulder washing and sloughing.

E) Asphalt Distributor Data

Type: Etnyre 1980 Model BT HA
Calibration: Calibrated by Iowa Department of Transportation
Productivity: 6,750 gallons capacity
Bar Height was 13"
Condition of heaters: 1980 unit used L.P. gas - all new
Pumps: Etnyre, capacity of 400 gallons per minute
Measuring Devices: Calibrated tank stick measurement
Nozzles: Slotted 1/8" nozzles, full set

F) Aggregate Spreading Operation

Intended lbs. per square yard

1st Lift was 30

2nd Lift was 25

Average application rate per square yard:

Date	9-24	Section 5	1st Lift	28.7 lbs
			2nd Lift	26.4
		Section 6	1st Lift	29.3
			2nd Lift	27.0
		Section 7	1st Lift	32.2
			2nd Lift	34.2
		Section 4	1st Lift	30.9
			2nd Lift	31.2

Date	9-25	Section 1	1st Lift	32.9
			2nd Lift	37.7
		Section 2	1st Lift	32.9
			2nd Lift	37.7
		Section 3	1st Lift	32.9
			2nd Lift	37.6
		Section 4	1st Lift	32.8
			2nd Lift	37.7
		Section 5	1st Lift	30.6
			2nd Lift	30.3

Date	9-29	Section 6	1st Lift	33.1
			2nd Lift	33.1
		Section 7	1st Lift	37.3
			2nd Lift	30.9
		Section 1	1st Lift	29.6
			2nd Lift	31.6
		Section 2	1st Lift	29.6
			2nd Lift	31.6
		Section 3	1st Lift	31.1
			2nd Lift	31.5

Date	9-30	Section 3	2nd Lift	31.2
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and driveways.

F) Aggregate Spreading Operation (continued)

Productivity: seal coat project was completed in four and one-half days. 2,647.25 tons of 1/2" chips were used on the project.

Patterns: Limestone chips were placed on the road at spreads from 14' to 11'. Chips were spread 7' wide on the shoulders.

G) Aggregate Spreader Data

Type: 1980 Flaherty Chipper

Adjustments IAW Manufacturer Specifications: No adjustments had to be made to meet the specs.

H) Rolling Operation

Type: Contractor used two types:

Steel - RayGo #266

Rubber - Michigan #140

Patterns: Contractor began rolling with rubber tires followed by steel. They worked from outside to inside.

Weights: Steel - RayGo #266 12 to 14 tons.

Rubber - Michigan #140 10 to 12 tons.

Timeliness: A very efficient operation. Rolling began within minutes after aggregate was spread on the emulsion.

Condition & Adjustments of Equipment: The condition of the rollers was excellent and no adjustments were made. They both met the Iowa Department of Transportation specs.

I) Brooming and Other Cleaning Operations

Type: Broom was Brosc Broom 1976, self-propelled. The only brooming done was light broomings over primed areas where excess material was placed. Brooming was done between first and second lifts where excess aggregate had accumulated. All chips had been washed before project started.

J) Breaking and Curing Characteristics of Emulsion

The breaking and curing seemed to occur in a very short time. The emulsion was black in color, then turned brownish as it was sprayed from the distributor. The emulsion broke. Within a matter of minutes it would turn black and start curing.

K) Total Mat Thickness

Examining the project after completion, we determined the mat thickness to be an average of 3/4".

IV COST OF ALTERNATE MATERIALS

This is a cost comparison of emulsion used on the project and asphalt cutback MC800 for the same type of surface treatment.

The cost of emulsion per gallon on contract was 75¢ per gallon times 55,946 gallons of emulsion used = \$41,959.50.

Cost of MC 800 per gallon as a comparison taken from a contract with the same contractor during the same year, 1980:

Cost of MC 800: 98¢ per gallon times 55,946 gallons used = \$54,827.08.

Total sq. yd. of Seal Coating was 161,114 sq. yd.

MC800	Total Cost	+ 54,827.08	cost per sq. yd.	\$0.34/sq. yd.
Emulsion		- 41,959.50	cost per sq. yd.	<u>\$0.26/sq. yd.</u>
TOTAL SAVINGS		\$12,867.58		\$0.08/sq. yd.

Information received from Koch Asphalt determined that there were 400 gallons of fuel saved per day of plant operation. This amounted to 400 x 3 days x \$0.90/gal. = \$1080 by manufacturing emulsion instead of MC 800.

V ENERGY CONSUMPTION

ENERGY CONSUMPTION + CONSERVATION

MC-800 vs. High Float Emulsion for Seal Coat

Fuel consumed to manufacture 55,946 gallons

	<u>Fuel</u>		<u>BTU/gal.</u>	<u>BTU</u>
MC-800	1800 gal. #3		143,000	257,400,000
HFE	600 gal. #3		143,000	85,800,000
Savings	1200 gal. #3		143,000	171,600,000

Equivalent Gasoline 171,600,000 BTU
Equivalent Gasoline gallons saved 125,000 BTU/gal. of gasoline = 1373 gal.

DISTILLATE COMPARISON BASED ON 55,946 Gallons

	<u>Fuel</u>		<u>BTU/gal.</u>	<u>BTU</u>
MC-800 -20%	11,189 gal. #1		135,000	1,510,515,000
HFE -5%	2,797 gal. #2		139,000	388,783,000
Savings				1,121,732,000

1,121,732,000 BTU
Equivalent Gasoline gallons saved 125,000 BTU/gal. of gasoline = 8974 gal.

TOTAL EQUIVALENT GALLONS OF GASOLINE SAVED = 10,347

VI ENVIRONMENTAL CONSIDERATIONS

There are no local or state environmental regulations concerning asphalt emulsions. There are no local or state regulations concerning HC emissions.

Environmental Weather Data from Dubuque Airport Office of National Weather Service*

Avg. Temp	Date	High	Low	Rain	Wind Direc.	Low (knots)	High
72	8-14	79	65	0	N		
69	15	76	61	0	N	5	12
62	16	67	52	1.6	N	10	15
67	17	76	57	.33	NNE	3	12
69	18	82	56	0	NNE	3	9
78	19	88	68	1.62	NNE	6	11
80	20	89	71	1.37	NNE	7	12
75	21	80	69	0	NNE	8	14
70	22	81	59	0	N	3	7
69	23	80	58	0	NNE	4	11
71	24	81	61	0	NNE	7	13
75	25	84	65	0	NNE	10	12
75	26	86	64	0	NNE	4	21
74	27	84	64	0	N	7	12
73	28	82	64	0	N	3	7
78	29	86	69	0	N	3	13
68	30	72	64	.4	NNE	3	14
73	31	79	66	.1	NNE	5	9
71	9- 1	78	64	.14	NNE	7	11
67	2	77	56	0	N	4	10
72	3	83	60	0	NNE	8	14
67	4	77	56	.83	NNE	5	14

*The National Weather Service Office is located 8 to 11 miles from this project at the Dubuque Municipal Airport.

Avg. Temp.	Date	High	Low	Rain	Wind Direc.	Low (knots)	High
68	5	81	54	0	NNE	3	10
71	6	82	60	.02	N	3	7
74	7	86	62	.75	N	7	15
78	8	89	66	0	NNE	5	8
66	9	77	55	.01	NNE	6	18
59	10	72	45	0	NNE	4	8
62	11	75	49	0	NNE	4	10
70	12	78	61	2.34	NNE	6	15
73	13	83	62	.25	NNE	4	12
59	14	64	54	Tr	NNE	8	10
60	15	66	54	0	NNE	4	13
57	16	63	50	.20	NNE	3	12
52	17	63	41	0	NNE	0	6
62	18	74	49	0	NNE	4	12
65	19	80	50	0	NNE	6	14
74	20	83	65	1.58	NNE	4	12
70	21	78	61	0	NNE	5	14
61	22	69	52	.22	NNE	4	14
52	23	62	42	0	N	3	7
56	24	66	46	Tr	NNE	4	9
53	25	60	45	Tr	NNE	4	15
50	26	61	38	0	NNE	0	6
59	27	68	49	0	N	4	12
59	28	66	51	.14	NNE	0	7
61	29	75	47	0	NNE	4	3
67	30	79	54	0	NNE	4	9
60	10- 1	69	51	0	NNE	4	15
51	2	62	40	.02	NNE	6	15

Appendix B

As Built Plans

LETTING DATE JULY 15, 1980

DUBUQUE COUNTY 5N-4657(3)-51-31

37

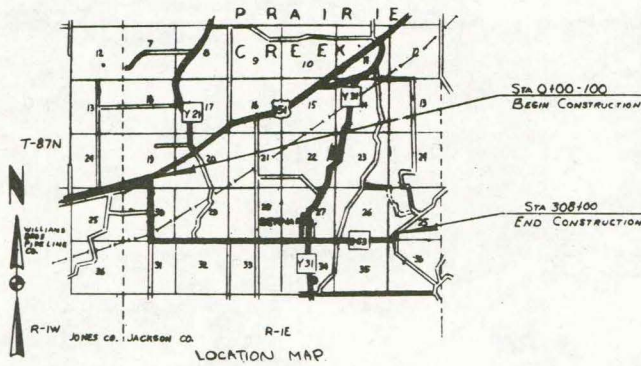
CONVENTIONAL SIGNS

- State Line
- Co. Line
- Twp. Line
- Sec. Line
- Corp. Line
- Water Body
- R.C.W. Lines
- Survey Line
- Sec. Corner
- Profile Grade
- Railroad
- Field File
- Underground Lines
- Culverts
- Utility Poles
- Fence
- Tree Or Brush
- Stream
- Dike
- County Road No.
- Primary Road No.
- U.S. Road No.
- Interstate Road No.



PROJECT TRAFFIC CONTROL PLAN

This road will be closed to through traffic during construction. Local traffic to adjacent properties will be maintained as provided for in Article 1407.02, 1977 Standard Specifications. Traffic control devices, procedures and equipment shall be as provided for by supplemental specifications for traffic control for street and highway construction and maintenance operations, Specification 807.



IOWA DEPARTMENT OF TRANSPORTATION

Highway Division

PLANS OF PROPOSED IMPROVEMENT ON THE

FARM TO MARKET SYSTEM
DUBUQUE COUNTY

Beginning of US Highway 151 in the 3/4 Sec 19 T81N-R1E, Thence South to near the SW corner Sec 30, Thence east to the SW 1/4 SW 1/4 Sec 25 T81N-R1E

RESEARCH PROJ HR-216 ROADWAY PAVEMENT

SCALES AS NOTED

THE STANDARD SPECIFICATIONS, SERIES OF 1977 OF THE IOWA DEPARTMENT OF TRANSPORTATION SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT PLUS CURRENT SUPPLEMENTAL SPECIFICATIONS AND PROVISIONS

INDEX OF SHEETS	
NO	DESCRIPTION
1	TITLE SHEET, LOCATION MAP, MILEAGE SUMMARY, ESTIMATE PROJECT QUANTITIES, GENERAL NOTES
2	TYPICAL SECTIONS NO.1 THRU NO.7, TYPICAL SECTION NOTES
3 & 15	PLAN AND PROFILE SHEETS

MILEAGE SUMMARY

TYPICAL SECTION NO 1	= 1500.0'	= 0.852 MILES
TYPICAL SECTION NO 2	= 1500.0'	= 0.853 MILES
TYPICAL SECTION NO 3	= 1113.5'	= 0.779 MILES
TYPICAL SECTION NO 4	= 1500.0'	= 0.852 MILES
TYPICAL SECTION NO 5	= 1500.0'	= 0.852 MILES
TYPICAL SECTION NO 6	= 1500.0'	= 0.852 MILES
TYPICAL SECTION NO 7	= 1500.0'	= 0.852 MILES
TOTAL LENGTH PROJECT	= 30,918.5'	= 5.855 MILES

PROJECT QUANTITIES AS BUILT

ESTIMATE PROJECT QUANTITIES			
ITEM	DESCRIPTION	UNIT	TOTAL
1	BASE, TYPE B CLASS 1 ASPHALT CEMENT CONCRETE	TON	6815
2	ASPHALT TREATED BASE CLASS 2	TON	1370
3	ASPHALT CEMENT	TON	589
4	STABILIZED SHOULDER MATERIAL	TON	6455
5	ROADWAY CENTER BAGGEGATE (1/2" CHIPS)	TON	2049
6	BINDER BITUMEN (EMULSION)	GAL	48761
7	PRIMER OR TACK COAT BITUMEN	GAL	24995
8	EMULSION TREATED MACADAM STONE BASE	TON	15850
9	MACADAM STONE BASE	TON	16040
10	EMULSION TREATED CHOKESTONE BASE	TON	6628
11	CHOKESTONE BASE	TON	6628
12	EMULSION (TREATED BASE MATERIAL)	GAL	283075

GENERAL NOTES

- Item 1. Section 2203 Specification shall apply.
 - Item 2. Section 2202 Specification shall apply.
 - Item 3. Section 1137 Specification shall apply.
 - Item 4. Section 2124 Specification shall apply and SP 912.
 - Item 5. Section 2307 Specification shall apply. First lift = 30 lbs sq yd. Second lift = 25 lbs sq yd.
 - Item 6. Section 2307 Specification shall apply. First lift = 0.35 gal sq yd. Second lift = 0.30 gal sq yd. (HFE 30 - CPS 2)
 - Item 7. Section 2210 Specification shall apply. Primer = 0.30 gal sq yd. Tack = 0.03 gal sq yd.
 - Item 9. Section 2210 Specification shall apply.
 - Item 11. Section 2210 Specification shall apply.
 - Item 10. ~~Section 2210 Specification shall apply.~~
 - Item 12. ~~Section 2210 Specification shall apply.~~
- Item 11. Shall include any Excavation required to meet existing Concrete Retain and Bridge Approaches. All Excavated material shall be disposed by the Contractor. No Extra Payment shall be made for excavation in approved Road Project Site.

ESTIMATED QUANTITIES	
SECTION	QUANTITY
00 + 00 - 12 + 00	14 + 00 - 36 + 00
25 + 00 - 30 + 00	41 + 00 - 63 + 00
68 + 00 - 57 + 00	90 + 00 - 65 + 00
71 + 00 - 75 + 00	77 + 00 - 79 + 00
100 + 00 - 102 + 00	104 + 00 - 100 + 00
120 + 00 - 120 + 00	120 + 00 - 120 + 00
137 + 00 - 139 + 00	141 + 00 - 143 + 00

EXTRA - 802M C-35
149400 - 197000
MATERIALS AND LABOR TO BE FURNISHED BY OTHERS

APPROVED

BOARD OF SUPERVISORS

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED UNDER MY SUPERVISION AND THAT ENGINEERING DECISIONS WITH REGARD TO THE DESIGN WERE MADE BY ME OR BY OTHERS DULY REGISTERED PROFESSIONAL ENGINEERS UNDER THE LAWS OF THE STATE OF IOWA

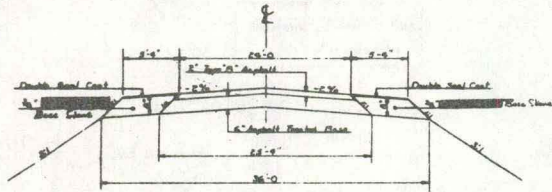
IOWA REGISTRATION NUMBER: 1 DATE: 7-20

IOWA Highway Division

DEPUTY CHIEF ENGINEER

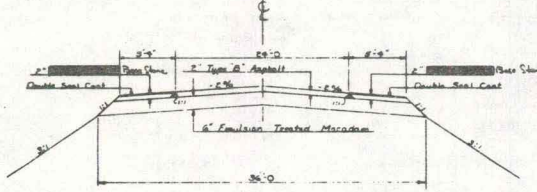
DATE

TYPICAL SECTION NO. 1



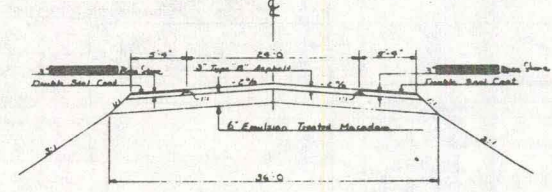
From Sta 0+00-100 To Sta 23+00 and
From Sta 152+00 To Sta 173+00

TYPICAL SECTION NO. 2



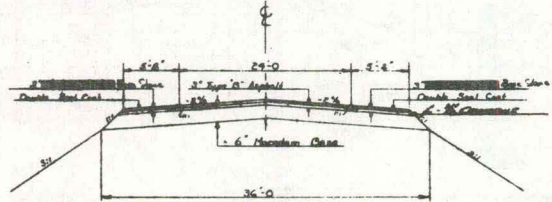
From Sta 23+00 To Sta 47+05 and
From Sta 173+00 To Sta 194+00

TYPICAL SECTION NO. 3



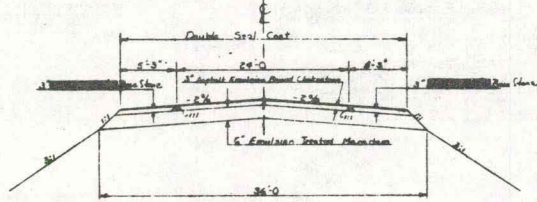
From Sta 47+35 To Sta 68+00 and
From Sta 194+00 To Sta 213+10
EQUIPMENT AT STA 67+50 LENGTHS 138.5'

TYPICAL SECTION NO. 4



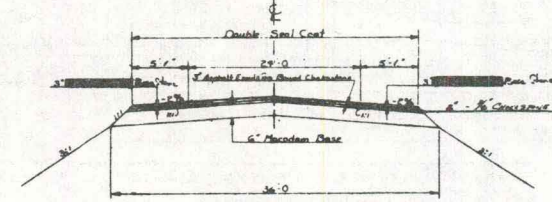
From Sta 68+00 To Sta 89+00 and
From Sta 214+00 To Sta 238+00

TYPICAL SECTION NO. 5



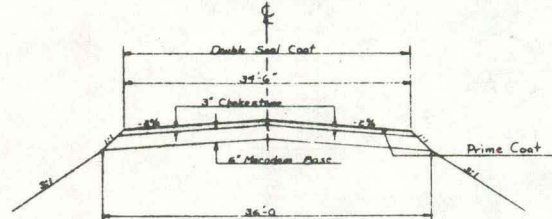
From Sta 99+00 To Sta 110+00 and
From Sta 238+00 To Sta 262+00

TYPICAL SECTION NO. 6



From Sta 110+00 To Sta 131+00 and
From Sta 262+00 To Sta 286+00

TYPICAL SECTION NO. 7



From Sta 131+00 To Sta 152+00 and
From Sta 286+00 To Sta 308+00

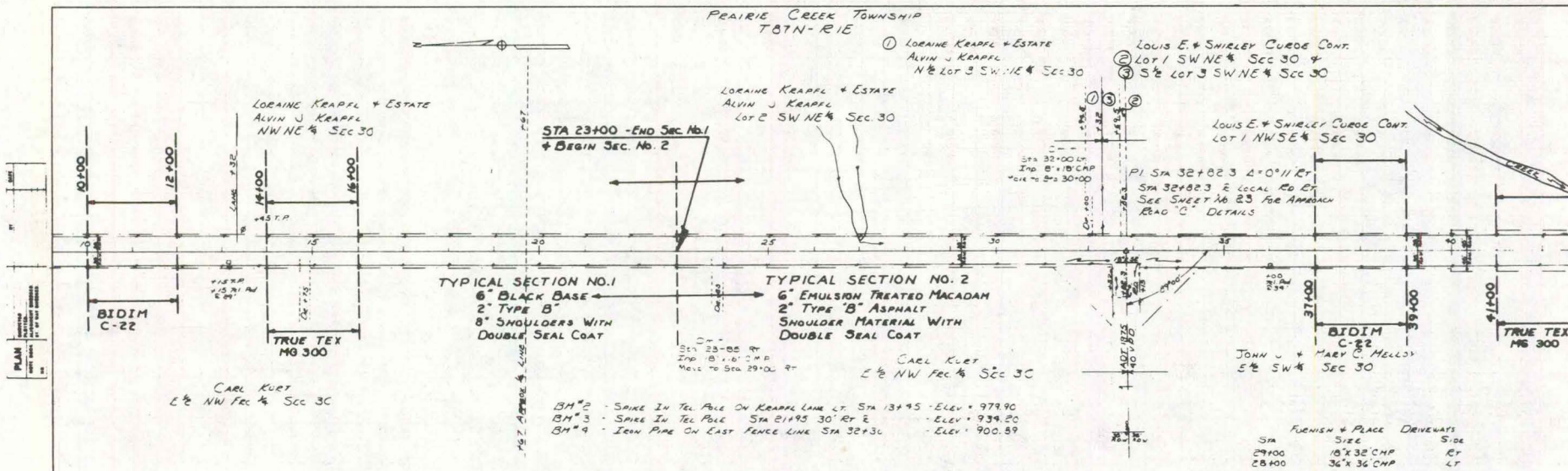
TYPICAL SECTION NOTES

- SECTION NO. 1 Two inches of Type B asphalt surface over a 6" asphalt treated base (ATB) and 8" of $\frac{3}{4}$ " base stone and double seal coat on the shoulder.
- SECTION NO. 2 Two inches of Type B asphalt surface over 6" of 3" x $\frac{3}{4}$ " asphalt emulsion treated macadam (AEBM) and 2" of $\frac{3}{4}$ " base stone and double seal coat on the shoulder.
- SECTION NO. 3 Three inches of Type B asphalt surface over 6" of 3" x $\frac{3}{4}$ " asphalt emulsion treated macadam (AEBM) and 3" of $\frac{3}{4}$ " base stone and double seal coat on the shoulder.
- SECTION NO. 4 Three inches of Type B asphalt surface over 2" of $\frac{3}{4}$ " chokerstone over 6" of 3" x $\frac{3}{4}$ " asphalt emulsion treated base stone and double seal coat on the shoulder.
- SECTION NO. 5 A double seal coat over 3" of asphalt emulsion treated chokerstone over 6" of 3" x $\frac{3}{4}$ " asphalt macadam (AEBM) and shoulder with 3" base stone.
- SECTION NO. 6 A double seal coat over 3" of asphalt emulsion treated chokerstone over 2" of $\frac{3}{4}$ " chokerstone over 6" of 3" x $\frac{3}{4}$ " base stone.
- SECTION NO. 7 A double seal coat over 3" of chokerstone over 6" of 3" x $\frac{3}{4}$ " macadam. Prime coat required over chokerstone before seal coat is applied.

Typical sections No. 1 thru No. 7 shall extend into road intersections a minimum of 50' and include radius, and also shall extend into field and farm entrances a minimum of 10' and include radius.

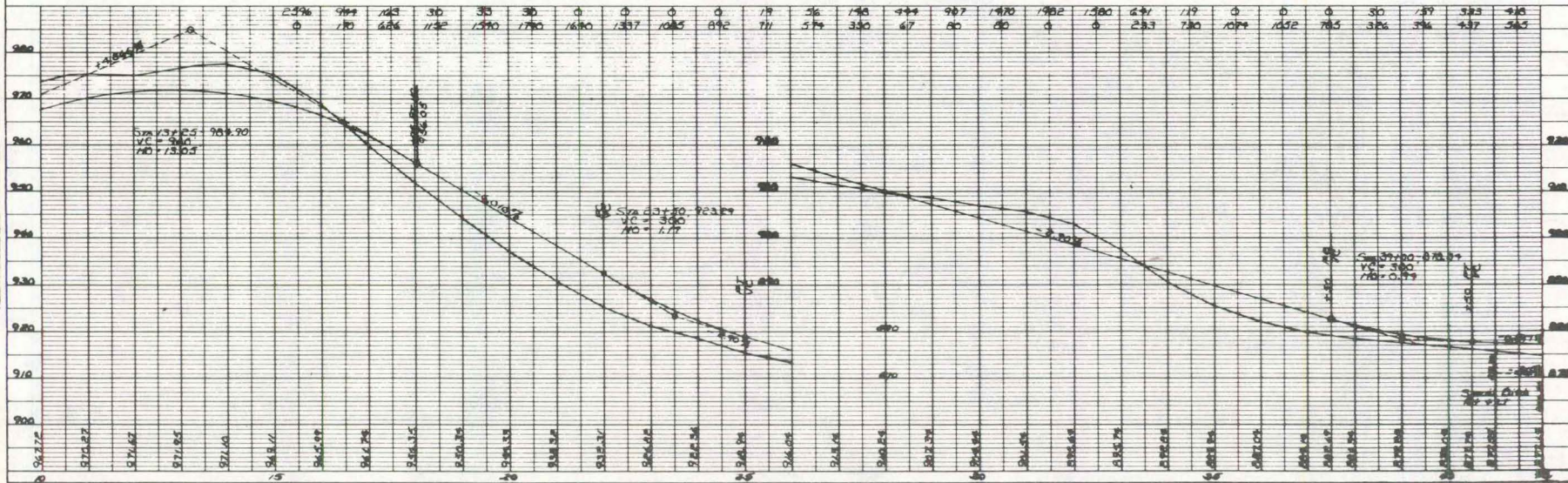
STATE	NO. ROAD	SECTION	DATE
OHIO	1	1/2	1/2

PEAIRIE CREEK TOWNSHIP
T87N-R1E



BM#2 - SPIKE IN TEL POLE ON KRAFFL LANE LT STA 13+95 - ELEV. 979.90
 BM#3 - SPIKE IN TEL POLE STA 21+95 30' RT R - ELEV. 939.20
 BM#9 - IRON PIPE ON EAST FENCE LINE STA 32+30 - ELEV. 900.89

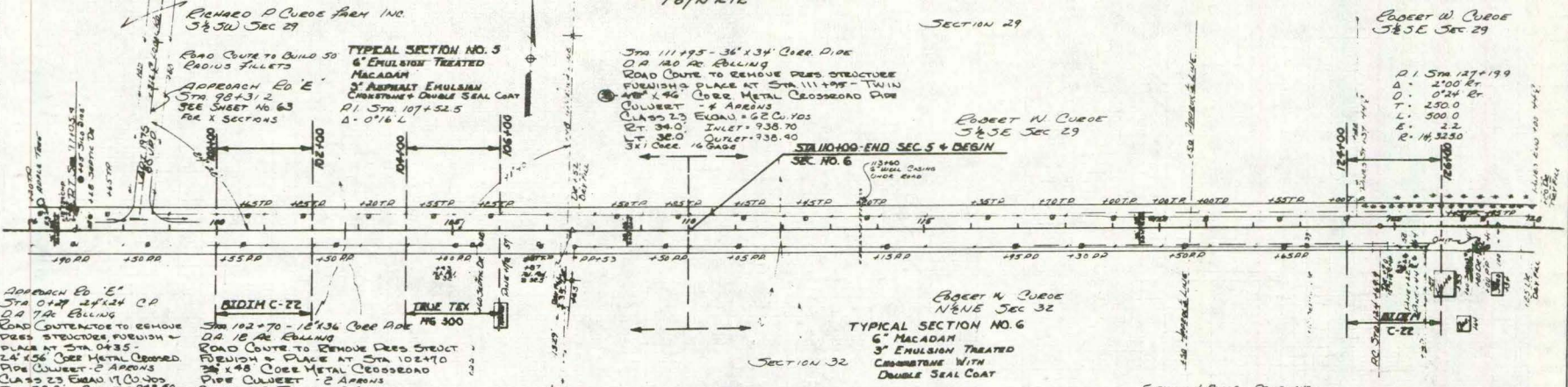
FURNISH & PLACE DRIVEWAYS
 STA 29+00 5'x6' SIDE
 CB#00 18'x32' CMP RT
 36'x36' CMP LT



PLAN 1
 SN - 26700 - 27-81

PROJECT NO.	STATE	PROJECT NO.	SECTION
5	INDIA	4471	29

PEARIE CREEK TOWNSHIP
TOWN RIE



ROBERT W. CROOK
S 35 E Sec 29

D1 STA 127+199
A = 2'00" R
O = 0'24" R
T = 250.0
L = 500.0
E = 2.2
R = 14,325.0

ROBERT W. CROOK
S 35 E Sec 29

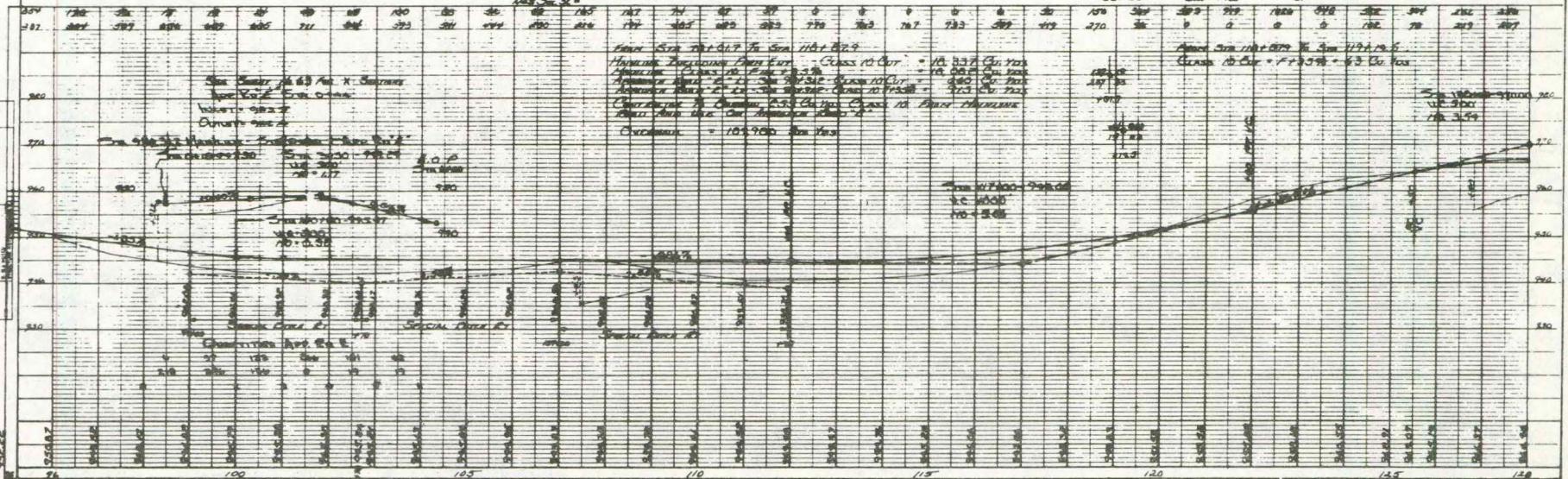
ROBERT W. CROOK
N 45 E Sec 32

ROBERT W. CROOK
N 45 E Sec 32

DEEN HARKS
DEEN HARKS #1 STA 97+00 - ELEV 946.98 - X IN CORR
POSTING DEEN CROOKS CHD LT
DEEN HARK #10 STA 107+60 ELEV 947.96 - JOCKE IN
FENCE POST RT AT DEEN'S HOME
DEEN HARK #71 STA 124+20 ELEV 939.85 JOCKE IN
34' DISTAL LEFT AT FIVE JOCKE

STA	SIZE	DRIVEWAYS
98+35	18" X 36" CMP	LT
107+35	18" X 36" CMP	RT
107+38	18" X 36" CMP	LT
106+70	18" X 36" CMP	RT
127+85	18" X 36" CMP	RT
106+20	18" X 36" CMP	LT

LORETHA DUNN COVE TO
NENA Sec 32



PLAN 1 - PLAN PROFILE

PEARIE CREEK TOWNSHIP
T87N R1E

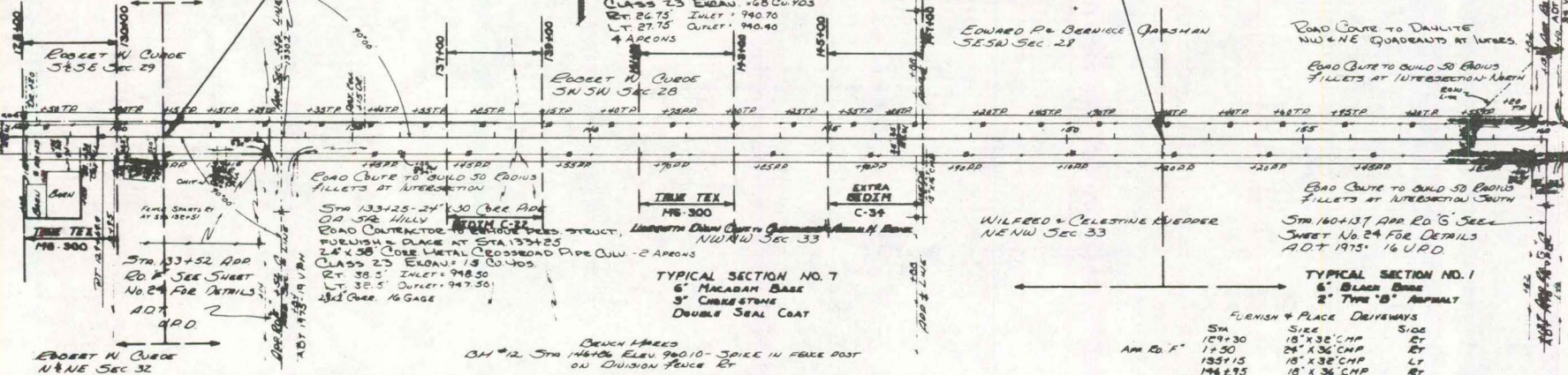
Sta 129+37 36" x 36" CURB AND
400' BRIDGE
ROAD CONTRACTOR TO REMOVE
STRUCTURE, CLASS 23 GRADE = 22 CU YDS
CONTRACTOR IS TO SALVAGE PRESENT
36" x 36" CURB AND IS TO BECOME THE
PROPERTY OF ROBERT W. CURDE.

STA 131+00 - END SEC. NO. 6
BEGIN SEC. NO. 7

Sta 136+65 36" x 36" CURB CURV
D.R. 120' R. HILLY
ROAD CURVE TO REMOVE CURB STRUCTURE
FURNISH PLAGE @ 58" x 36" TUBULAR STEEL
PIPE ARCH 31" CURB AND CURV AT STA 136+65
CLASS 23 GRADE +68 CU YDS
RT. 26.75' INLET +940.70
LT. 27.75' OUTLET +940.40
4 APRONS

STA 152+00 - END SEC. NO. 7
BEGIN SEC. NO. 1

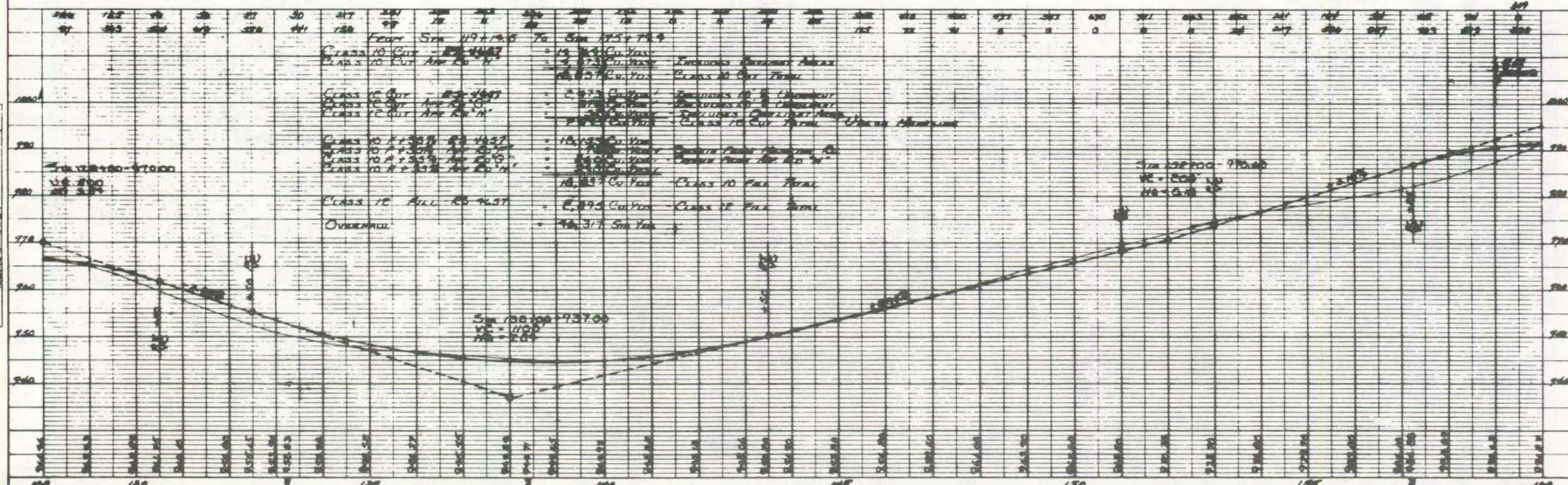
Sta 160+37 ADD RD 'H' SEC 2
SHEET No 24 FOR DETAILS
A.D.T. 1975 34 U.P.D.



ROBERT W. CURDE
NE 1/4 SEC 32

BENCH MARK
34" x 12" STA 146+06 ELEV 940.10 - SPIKE IN FENCE POST
ON DIVISION FENCE RT

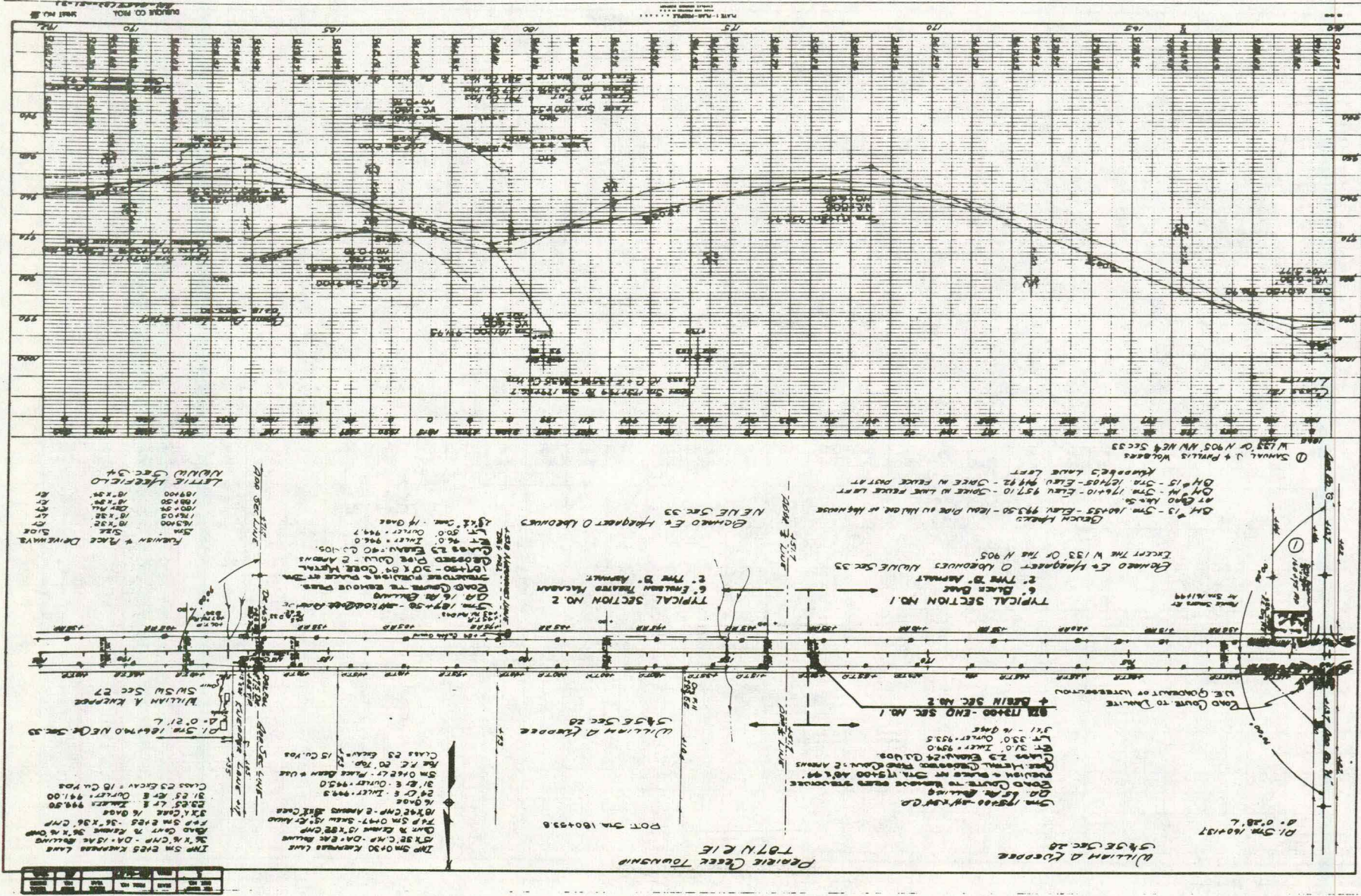
TYPICAL SECTION NO. 1
6" BLACK BASE
2" TYPE 'B' ASPHALT
FURNISH & PLACE DRIVEWAYS
Sta SIZE S/C
AM RD F' 129+30 18" x 36" CMP RT
1+50 24" x 36" CMP RT
153+15 18" x 36" CMP LF
146+25 18" x 36" CMP RT



PLAN 1 - PLAN PROFILE

DUNFORD CO. PROJ.
311 - 6667 (C) - 71 - 21

44



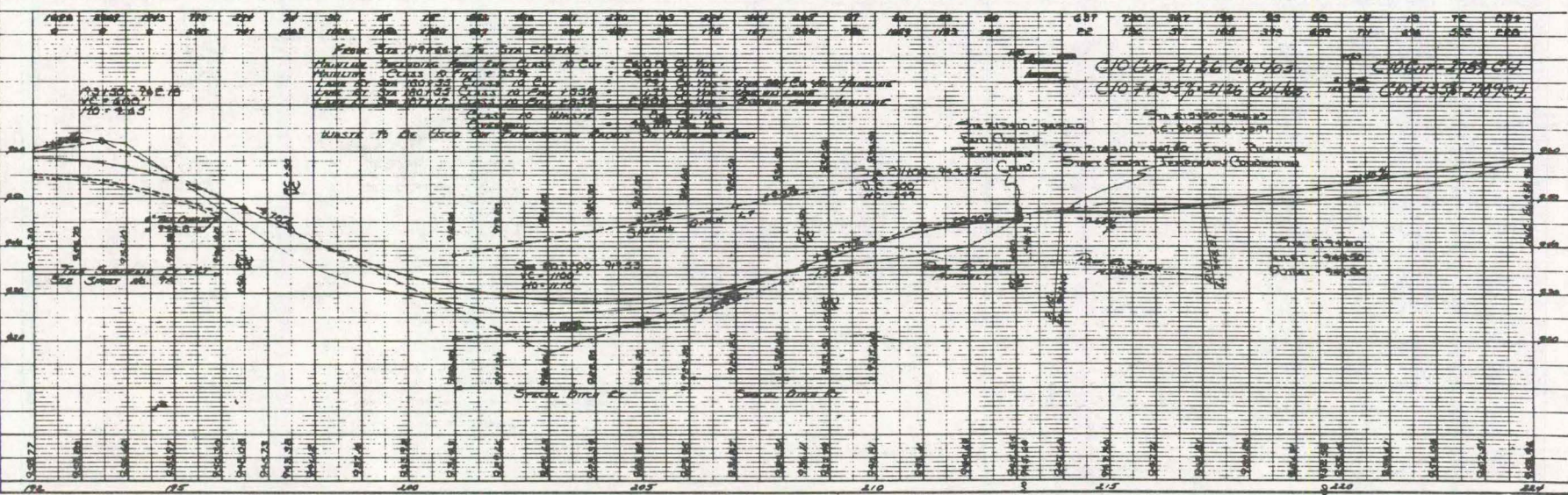
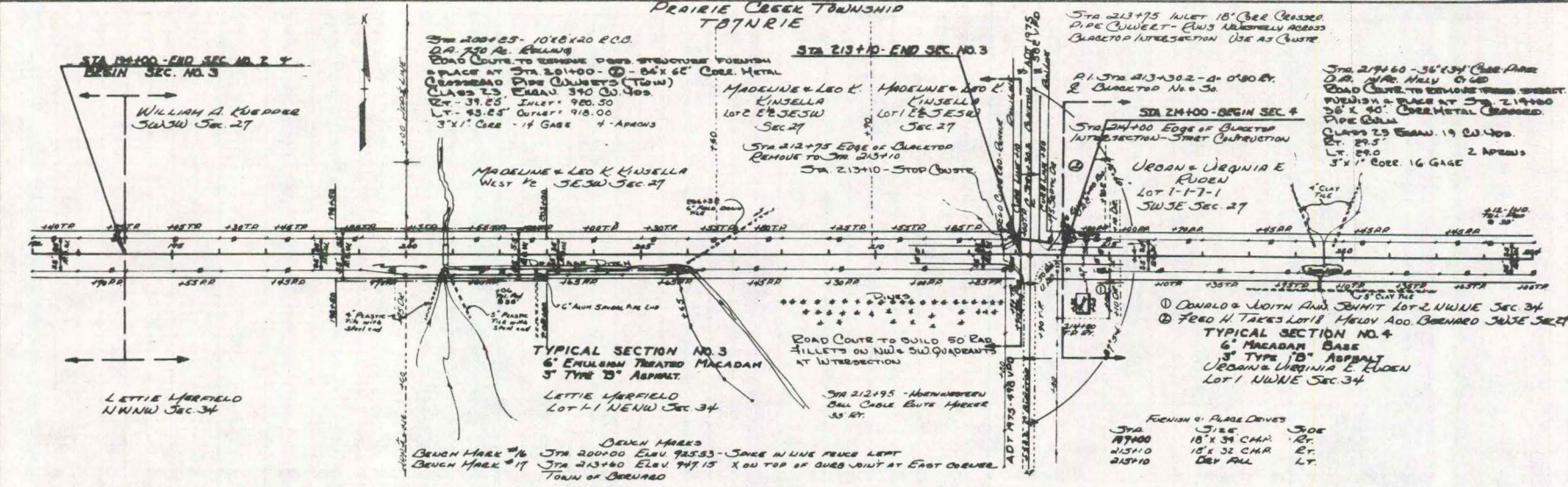
NO.	DESCRIPTION	DATE
1
2
3
4
5
6
7
8
9
10

NO.	DESCRIPTION	DATE
1
2
3
4
5
6
7
8
9
10

NO.	DESCRIPTION	DATE
1
2
3
4
5
6
7
8
9
10

NO ROAD DIST. IN	STATE	PROJ. NO.	SCALE	SHEET NO.	TOTAL SHEETS
5	INDIA	28-6437		14	70

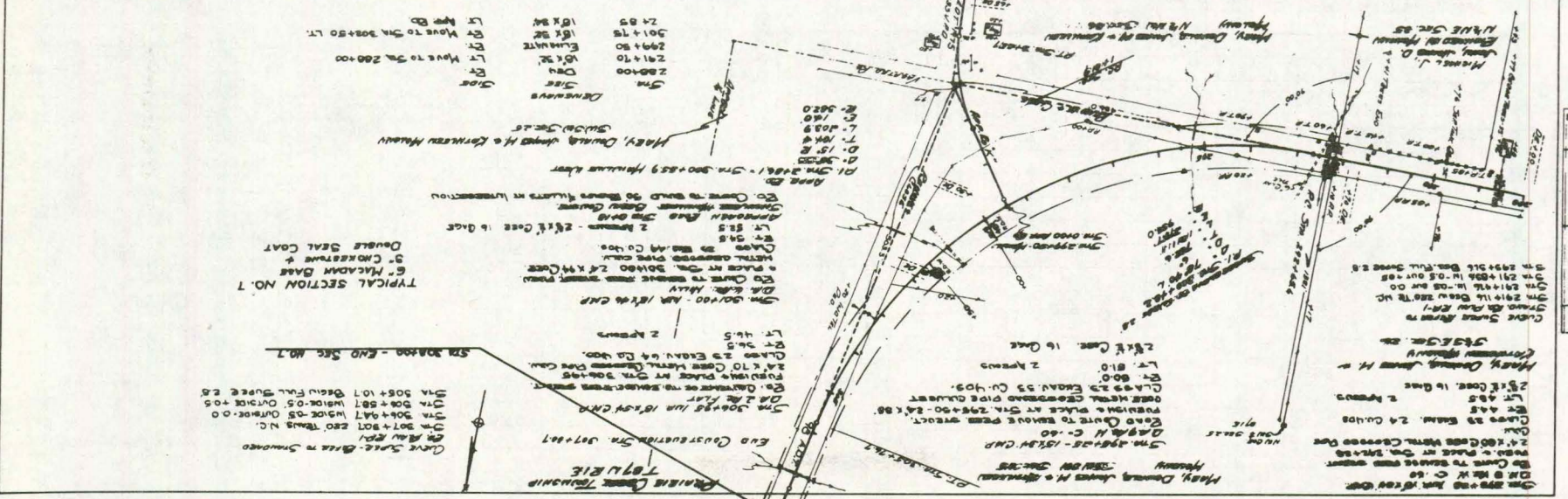
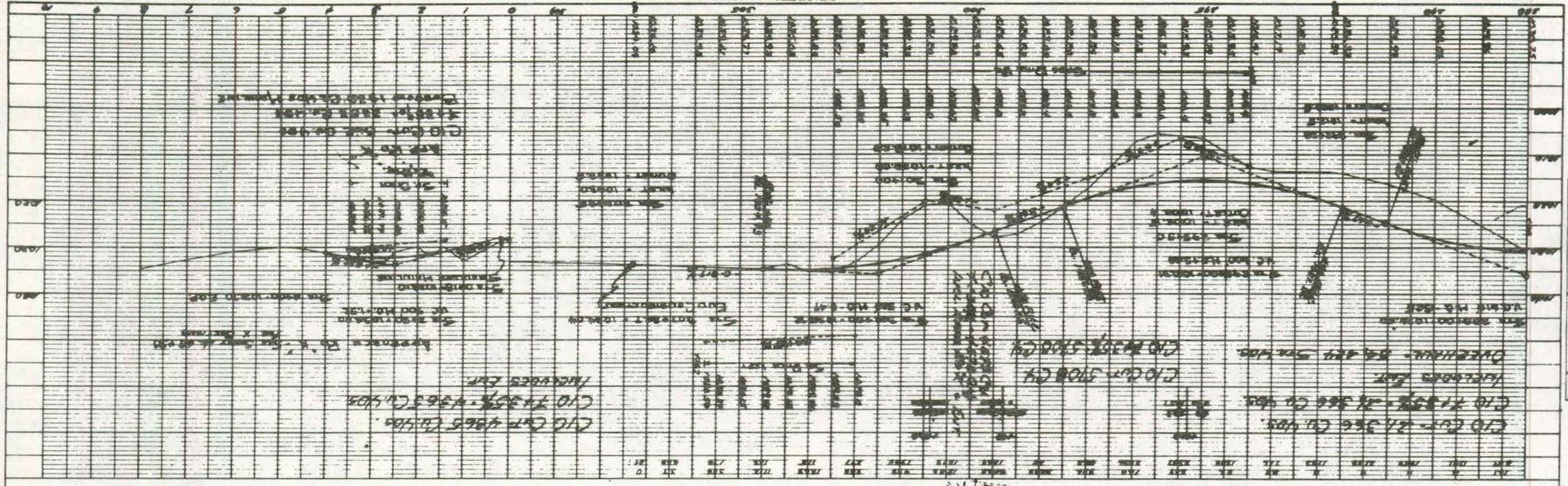
**PRAIRIE CREEK TOWNSHIP
TOWNSHIP**



PLAN
 PROPERTY
 SURVEY
 NORTH ARROW
 SCALE
 1" = 40'

PROFILE
 PROPERTY
 SURVEY
 NORTH ARROW
 SCALE
 1" = 40'

SM-4487-12-31



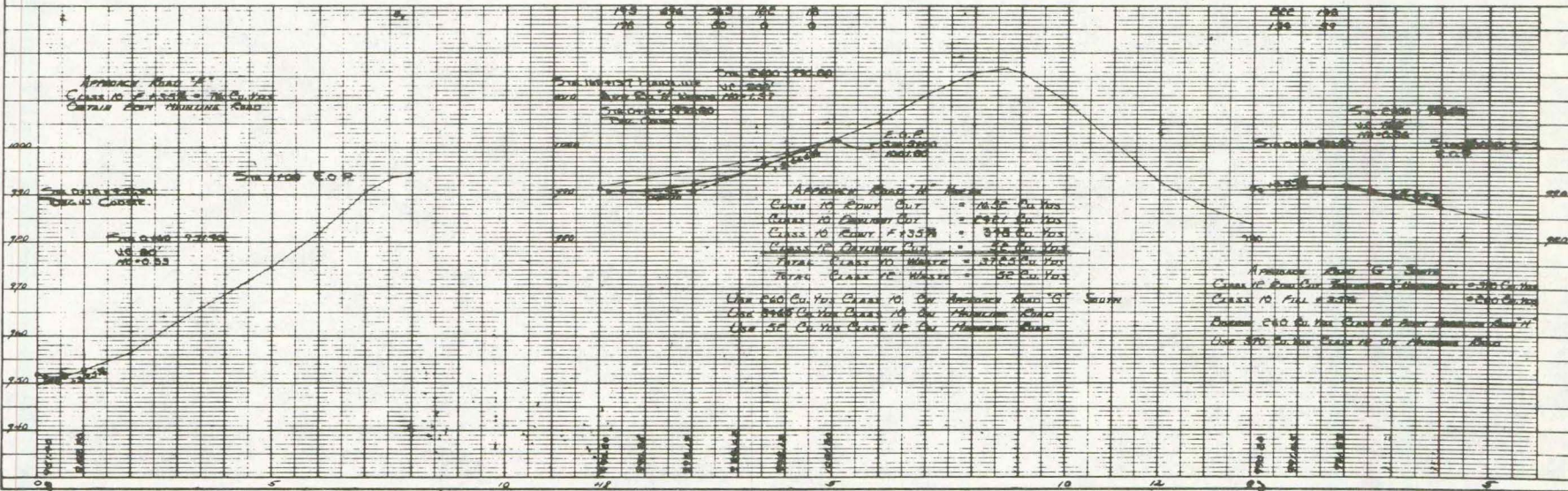
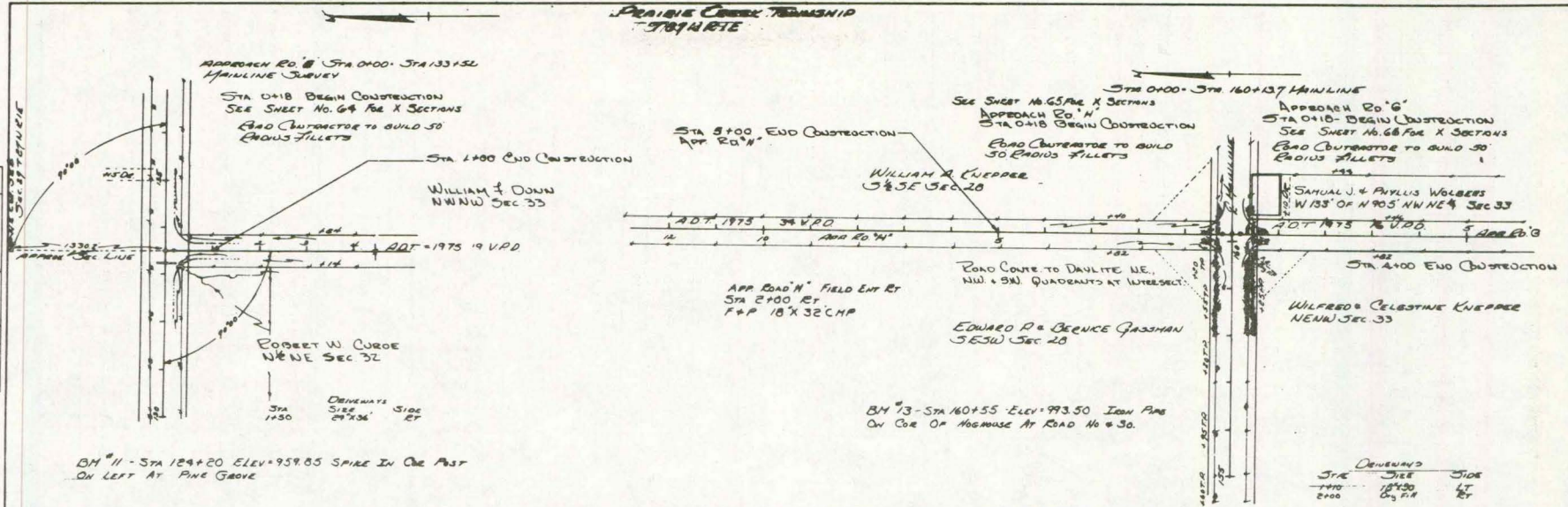
DATE	BY	CHKD	APP'D
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM

DATE	BY	CHKD	APP'D
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM

DATE	BY	CHKD	APP'D
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM
11/11/11	SM	SM	SM

NO	DATE	BY	REVISION
5	1910	W. A. KUEPPER	REVISED

PEABODY CREEK TOWNSHIP
- 3784 RT 2



Appendix C

Test Reports

IOWA DEPARTMENT OF TRANSPORTATION
 OFFICE OF MATERIALS
 ASPHALT CONCRETE MIX DESIGN
 LAB LOCATION AMES

MIX, TYPE AND CLASS: TYPE B CLASS I LAB NO. ABB0-129

INTENDED USE:

SIZE 3/4" SPEC. NO. 852-857 DATE REPORTED 8/18/80

COUNTY DUBUQUE PROJECT SN-4657(3)--51-31

CONTRACTOR TSCHIGGFRIE

PROJ. LOCATION ON SEC. RD. FROM U.S. 151 @ 25-87-1E S. AND E. 5.9 MILES

AGG. SOURCES 3/4" LST. CHIPS - MAR JO HILLS GR. - DUBUQUE CO.; 3/8" CR. LST. - MAR JO HILLS GR. - DUBUQUE CO.; SAND - BELLEVUE - JACKSON CO.
 JOB MIX FORMULA AGGREGATE PROPORTIONS: 20% AAT0-433, 50% AAT0-434, 30% AAT0-423

JOB MIX FORMULA - COMBINED GRADATION

1-1/2"	1"	3/4"	1/2"	3/8"	NO.4	NO.8	NO.16	NO.30	NO.50	NO.100	NO.200
100	99	86	81	67	54	42	31	19	11		5.5

TOLERANCE: 98/100 7 7 6 5 2.43 3

75 BLOW MARSHALL DENSITY
 ASPHALT SOURCE AND APPROXIMATE VISCOSITY KOCH - 1190 POISES
 PLASTICITY INDEX N. P.

% ASPH. IN MIX 4.50 5.50 6.50
 NUMBER OF MARSHALL BLOWS 50 50 50
 MARSHALL STABILITY - LBS. 2945 3000 2100
 FLOW - 0.01 IN. 7 8 13

SP.GR. BY DISPLACEMENT(LAB DENS.) 2.36 2.41 2.41
 BULK SP. GR. COMB. DRY AGG. 2.726 2.726 2.726
 SP. GR. ASPH. @ 77 F. 1.029 1.029 1.029
 CALC. SOLID SP.GR. 2.56 2.52 2.48
 % VOIDS - CALC. 7.8 4.4 2.9
 RICE SP. GR. 2.55 2.50 2.46

% VOIDS - RICE 7.5 3.5 2.2
 % WATER ABSORPTION - AGGREGATE 0.73 0.73 0.73
 % VOIDS IN THE MINERAL AGGREGATE 17.3 16.4 17.3
 % V.M.A. FILLED WITH ASPHALT 55.0 73.4 83.2
 CALCULATED ASPH.FILM THICKNESS(MICRONS) 6.2 7.7 9.3
 FILLER/BITUMEN RATIO 1.0

A CONTENT OF 5.75% ASPHALT IS RECOMMENDED TO START THE JOB.

COPIES:

- ASPH. MIX DESIGN
- SN-4657(3)--51-31, DUBUQUE
- R. C. HENELEY
- C. BAULE
- D. JORDISON
- R. SHELQUIST
- L. ZEARLEY
- TSCHIGGFRIE
- C. JONES
- D. HINES

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
ASPHALT CONCRETE MIX DESIGN
LAB LOCATION AMES

MIX, TYPE AND CLASS: A.T.B. CLASS 2 LAB NO. ABD0-135

INTENDED USE:

SIZE 3/4" SPEC. NO. 852-857 DATE REPORTED 8-18-80

COUNTY DUBUQUE PROJECT SN-4657(3)--51-31

CONTRACTOR TSCHIGGFRIE

PROJ. LOCATION ON SEC. RD. FROM U.S. 151 @ 25-87-1E SOUTH & EAST 5.9 MILES

AGG. SOURCES 3/4" CR. LST.-MAR JO HILLS QR.-DUBUQUE CO.; SAND-BELLEVUE-
JACKSON CO.

JOB MIX FORMULA AGGREGATE PROPORTIONS: 70% AAT0-431; 30% AAT0-432

JOB MIX FORMULA - COMBINED GRADATION

1-1/2"	1"	3/4"	1/2"	3/8"	NO.4	NO.8	NO.16	NO.30	NO.50	NO.100	NO.200
	100	99	90	80	62	47	37	26	14	8.0	5.5
TOLERANCE: 98/100			7	7	6		5				3

ASPHALT SOURCE AND APPROXIMATE VISCOSITY KOCH - 1190 POISES

PLASTICITY INDEX

% ASPH. IN MIX 4.50 5.50

NUMBER OF MARSHALL BLOWS 50 50

MARSHALL STABILITY - LBS. 2858 2762

FLOW - 0.01 IN. 7 8

SP.GR. BY DISPLACEMENT(LAB DENS.) 2.35 2.38

BULK SP. GR. COMB. DRY AGG. 2.689 2.689

SP. GR. ASPH. @ 77 F. 1.029 1.029

CALC. SOLID SP.GR. 2.54 2.50

* VOIDS - CALC. 7.5 4.9

RICE SP. GR. 2.53 2.48

% VOIDS - RICE 7.0 40

% WATER ABSORPTION - AGGREGATE 1.17 1.17

% VOIDS IN THE MINERAL AGGREGATE 16.5 16.4

% V.M.A. FILLED WITH ASPHALT 54.4 69.9

CALCULATED ASPH.FILM THICKNESS(MICRONS) 6.8 8.6

VOIDS/BITUMEN INDEX RATIO 5.4 2.8

A CONTENT OF 4.50% ASPHALT IS RECOMMENDED FOR THE JOB.

COPIES:

ASPH. MIX DESIGN

SN-4657(3)--51-31, DUBUQUE

BAULE

R. HENELY

D. JORDISON

R. SHELQUIST

L. ZEARLEY

TSCHIGGFRIE

C. JONES

D. HINES

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
ASPHALT CONCRETE MIX DESIGN
LAB LOCATION AMES

MIX, TYPE AND CLASS: A.T.B. CLASS 2 LAB NO. ABD0-136

INTENDED USE:

SIZE 3/4" SPEC. NO. 852-857 DATE REPORTED 8/18/80

COUNTY DUBUQUE PROJECT SN-4657(3)--51-31

CONTRACTOR TSCHIGGFRIE

PROJ. LOCATION ON SEC. RD. FROM U.S. 151 @ 25-87-1E S. AND E. 5.9 MILES

AGG. SOURCES 3/4" LST. CHIPS - MAR JO HILLS QR. - DUBUQUE CO.; 3/8" CR. LST. -
MAR JO HILLS QR. - DUBUQUE CO.; SAND - BELLEVUE - JACKSON CO.

JOB MIX FORMULA AGGREGATE PROPORTIONS: 20% AAT0-433, 50% AAT0-434, 30% AAT0-423

JOB MIX FORMULA - COMBINED GRADATION

1-1/2"	1"	3/4"	1/2"	3/8"	NO.4	NO.8	NO.16	NO.30	NO.50	NO.100	NO.200
	100	99	86	81	67	54	42	31	19	11	5.5
TOLERANCE:	98/100			7	7	6		5			3

ASPHALT SOURCE AND APPROXIMATE VISCOSITY KOCH - 1190 POISES

PLASTICITY INDEX

% ASPH. IN MIX

4.50

5.50

NUMBER OF MARSHALL BLOWS

50

50

MARSHALL STABILITY - LBS.

2945

3000

FLOW - 0.01 IN.

7

8

SP. GR. BY DISPLACEMENT (LAB DENS.)

2.36

2.41

BULK SP. GR. COMB. DRY AGG.

2.726

2.726

SP. GR. ASPH. @ 77 F.

1.029

1.029

CALC. SOLID SP. GR.

2.56

2.52

* VOIDS - CALC.

7.8

4.4

RICE SP. GR.

2.55

2.50

% VOIDS - RICE

7.5

3.5

% WATER ABSORPTION - AGGREGATE

0.73

0.73

% VOIDS IN THE MINERAL AGGREGATE

17.3

16.4

% V.M.A. FILLED WITH ASPHALT

55.0

73.4

CALCULATED ASPH. FILM THICKNESS (MICRONS)

6.2

7.7

VOIDS/BITUMEN INDEX RATIO

6.2

2.7

A CONTENT OF 4.75% ASPHALT IS RECOMMENDED FOR THE JOB.

COPIES:

ASPH. MIX DESIGN

SN-4657(3)--51-31, DUBUQUE

R. C. HENELY

C. BAULE

D. JORDISON

R. SHELQUIST

L. ZEARLEY

TSCHIGGFRIE

C. JONES

D. HINES

1000, DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
ASSURANCE SAMPLE TEST REPORT - MISCELLANEOUS MATERIALS
LAB LOCATION AMES

MATERIAL 3" MACADAM LAB NO. AAR0-276
INTENDED USE EMULSION TREATED MACADAM
COUNTY DUBUQUE PROJ NO. SN-4657(3)---51-31
DESIGN CONTRACT NO.
PRODUCER BEECHER STONE CONTRACTOR TSCHIGGFRIE
SOURCE BERNARD
UNIT OF MATERIAL SAMPLED FROM STOCKPILE AT QUARRY CONTRACT QUANTITY
SAMPLED BY J. LAMANTIA SENDERS' NO. CROAS-170
DATE SAMPLED J. LAMANTIA REC'D 9-19-80 REPORTED 9-30-80

% PSG. #8 AFTER 25 CYCLES, F&T, WATER SOL. 1
% WEAR, LA ABRASION, GRADING B 40

COPIES
ROAD STONE
R. C. HENELY
C. BAULE
SN-4657(3)---51-31
GEOLOGY

DISPOSITION: PROPERTIES TESTED COMPLY

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

ASSURANCE SAMPLE

INDIA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT - MISCELLANEOUS MATERIALS
LAB LOCATION AMES

MATERIAL 3/4" CRUSHED STONE

LAB NO. AAT0-544

INTENDED USE TYPE B ASPHALT

COUNTY

PROJ NO. SN-4657(3)--51-31

DESIGN

CONTRACT NO.

PRODUCER TSCHIGGRIE

CONTRACTOR TSCHIGGRIE

SOURCE DUBUQUE

UNIT OF MATERIAL SAMPLED FROM STOCKPILE AT PROD. PLANT CONTRACT QTY.

SAMPLED BY J. LAMANTIA

SENDERS' NO. CROAS-165

D. E SAMPLED 9-8-80

REC'D 9-19-80

REPORTED 9-30-80

% PSQ, #8 AFTER 16 CYCLES, FAT, WATER-ALC. SOL. 1

% PSQ, #8 AFTER 25 CYCLES, FAT, WATER SOL. 1

% WEAR, LA ABRASION, GRADING B 30

LIQUID LIMIT 16

PLASTIC LIMIT 16

PLASTICITY INDEX 0

COPIES:

- 51T, AGG.
- R. C. HENELY
- C. BAULE
- SN-4657(3)--51-31, DUBUQUE

GEOLOGY

DISPOSITION: PROPERTIES TESTED COMPLY

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

ASSURANCE SAMPLE
IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT - MISCELLANEOUS MATERIALS
LAB LOCATION AMES

MATERIAL ASPHALT AC-10 LAB NO. AB0-220
INTENDED USE TYPE B ASPHALT
COUNTY DUBUQUE PROJ NO. SN-4657(3)--51-31
DESIGN CONTRACT NO.
PRODUCER KOCH CONTRACTOR TSCHIGGFRIE
SOURCE DUBUQUE TERMINAL
UNIT OF MATERIAL SAMPLE AT ASPHALT PLANT. CONTRACT QUANTITY
SAMPLED BY JOHN LAMANTIA SENDER'S NO. CR0AS-167
DATE SAMPLED 9/9/80 REC'D 9/29/80 REPORTED 10/1/80

SPECIFIC GRAVITY AT 60 F/60 F.

SOFT. POINT: METHOD (R & B)

PENETRATION AT 77 F. 100 GMS. 5 SEC. 102

FLASH POINT

SOLUBLE IN TRICHLOROETHYLENE 99.69%

DUCTILITY AT 77 F.

SPOT TEST

THIN FILM LOSS ON HEATING 5 HRS AT 325 F. 0.54%

% ORIGINAL PENETRATION (THIN FILM RES.) 50

PENETRATION OF RES. AT 77 F. 100 GMS. 5 SEC. 51

DUCTILITY AT 77 F. (THIN FILM RES.) 125+ CMS.

ABSOLUTE VISCOSITY ORIGINAL 140 F. 30 CM HG 1190 POISES

ABSOLUTE VISCOSITY THIN FILM RES. 140 F. 30 CM HG 3550 POISES

KIN. VISCOSITY ORIGINAL @ 275 F.

COPIES:

ASPHALT

R. C. HENELY

C. BAULE

SN-4657(3)--51-31, DUBUQUE

DISPOSITION: COMPLIES WITH AASHTO M226

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

ASSURANCE SAMPLE

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT - MISCELLANEOUS MATERIALS
LAB LOCATION AMES

MATERIAL MC-70

LAB NO. AR00-100

INTENDED USE PRIME & TACK

COUNTY DUBUQUE

PROJ NO. SN-4657(3)--51-31

DESIGN

CONTRACT NO.

PRODUCER KOCH

CONTRACTOR TSCHIGGFRIE

SOURCE DUBUQUE

UNIT OF MATERIAL SAMPLED FROM DISTRIBUTOR ON PROJECT CONTRACT QUANTITY

SAMPLED BY J. LAMANTIA

SENDER'S NO. CR0AS-168

DATE SAMPLED 9-9-80

REC'D 9-29-80

REPORTED 10-2-80

SP. GR. @ 60 F. / 60 F. 0.9547

FLASH POINT - OPEN CUP

KINEMATIC VISCOSITY, CENTISTOKES, @ 140 F. 130

DISTILLATION % BY VOL. TOTAL DISTILLATE TO 680 F.

IB.P.	388
374 F.	0.0%
437 F.	6.1%
500 F.	45.4%
600 F.	84.8%

RESIDUE BY VOL. ABOVE 680 F. 67.0

RESIDUE BY WEIGHT ABOVE 680 F. 72.9%

WATER NIL %

RESIDUE FROM DISTILLATION

PENETRATION @ 77 F. 100 GMS. 5 SEC. 187

DUCTILITY @ 77 F., CM.

SOLUBLE IN TRICHLOROETHYLENE

ABSOLUTE VISCOSITY AT 140 F. 300 MM HG, POISES 614

COPIES:

ROAD OIL
R. C. HENELY
C. BAULE
SN-4657(3)--51-31, DUBUQUE

DISPOSITION: COMPLIES WITH AASHTO M-82

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

ASSURANCE SAMPLE

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
AMES LABORATORY
TEST REPORT - BITUMINOUS MATERIALS

MATERIAL	3/4" ASPHALT MIX	LAB NO	ABC0-336
INTENDED USE	TYPE 'B' SURFACE 5.75%	COUNTY	DUBUQUE
PROJECT NO	SN-4657(3)--51-31	CONTRACT NO	
CONTRACTOR	TSCHIGGFRIE		
PRODUCER	TSCHIGGFRIE		
PLANT	DUBUQUE		
UNIT OF MATERIAL	SAMPLED ON PROJ.	CONTRACT QUANTITY	
SENDERS NO	CROAS-166		
SAMPLED BY	J. LAMANTIA		
DATE SAMPLED	9-9-80	DATE RECD	9-26-80
		DATE REPORTED	10-7-80

SIEVE ANALYSIS PERCENT PASSING

SIEVE	GM.RET	% RET	% PSG
1-1/2	0.0	0.00	0.00
1.05	0.0	0.00	0.00
3/4	0.0	0.00	100.00
1/2	212.0	13.39	86.61
3/8	155.5	9.83	76.78
4	184.5	11.66	65.12
8	208.0	13.14	51.98
16	162.5	10.27	41.71
30	154.5	9.76	31.95
50	202.5	12.79	19.16
100	113.0	7.13	12.03
200	73.5	4.64	7.39
WASH	91.0	7.39	0.00
PAN	26.0	0.00	0.00
DRY WT.	1584.000		
SUM OF RETAINED WTS.		1583.000	

% AGGREGATE BY EXTRACTION	94.600
% BITUMEN BY EXTRACTION	5.400
SPECIFIC GRAVITY	2.410
MARSHALL STABILITY	3567.000
MARSHALL FLOW 0.01 IN.	8.000

COPIES TO:

ASPH. CONC.
R. C. HENELY
C. BAULE
SN-4657(3)--51-31, DUBUQUE

ASSURANCE SAMPLE
IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT-- MISCELLANEOUS MATERIALS
LAB LOCATION AMES

MATERIAL HFMS-2 EMULSION HFE-150 LAB NO. ARE0-141
INTENDED USE EMULSION TREATED MACADAM
COUNTY DUBUQUE PROJ NO. SN-4657(3)--51-31
DESIGN CONTRACT NO.
PRODUCER KOCH CONTRACTOR TSCHIGGFRIE
SOURCE
UNIT OF MATERIAL SAMPLED FROM TANK AT BERNARD PLANT. CONTRACT QUANTITY
SAMPLED BY J. LAMANTIA SENDERS' NO. CR0AS-71
DATE SAMPLED 9/9/80 REC'D 10/6/80 REPORTED 10/8/80

VISCOSITY, SAYBOLT FUROL AT 77 F. (SEC.)	124
WT./GAL. LBS.	8.39
ASPHALT CONTENT, % BY WEIGHT	67.1
PENETRATION OF RESIDUE AT 77 F. 100 GMS. 5 SEC.	167

COPIES:
EMULSION
R. C. HENELY
C. BAULE
SN-4657(3)--51-31, DUBUQUE

DISPOSITION: COMPLIES

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

IOWA DEPARTMENT OF TRANSPORTATION
Office of Materials
Highway Division

Emulsion
Zearley
SN-4657(3)
Dubuque

TEST REPORT — MISCELLANEOUS MATERIALS
AMES LABORATORY

Material HF MS-2 emulsion HFE-90 Laboratory No. ARE0-71

Intended Use _____

County Dubuque Proj. No. SN-4657(3)

Producer Koch Contractor _____

Source Dubuque

Unit of Material 1 gal.

Sampled by Producer Sender's No. _____

Date Sampled _____ Date Rec'd 8-6-80 Date Reported 8-11-80

Asphalt Content, % by weight 67.5

Penetration of Residue at 77°F. 100 Gms. 5 Sec. 82

DISPOSITION:

Signed



Testing Engineer

C. Huisman
 B. Brown
 K. McLaughlin
 R. Shelquist
 D. Jordison
 B. Henely
 R. Merritt
 C. L. Baule

Test Method No. Iowa 1002-C
 August 1977

Iowa Department of Transportation
 Office of Materials

RMRV REPORT

Road No. _____ County Dubuque Lab Report No. 8125

Year Built 1980 Date Tested 11-5-80 Date Reported 11-14-80

Contractor Tschiggfrie Excavating Project No. SN-4657(3)-51-31

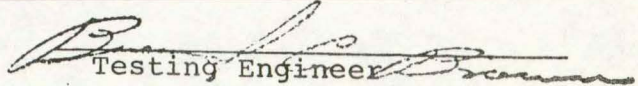
Project Length (miles) _____ Surface Type AC Resurf

Location From US 151 near the W 1/4 corner SE 1/4 Section 19-87-1E South and
East to just east of the SW Corner Section 25-87-1E

Weather Clear Wind _____ Temperature _____

Test Personnel Jones

	S Outside Bound Lane	N Outside Bound Lane
Length Tested.....	<u>3.063</u>	<u>3.066</u>
Longitudinal Profile Value.....	<u>3.775</u>	<u>3.775</u>
Average Longitudinal Profile Value.....	<u>3.78</u>	
Deduction for Cracking, Patching and Rut Depth.....	<u>0</u>	
Present Serviceability.....	<u>3.78</u>	


 Testing Engineer
 976

CONTRACT NO. 17539

TYPE OF WORK ASPH. CEMENT CONC. PAV'T.

PROJECT NO. SN-4657(3)--51-31

MILES 5.855

COST CENTER 801000 OBJECT 860

COUNTY DUBUQUE

ON SECONDARY ROAD FROM U S 151, NEAR THE W 1/4 COR. SE 1/4 SEC. 19-87-1E, SOUTH AND EAST TO JUST EAST OF THE SW COR. SEC. 25-87-1E

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

TSCHIGGFRIE EXCAVATING CO. OF DUBUQUE, IOWA

PARTY OF THE FIRST PART, AND 44990

PARTY OF THE SECOND PART.

WITNESSETH, THAT THE PARTY OF THE SECOND PART, FOR AND IN CONSIDERATION OF \$ ****897,023.10, PAYABLE AS SET FORTH IN THE SPECIFICATIONS CONSTITUTING A PART OF THIS CONTRACT, HEREBY AGREES TO CONSTRUCT VARIOUS ITEMS OF WORK AND, OR, TO SUPPLY VARIOUS MATERIALS OR SUPPLIES IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS THEREFOR, AND IN THE LOCATIONS DESIGNATED IN THE NOTICE TO BIDDERS, AS FOLLOWS:

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
INCLUDES 7 SECTIONS WITH DESIGN VARIATIONS					
1	BASE, TYPE B CLASS 1 ASPHALT CEMENT CONCRETE	6,815	TONS	15.25	103,928.75
2	BASE, ASPHALT TREATED, CLASS 2	4,370	TONS	14.25	62,272.50
3	ASPHALT CEMENT	589	TONS	145.00	85,405.00
4	STABILIZED SHOULDER MATERIAL	6,455	TONS	8.00	51,640.00
5	AGGREGATE, ROADWAY COVER, 1/2 IN.	2,064	TONS	11.00	22,704.00
6	BINDER BITUMEN	48,761	GALS.	.75	36,570.75
7	PRIMER OR TACK-COAT BITUMEN	24,995	GALS.	.80	19,996.00
8	BASE, MACADAM STONE - EMULSION TREATED	15,850	TONS	7.72	122,362.00
9	BASE, MACADAM STONE	16,040	TONS	6.72	107,788.80
10	BASE, CHOKE STONE - EMULSION TREATED	4,067	TONS	7.00	28,469.00
11	BASE, CHOKE STONE	6,628	TONS	7.00	46,396.00
12	EMULSION, TREATED BASE MATERIAL	283,095	GALS.	.74	209,490.30
GRAND TOTAL					\$897,023.10

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 JULY 10, 1980

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 1977 TOGETHER WITH SPECIAL PROVISIONS ATTACHED, TOGETHER WITH THE GENERAL AND DETAILED PLANS, IF ANY, FOR SAID PROJECT SN-4657(3)--51-31

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
APPROX JULY 30, 1980	40 WORKING DAYS

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 28 DAY OF July, 1980

COUNTY OF DUBUQUE, IOWA

BY [Signature] PARTY OF THE FIRST PART

TSCHIGGFRIE EXCAVATING CO. OF DUBUQUE, IOWA

BY [Signature] PARTY OF THE SECOND PART

Approved:

[Signature] JUL 31 1980 Contracts Engineer Date IOWA DEPT. OF TRANSPORTATION

TABLE I

STRUCTURAL RATING BASED ON ROAD RATER

Section #	Station from-to	Initial Structural Rating on Sub Base	Final Structural Rating on Pavement in Place
1	0 to 23+00	1.4	3.6
2	23+00 to 47+05	1.9	3.1
3	47+35 to 68+00	1.7	3.2
4	68+00 to 89+00	2.3	2.3
5	89+00 to 110+00	2.0	2.35
6	110+00 to 131+00	2.0	1.9
7	131+00 to 152+00	1.9	1.9
8-14	152+00 to 308+00	1.8	2.0

Using Table II* (on following page)
for comparison basis

Section Number 1 $(0.34) (6) + 0.44 (2) = 2.92$

6" black base 2" of Type B surface $2.04 + 0.88 = 2.92$ SN versus 3.6 final

Section Number 7 $(0.12) (6) + (0.14) (3) = 1.14$

$0.72 + 0.42 = 1.14$ SN versus 1.9 final

From all indications, the Type B asphaltic concrete over the 6" black base and the 6" emulsion bound macadam base are the best sections - Sections 1, 2, and 3. However, the spring will bring some changes to the pavements and as the summer approaches, deflection readings may decrease in Sections 4, 5, and 6. No substantial increase in structural characteristics is expected in section 7.

*Howard B. McPhail, Guide for Primary and Interstate Road Pavement Design, Iowa Department of Transportation, Ames 1968.

TABLE II

<u>Component</u>	<u>Coefficient</u>	<u>Minimum Thickness Permitted</u>
Surface Course		
Type A Asphalt Cement Concrete	0.44*	3 (300 tpd)
Type B Asphalt Cement Concrete	0.44*	2 (300 tpd)
Type B Asphalt Cement Concrete Class 2	0.40	
Inverted Penetration	0.20	
Base Course		
Type A Binder Placed as Base	0.40	
Type B Asphalt Cement Concrete Base Class I	0.38	2
Type B Asphalt Cement Concrete Base Class II	0.30	2
Asphalt Treated Base Class I	0.34*	4
Bituminous Treated Aggregate Base	0.23	6
Asphalt Treated Base Class II	0.26	4
Cold-Laid Bituminous Concrete Base	0.23	6
Cement Treated Granular (Aggregate) Base	0.20*	6
Soil-Cement Base	0.15	6
Crushed (Graded) Stone Base ***	0.14*	6
Macadam Stone Base	0.12	6
Portland Cement Concrete Base (New)	0.50	
Old Portland Cement Concrete	0.40**	
Subbase Course		
Soil-Cement Subbase	0.10	6
Soil-Lime Subbase	0.10	6
Granular Subbase	0.10*	4
Soil-Aggregate Subbase	0.05*	4

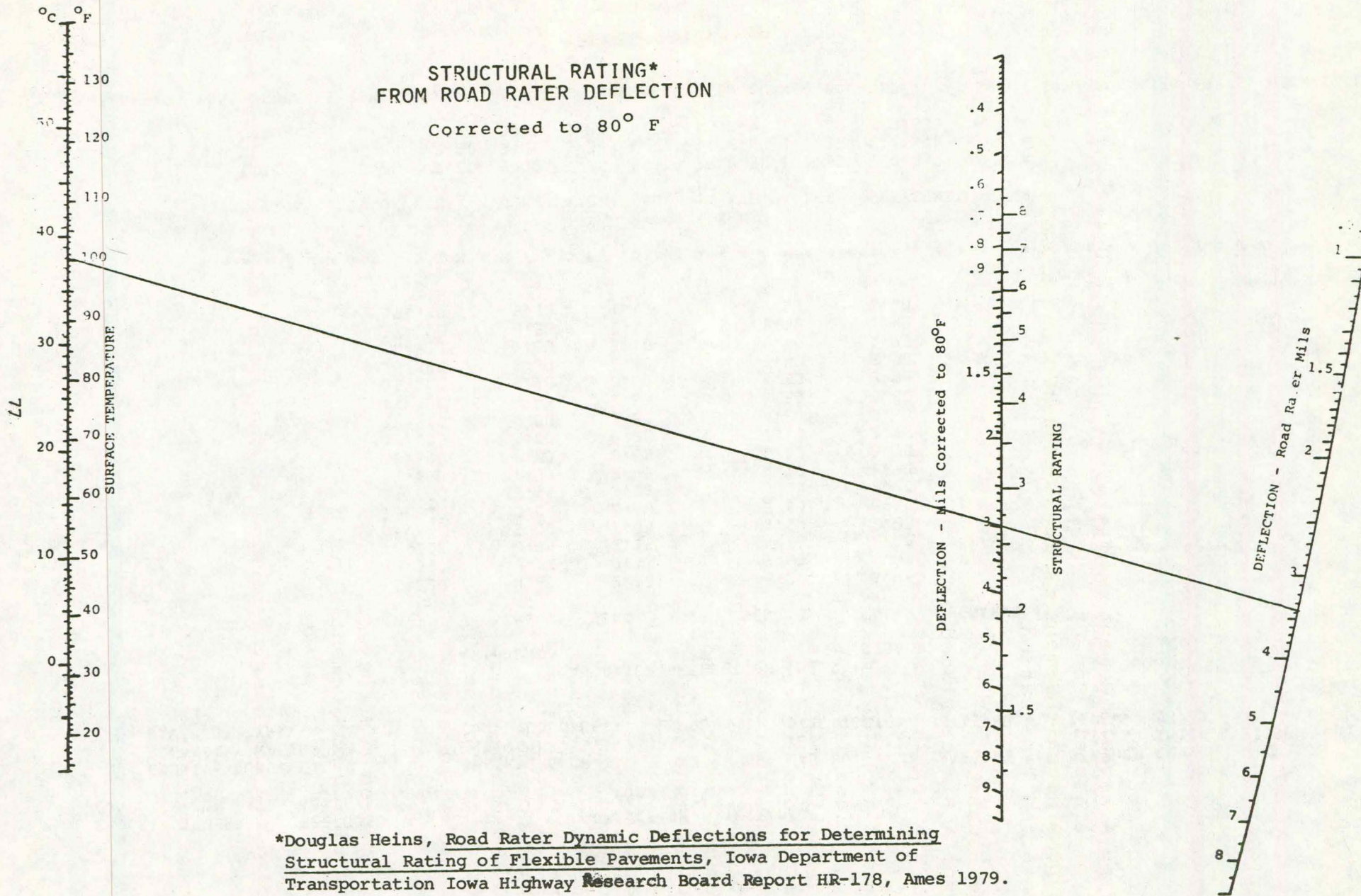
*Indicates coefficients taken from AASHTO Interim Guide for the Design of Flexible Pavement Structures.

**This value is for reasonably sound existing concrete. Actual value used may be lower, depending on the amount of deterioration that has occurred.

***No current specification.

Revised 8/30/77

STRUCTURAL RATING*
 FROM ROAD RATER DEFLECTION
 Corrected to 80° F



*Douglas Heins, Road Rater Dynamic Deflections for Determining Structural Rating of Flexible Pavements, Iowa Department of Transportation Iowa Highway Research Board Report HR-178, Ames 1979.

PROGRAM NUMBER- FE220050
 COMPUTER RUN DATE- 88/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. 905B
 PAVEMENT TYPE..

BEGINNING MP.... 0.0
 ENDING MP..... 23.00
 COMPUTED MILES.. 23.00

LAB NO..... RR1-102E
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS..... SMITH & TRITSCH
 TIME... 13:20

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
5.000	4.60	2.20	3.00	2.45	
8.500	3.55	2.15	7.60	4.40	
9.000	3.75	2.10	4.50	2.20	
9.500	3.50	1.90	5.50	2.20	
10.500	3.00	1.50	5.50	2.60	
11.000	3.45	2.15	5.10	2.70	
11.500	7.20	3.40	6.70	2.70	
12.500	4.80	2.65	6.90	2.70	
13.000	5.00	2.20	7.10	2.70	
13.500	5.00	3.80	6.20	3.40	
14.500	4.65	2.25	6.20	3.00	
15.000	6.30	2.80	5.10	2.90	
15.500	5.60	2.80	7.40	3.90	
16.500	7.00	2.10	4.90	1.75	
17.000	4.50	1.55	5.40	1.40	
17.500	5.70	1.90	4.50	1.60	

*Average temperature
72°*

78

***** SUMMARY OF DATA ***** HISTORY *****

DIRECTION	STD.DEV.	SENS1 MAX.	MIN.	AVE.	Design 80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	1.26	7.20	3.00	4.85	5.91	2.34	2.51	0.517
WEST	1.24	7.60	3.00	5.72	6.77	2.60	3.12	0.546
COMB	1.31	7.20 7.20	3.00	5.29	6.34	2.47	2.82	0.533

REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

1.4

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 24/02/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE..

BEGINNING MP.... 23.00
 ENDING MP..... 47.50
 COMPUTED MILES.. 24.50

LAB NO..... RRL-1023
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER
 OBS.... SMITH & TRITSCH
 TIME... 13:30

ROAD RATER DEFLECTION (MILS)

EASTBOUND

WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
24.000	5.30	1.70	4.70	1.00	<i>Average temperature 72°</i>
30.000	4.20	1.70	5.40	2.40	
35.500	3.25	1.60	3.50	1.10	
36.000	3.85	1.75	3.05	1.55	
36.500	2.75	1.50	3.20	1.40	
37.500	3.65	2.00	2.80	1.30	
38.000	3.80	1.40	3.25	1.20	
38.500	4.40	1.80	3.70	1.50	
39.500	3.45	1.30	3.50	1.45	
40.000	3.55	1.60	3.60	1.40	
40.500	3.20	1.60	2.61	1.32	
41.500	2.65	1.25	3.70	1.60	
42.000	3.00	1.30	3.30	1.55	
42.500	2.95	1.25	3.40	1.60	
43.500	4.60	1.60	3.85	1.60	
44.000	4.80	1.60	3.45	1.50	
44.500	4.70	1.45	3.50	1.50	

79

***** SUMMARY OF DATA *****

***** HISTORY *****

DIRECTION	STD.DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.79	5.30	2.65	3.77	4.43	1.55	2.22	0.588
WEST	0.66	5.40	2.61	3.56	4.11	1.47	2.09	0.587
COMB	0.72	5.30	2.61	3.66	4.27	1.51	2.15	0.588

REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

1.9

PROGRAM NUMBER- P22205C
 COMPUTER RUN DATE- 99/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D053
 PAVEMENT TYPE..

BEGINNING MP.... 47.35
 ENDING MP..... 68.00
 COMPUTED MILES.. 20.65

LAB NO..... RRL-1024
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 13:40

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
53.500	3.35	1.55	4.30	1.50	SECH SECL
54.000	3.95	1.90	5.60	1.80	SECH SECL
54.500	3.60	1.50	5.00	1.60	SECH SECL
55.500	3.80	1.65	3.95	1.85	SECH SECL
56.000	4.55	2.25	4.60	2.05	SECH SECL
56.500	5.00	2.50	5.00	2.90	SECH SECL
57.500	6.60	2.20	4.15	2.35	SECH SECL
58.000	4.20	1.70	6.30	2.70	SECH SECL
58.500	3.55	2.00	5.20	3.20	SECH SECL
59.500	2.95	1.70	3.20	2.10	SECH SECL
60.000	5.10	2.40	4.90	2.90	SECH SECL
60.500	5.20	2.20	5.50	2.90	SECH SECL
61.500	4.70	2.20	3.15	1.60	SECH SECL
62.000	3.75	1.85	3.60	2.00	SECH SECL
62.500	4.75	1.65	3.85	1.90	SECH SECL
67.000	3.40	1.45			

*Average temperature
72°*

***** SUMMARY OF DATA ***** HISTORY *****

DIRECTION	STD.DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.96	6.80	2.95	4.29	5.10	1.92	2.37	0.553
WEST	0.92	6.30	3.15	4.55	5.32	2.22	2.33	0.512
COMB	0.93	6.80	2.95	4.42	5.20	2.07	2.35	0.532

REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

PROGRAM NUMBER- P222005C
 COMPUTER RUN DATE- 10/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D953
 PAVEMENT TYPE..

BEGINNING MP.... 67.00
 ENDING MP..... 89.00
 COMPUTED MILES.. 22.00

LAB NO..... RR1-1025
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 13:50

ROAD RATER DEFLECTION (MILS)

EASTBOUND

WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
67.000			2.52	1.20	
71.500	4.70	1.70	3.80	1.30	
72.000	3.85	1.60	3.60	1.35	
73.500	2.95	1.00	2.58	1.02	
73.500	2.55	0.90	2.82	1.05	
74.000	3.00	1.25	3.75	1.65	
74.500	2.90	1.00	2.70	1.02	
75.500	2.90	1.35	2.85	1.30	
76.000	3.90	1.75	3.50	1.90	
76.500	2.28	0.93	2.52	0.96	
77.500	2.46	0.87	3.20	0.50	
78.000	2.07	0.90	2.70	0.84	
78.500	2.65	1.25	2.64	0.60	
79.500	3.05	1.10	3.25	1.15	
80.000	2.31	1.11	2.22	1.14	
80.500	2.22	1.08	2.75	1.00	

*Average temperature
72°*

***** SUMMARY OF DATA *****

***** HISTORY *****

DIRECTION	STD. DEV.	SENS1			SENS2			SCI	SCI/SENS1
		MAX.	MIN.	AVE.	80%	AVE.	SCI		
EAST	0.73	4.70	2.07	2.92	3.53	1.19	1.73	0.594	
WEST	0.49	3.80	2.22	2.96	3.37	1.12	1.84	0.621	
COMB	0.61	4.70	2.07	2.94	3.45	1.15	1.79	0.608	

REMARKS: TNN- SURFACE TEMPERATURE.

SECL- SUPERELEVATED CURVE, LOW SIDE.

SECH- SUPERELEVATED CURVE, HIGH SIDE

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 21/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE..

BEGINNING MP..... 89.00
 ENDING MP..... 110.00
 COMPUTED MILES.. 21.00

LAB NO..... RRI-1726
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 14:00

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
90.000	3.60	2.30	3.60	2.00	
98.500	2.90	1.65	3.75	1.45	
99.000	2.34	1.32	3.05	1.85	
99.500	2.37	1.32	2.70	1.47	
101.500	2.60	1.50	3.80	1.75	
101.000	2.31	1.26	5.40	2.00	
101.500	2.80	1.20	4.90	1.70	
102.500	4.20	2.70	4.35	2.30	
103.000	2.95	1.50	5.30	2.30	
103.500	4.30	1.70	2.16	1.32	
104.500	2.95	1.70	2.31	1.26	
105.000	2.60	1.35	3.60	1.45	
105.500	3.00	1.40	2.60	1.50	
106.500	3.40	1.70	2.80	1.35	
107.000	2.90	1.70	2.80	1.45	
107.500	4.05	1.80	3.35	1.75	

*Average temperature
72°*

82

***** SUMMARY OF DATA *****

DIRECTION	STD.DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.65	4.30	2.31	3.03	3.63	1.63	1.45	0.470
WEST	1.02	5.40	2.16	3.53	4.39	1.68	1.85	0.524
COMB	0.87	4.33 5.70	2.16	3.30	4.04	1.66	1.65	0.499

***** HISTORY *****

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REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

20

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 32/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- DD53
 PAVEMENT TYPE..

BEGINNING MP.... 110.00
 ENDING MP..... 131.00
 COMPLETED MILES.. 21.00

LAB NO..... RRL-1027
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 14:10

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
115.000	3.40	1.80	4.90	1.60	
122.500	3.40	2.00	3.70	1.80	
123.000	2.95	1.70	3.30	1.80	
123.500	2.70	1.40	3.45	1.80	
124.500	1.89	1.29	3.15	1.90	
125.000	2.28	1.33	2.58	1.53	
125.500	2.70	1.50	2.90	1.50	
126.500	3.50	1.90	3.70	1.60	
127.000	4.50	1.50	4.50	1.40	
127.500	3.45	2.10	4.05	1.50	
128.500	2.75	2.00	4.65	1.75	
129.000	3.20	2.60	4.05	1.70	
129.500	3.15	1.70	4.00	1.60	
130.500	3.30	1.75	2.67	1.41	
131.000	2.34	1.50	3.70	1.50	

*Average temperature
72°*

***** SUMMARY OF DATA *****

DIRECTION	STD. DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.63	4.50	1.89	3.03	3.57	1.74	1.29	0.426
WEST	0.70	4.90	2.58	3.69	4.27	1.63	2.06	0.559
COMB	0.73	4.50 4.90	1.89	3.36	3.98	1.68	1.68	0.499

***** HISTORY *****

REMARKS: TNNN- SURFACE TEMPERATURE.

SECL- SUPERELEVATED CURVE, LOW SIDE.

SECH- SUPERELEVATED CURVE, HIGH SIDE

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 43/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE..

BEGINNING MP.... 131.00
 ENDING MP..... 152.00
 COMPUTED MILES.. 21.00

LAB NO..... RR1-1028
 YEAR BUILT.. 1980
 DATE TESTED. - -
 8-10-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 14:20

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
131.500	2.31	1.68	3.60	1.35	
135.500	4.30	1.85	3.40	1.70	
136.000	2.95	1.80	3.00	1.80	
136.500	4.60	2.70	3.35	2.10	
137.500	4.50	2.30	6.10	2.60	
138.000	4.70	2.30	4.55	2.35	
138.500	5.20	2.60	7.40	2.40	
139.500	2.22	1.35	2.80	1.40	
140.000	2.25	1.32	3.20	1.55	
140.500	2.40	1.44	3.70	2.00	
141.500	3.15	1.50	3.00	1.45	
142.000	2.90	1.80	3.50	2.00	
142.500	2.85	1.75	3.95	1.95	
143.500	4.20	1.60	3.15	1.30	
144.000	2.34	0.78	4.10	1.65	
144.500	4.05	1.50	4.35	1.75	
145.500	3.00	1.45	3.45	1.85	
146.000	3.40	2.15	3.00	1.60	
146.500	2.52	1.50	3.15	1.60	
147.500	2.85	1.75	3.60	2.00	
148.000	3.60	2.25	3.00	1.90	
148.500	3.45	2.50	3.10	2.00	
150.000	3.70	1.90			

*Average temperature
72°*

84

***** SUMMARY OF DATA *****

DIRECTION	STD. DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.90	5.20	2.22	3.37	4.12	1.82	1.55	0.461
WEST	1.09	7.40	2.80	3.75	4.67	1.83	1.92	0.511
COMB	1.00	5.20 7.40	2.22	3.55	4.40	1.82	1.73	0.487

***** HISTORY *****

REMARKS: TNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

1.9

PROGRAM NUMBER- P22E0050
 COMPUTER RUN DATE- 54/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE..

BEGINNING MP.... 152.00
 ENDING MP..... 305.00
 COMPUTED MILES.. 153.00

LAB NO..... RRL-1029
 YEAR BUILT.. 1980
 DATE TESTED. 08-13-80

WEATHER CLDY
 OBS.... SMITH & TRITSCH
 TIME... 14:30

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
155.000			3.50	1.70	
160.000	2.40	0.78			
165.000			3.15	1.25	
170.000	3.70	2.35			
175.000			3.50	2.00	
180.000	3.40	1.85			
185.000			2.80	1.60	
190.000	4.05	2.15			
195.000			3.30	2.00	
200.000	4.35	1.70			
205.000			4.90	3.10	
210.000	3.20	1.55			
215.000			3.15	2.15	
220.000	3.00	1.40			
225.000			3.90	2.10	
230.000	3.00	1.80			
235.000			1.86	1.14	
240.000	3.05	1.60			
245.000			7.00	4.10	
250.000	2.70	1.30			
255.000			2.46	1.47	
260.000	2.55	1.38			
265.000			4.40	2.00	
270.000	3.80	1.35			
275.000			3.40	1.85	
280.000	2.46	1.74			
285.000			5.10	2.60	
290.000	5.00	3.00			
295.000			4.60	2.30	SECL
300.000	6.20	2.60			SECH
305.000			5.80	3.30	SECL

*Average temperature
72°*

85

***** SUMMARY OF DATA *****

DIRECTION	STD. DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	1.05	6.20	2.40	3.52	4.40	1.77	1.75	0.498
WEST	1.31	7.00	1.86	3.93	5.03	2.17	1.76	0.448
COMB	1.19	6.20 7.00	1.86	3.73	4.73	1.97	1.76	0.471

***** HISTORY *****

1.8

REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

PROGRAM NUMBER- P3220050
 COMPUTER RUN DATE- 11/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE.. AC

BEGINNING MP..... 0.0
 ENDING MP..... 23.00
 COMPUTED MILES.. 23.00

LAB NO..... RRL-1J14
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:00

AS BUILT

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
1.650	1.74	1.50			
5.000	1.44	1.20	1.20	1.08	
8.500	1.84	1.60	1.44	1.36	
9.000	1.64	1.40	1.24	1.20	
9.500	1.60	1.32	1.52	1.32	
10.500	1.56	1.32	1.20	1.00	T075
11.000	1.56	1.40	1.64	1.60	
11.500	1.40	1.32	1.44	1.28	
12.500	1.56	1.40	1.40	1.36	
13.000	1.44	1.32	1.60	1.48	
13.500	1.28	1.16	1.44	1.36	
14.500	1.60	1.28	1.68	1.56	
15.000	1.80	1.60	1.44	1.40	T055
15.500	2.40	1.92	1.60	1.44	
16.500			1.20	1.12	
17.000	1.56	1.24	1.00	0.96	
17.500	1.24	1.00	1.16	1.00	

*Average temperature
65°*

***** SUMMARY OF DATA *****

DIRECTION	SENS1					SENS2			
	STD.DEV.	MAX.	MIN.	AVE.	80%	AVE.	SCI	SCI/SENS1	
EAST	0.27	2.40	1.24	1.60	1.83	1.37	0.23	0.143	
WEST	0.20	1.68	1.00	1.39	1.56	1.28	0.10	0.076	
COMB	0.26	2.40	1.00	1.50	1.71	1.33	0.17	0.112	

***** HISTORY *****

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REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 22/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D053
 PAVEMENT TYPE.. AC

BEGINNING MP.... 23.00
 ENDING MP..... 47.05
 COMPUTED MILES.. 24.05

LAB NO..... RR1-1015
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:10

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
24.000	1.84	1.20	2.34	1.50	
30.000	1.80	1.28	2.10	1.44	
35.500	2.10	1.26	1.40	1.12	
36.000	2.34	1.32	1.40	1.20	
36.500	1.86	1.20	1.60	1.20	
37.500	2.10	1.20	1.60	1.00	
38.000	1.60	1.48	1.86	1.20	
38.500	1.80	1.16	1.92	1.32	
39.500	1.68	1.08	1.80	1.26	
40.000	2.04	1.32	1.80	1.32	
40.500	1.92	1.20	1.80	1.20	
41.500	2.40	1.32	2.10	1.50	
42.000	2.37	1.32	1.80	1.20	
42.500	2.64	1.50	1.40	0.88	
43.500	2.16	1.32	1.76	1.32	
44.000	2.16	1.32	1.76	1.20	
44.500	2.10	1.20	1.60	1.16	

*Average temperature
65°*

***** SUMMARY OF DATA *****

DIRECTION	STD. DEV.	SENS1				SENS2		
		MAX.	MIN.	AVE.	80%	AVE.	SCI	SCI/SENS1
EAST	0.28	2.64	1.60	2.05	2.29	1.28	0.78	0.379
WEST	0.26	2.34	1.40	1.77	1.98	1.24	0.53	0.300
COMB	0.30	2.64	1.40	1.91	2.16	1.26	0.65	0.343

***** HISTORY *****

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REMARKS: TNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE.

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 12/02/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- SDBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE.. AC

BEGINNING MP.... 47.35
 ENDING MP..... 67.00
 COMPUTED MILES.. 19.65

LAB NO..... RRL-1716
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:20

ROAD RATER DEFLECTION (MILS)

EASTBOUND

WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
53.500	2.34	1.50	1.80	1.36	SECH SECL
54.000	2.10	1.50	1.56	1.20	SECH SECL
54.500	2.34	1.56	1.60	1.20	SECH SECL
55.500	2.04	1.50	1.44	1.16	SECH SECL
56.000	2.10	1.44	1.40	1.20	SECH SECL
56.500	2.10	1.50	1.76	1.24	SECH SECL
57.500	1.80	1.38	1.24	1.00	SECH SECL
58.000	1.92	1.32	1.52	1.20	SECH SECL
58.500	2.10	1.50	1.48	1.28	SECH SECL
59.500	1.56	1.04	1.16	1.08	SECH SECL
60.000	1.92	1.26	1.56	1.20	SECH SECL
60.500	1.92	1.50	1.64	1.36	SECH SECL
61.500	2.34	1.50	1.20	1.00	SECH SECL
62.000	1.64	1.20	1.40	1.12	SECH SECL
62.500	2.10	1.50	1.20	1.00	SECH SECL
67.000	1.80	1.14	1.20	0.88	

*Average temperature
65°*

88

***** SUMMARY OF DATA *****

***** HISTORY *****

DIRECTION	STD.DEV.	SENS1				SENS2			
		MAX.	MIN.	AVE.	80%	AVE.	SCI	SCI/SENS1	
EAST	0.23	2.34	1.56	2.01	2.20	1.40	0.61	0.304	
WEST	0.20	1.80	1.16	1.45	1.62	1.15	0.29	0.202	
COMB	0.36	2.34	1.16	1.73	2.03	1.28	0.45	0.262	

REMARKS: TNN- SURFACE TEMPERATURE.

SECL- SUPERELEVATED CURVE, LOW SIDE.

SECH- SUPERELEVATED CURVE, HIGH SIDE

3.2

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 33/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D053
 PAVEMENT TYPE.. AC

BEGINNING MP.... 68.00
 ENDING MP..... 89.00
 COMPUTED MILES.. 21.00

LAB NO..... RRL-1017
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:30

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
71.500	3.50	1.70	2.34	1.50	
72.000	2.70	1.32	2.34	1.44	
72.500	2.70	1.32	2.10	1.44	
73.500	3.00	1.90	2.40	1.68	
74.000	2.76	1.50	2.10	1.20	
74.500	3.00	1.70	2.40	1.62	
75.500	4.00	2.20	1.80	1.08	
76.000	2.76	1.50	2.10	1.68	
76.500	3.00	1.10	2.04	1.20	
77.500	2.70	1.32	1.92	1.16	
78.000	3.30	1.90	2.10	1.32	
78.500	3.00	1.50	2.04	1.32	T055
79.500	3.50	2.00	2.10	1.20	
80.000	2.70	1.32	2.10	1.20	
80.500	2.52	1.32	1.80	1.20	

Average temperature 55°

***** SUMMARY OF DATA *****

DIRECTION	STD.DEV.	SENS1			SENS2			SCI	SCI/SENS1
		MAX.	MIN.	AVE.	80%	AVE.	SCI		
EAST	0.40	4.00	2.52	3.01	3.35	1.57	1.44	0.477	
WEST	0.19	2.40	1.80	2.11	2.27	1.35	0.76	0.361	
COMB	0.55	4.00	1.80	2.56	3.03	1.46	1.10	0.429	

***** HISTORY *****

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REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

89

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 44/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D053
 PAVEMENT TYPE.. SC

BEGINNING MP.... 89.00
 ENDING MP..... 110.00
 COMPUTED MILES.. 21.00

LAB NO..... RR1-1018
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:40

ROAD RATER DEFLECTION (MILS)

M-P	EASTBOUND		WESTBOUND		REMARKS
	SENS 1	SENS 2	SENS 1	SENS 2	
90.000	3.30	2.00	2.70	1.80	
98.500	2.52	1.32	2.16	1.20	
99.000	2.40	1.32	2.70	1.50	
99.500	2.10	1.20	2.40	1.50	
100.500	2.40	1.32	2.64	1.50	
101.000	2.76	1.50	2.70	1.50	
101.500	2.46	1.32	2.46	1.74	
102.500	3.50	2.20	2.40	1.50	
103.000	2.04	1.20	2.90	1.80	
103.500	3.00	1.50	1.92	1.14	
104.500	3.30	1.60	2.40	1.20	
105.000	2.34	1.20	2.46	1.26	
105.500	3.50	1.60	2.28	1.32	
106.500	2.52	1.50	2.10	1.26	
107.000	2.70	1.62	2.10	1.32	
107.500	3.60	2.20	2.22	1.50	

Average temperature 55°

06

***** SUMMARY OF DATA *****

DIRECTION	STD. DEV.	SENS1				SENS2			SCI	SCI/SENS1
		MAX.	MIN.	AVE.	80%	AVE.	SCI			
EAST	0.52	3.60	2.04	2.78	3.21	1.54	1.24	0.446		
WEST	0.27	2.90	1.92	2.41	2.64	1.44	0.97	0.402		
COMB	0.45	3.60	1.92	2.59	2.97	1.49	1.10	0.426		

***** HISTORY *****

REMARKS: TNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

2.35

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 55/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE. D053
 PAVEMENT TYPE.. SC

BEGINNING MP.... 110.00
 ENDING MP..... 131.00
 COMPUTED MILES.. 21.00

LAB NO..... RRL-1719
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 14:50

ROAD RATER DEFLECTION (MILS)

EASTBOUND

WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
115.000	3.00	1.40	3.90	1.60	
122.500	2.90	1.50	3.30	1.70	
123.000	3.40	1.50	3.10	1.50	
123.500	3.00	1.50	3.50	1.50	
124.500	2.80	1.20	2.70	1.50	
125.000	3.10	1.50	3.10	1.50	
125.500	3.60	1.50	3.40	1.60	
126.500	3.50	1.80	3.00	1.50	
127.000	3.50	1.60	3.50	1.60	
127.500	3.40	1.60	6.00	1.80	
128.500	3.60	1.50	3.30	1.50	
129.000	3.70	1.50	4.00	2.00	
129.500	3.90	1.50	3.40	1.50	
130.500	3.00	1.00	2.90	1.50	
131.000	2.90	1.00	3.00	1.40	

*Average temperature
550*

***** SUMMARY OF DATA *****

DIRECTION	STD.DEV.	SENS1 MAX.	MIN.	AVE.	80%	SENS2 AVE.	SCI	SCI/SENS1
EAST	0.35	3.90	2.80	3.29	3.58	1.44	1.85	0.562
WEST	0.78	6.00	2.70	3.47	4.13	1.58	1.89	0.545
COMB	0.60	3.90 6.00	2.70	3.38	3.89	1.51	1.87	0.553

***** HISTORY *****

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REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

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1.9

PROGRAM NUMBER- P222005C
 COMPUTER RUN DATE- 66/15/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DLBUWLE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE.. SC

BEGINNING MP.... 131.00
 ENDING MP..... 152.00
 COMPUTED MILES.. 21.00

LAB NO..... RRL-1020
 YEAR BUILT.. 1980
 DATE TESTED. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 15:00

ROAD RATER DEFLECTION (MILS)

EASTBOUND

WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
131.500	3.10	1.20	3.00	1.20	
135.500	3.20	1.40	3.30	1.60	
136.000	3.20	1.60	3.20	1.60	
136.500	3.60	2.00	3.10	1.50	
137.500	4.20	2.10	3.80	2.20	
138.000	4.20	2.50	3.90	2.00	
138.500	3.00	1.70	6.00	3.80	
139.500	2.90	1.20	2.88	1.50	
140.000	2.90	1.30	3.20	1.20	
140.500	3.10	1.50	2.70	1.32	
141.500	3.20	1.50	3.40	1.40	
142.000	3.50	1.90	3.30	1.60	
142.500	4.40	2.10	3.30	2.00	
143.500	2.80	1.00	3.10	1.50	
144.000	2.52	1.14	3.10	1.20	
144.500	2.76	1.32	2.10	0.96	
145.500	3.50	2.00	4.80	2.20	
146.000	3.20	1.90	3.50	1.90	
146.500	3.50	1.50	3.50	1.60	T060
147.500	3.00	1.50	3.10	1.70	
148.000	3.00	1.60	2.82	1.26	
148.500	3.10	1.70	2.40	1.80	T050
150.000	2.70	1.02			

*Average temperature
55°*

***** SUMMARY OF DATA *****

DIRECTION	SENS1					SENS2			
	STD. DEV.	MAX.	MIN.	AVE.	80%	AVE.	SCI	SCI/SENS1	
EAST	0.49	4.40	2.52	3.24	3.65	1.59	1.65	0.508	
WEST	0.80	6.00	2.10	3.34	4.01	1.68	1.66	0.496	
COMB	0.65	4.40 6.00	2.10	3.29	3.84	1.64	1.65	0.502	

***** HISTORY *****

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REMARKS: TNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE.

PROGRAM NUMBER- P2220050
 COMPUTER RUN DATE- 77/12/80

OFFICE OF MATERIALS
 ROAD RATER

TESTS

COUNTY- DUBUQUE
 SECONDARY ROUTE- D053
 PAVEMENT TYPE.. AC

BEGINNING MP.... 152.00
 ENDING MP..... 305.00
 COMPLETED MILES.. 153.00

LAB NO..... RRL-1021
 YEAR BUILT.. 1980
 DATE TESTED.. 10-13-80

WEATHER CLDY
 OBS.... TWOHEY & TRITSCH
 TIME... 15:10

ROAD RATER DEFLECTION (MILS)
 EASTBOUND WESTBOUND

M-P	SENS 1	SENS 2	SENS 1	SENS 2	REMARKS
155.000			0.96	0.80	
160.000	0.66	0.42			
165.000			0.82	0.68	
170.000	1.04	0.84			
175.000			1.52	1.00	
180.000	2.40	1.56			
185.000			1.64	1.16	
190.000	2.52	1.32			
195.000			1.56	1.20	
200.000	1.92	1.20			
205.000			1.80	1.28	
210.000	2.46	1.44			
215.000			2.82	2.10	
220.000	2.94	1.80			T070
225.000			2.40	2.10	
230.000	2.46	1.62			
235.000			2.40	1.50	
240.000	3.10	1.50			
245.000			3.00	1.50	
250.000	1.50	1.30			
255.000			4.40	2.30	
260.000	2.22	1.20			
265.000			3.30	1.70	T030
270.000	3.10	1.50			
275.000			3.60	1.50	
280.000	3.10	1.60			
285.000			4.00	2.20	
290.000	4.00	2.00			
295.000			3.40	1.90	SECL
302.000	6.00	3.00			SECH

*Average temperature
50°*

***** SUMMARY OF DATA ***** HISTORY *****

DIRECTION	SENS1					SENS2			
	STD. DEV.	MAX.	MIN.	AVE.	SD%	AVE.	SCI	SCI/SENS1	
EAST	1.27	6.00	0.66	2.63	3.69	1.49	1.14	0.434	
WEST	1.11	4.40	0.82	2.51	3.44	1.53	0.98	0.391	
COMB	1.17	6.00	0.66	2.57	3.55	1.51	1.06	0.413	

REMARKS: TNNN- SURFACE TEMPERATURE. SECL- SUPERELEVATED CURVE, LOW SIDE. SECH- SUPERELEVATED CURVE, HIGH SIDE

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Appendix F

Special Provisions

IOWA DEPARTMENT OF TRANSPORTATION
Ames, Iowa



Special Provisions
for

EMULSION TREATED MACADAM

Dubuque County SN-4657(3)--51-31

July 15, 1980

THE STANDARD SPECIFICATIONS, SERIES OF 1977, ARE AMENDED BY THE FOLLOWING ADDITIONS. THESE ARE SPECIAL PROVISIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

GENERAL. The work on this project includes several variations of base and wearing course construction, all described on the plans. This specification describes emulsion treated Macadam base and the related emulsion treated choke stone base, neither of which is described elsewhere in the specifications, and modifications to other standard specifications relating to this project. Certain aspects of this project are of a research nature, and requirements may be changed by the engineer in order to make these aspects more meaningful.

EMULSION TREATED MACADAM BASE AND EMULSION TREATED CHOKE STONE COURSE

MATERIALS. Aggregate for emulsion treated Macadam and emulsion treated choke stone courses shall be the product of crushing limestone, dolomite, or quartzite and shall meet the following requirements:

- A. Abrasion Loss. The percentage of wear, determined in accordance with AASHTO T 96, Grading A or B, shall not exceed 45.
- B. Soundness. When subjected to the freezing-and-thawing test, Laboratory Test Method 211, Method C, the percentage loss shall not exceed 10.
- C. Gradation. The aggregate for both base course and choke stone course shall be produced from the same source by primary crusher, both products of that operation. The gates or breaker bars shall be adjusted to produce a nominal maximum size of 3 inches, and the product of the primary crusher shall be screened over a 3/4-inch screen. The aggregate retained on the 3/4-inch screen shall be furnished as the aggregate for emulsion treated Macadam base course. The aggregate passing the 3/4-inch screen shall be furnished as the aggregate for emulsion treated choke stone course; however, the percentage of fines passing the No. 200 sieve shall not exceed 5.0 percent for the choke stone course aggregate that is to be treated with emulsion.

Emulsion for emulsion treated Macadam base and emulsion treated choke stone courses shall meet requirements of AASHTO M 140-79I, Grades HFMS-2 or CSS-1. This material or CRS-2 shall also be used for tack coats, if required.

PLANT EQUIPMENT. Article 2205.04 shall apply.

SPREADING EQUIPMENT. Spreading equipment for emulsion treated Macadam base shall be capable of uniformly depositing and spreading the base material to the required thickness. Equipment described in 2001.19 may be used.

Spreading equipment for emulsion treated choke stone course shall meet requirements of 2001.19.

HEATING EQUIPMENT. Article 2001.11 shall apply.

COMPACTION EQUIPMENT. Compaction equipment used shall be of such design that its operation shall not disturb the subgrade or subbase. Initial compaction of the Macadam base shall be by use of a self-propelled vibratory roller, and the engineer may require additional compaction by a steel-tired roller or a pneumatic-tired roller. The same rollers shall be used for the emulsion treated choke stone course, but the engineer may prohibit or restrict use of the self-propelled vibratory roller. Compaction equipment shall meet requirements of 2001.04.

WEIGHING EQUIPMENT. Article 2001.07 shall apply.

DISTRIBUTOR. Article 2001.12 shall apply.

CONSTRUCTION. The subgrade for these bases will be prepared by the county.

At railroad crossings, junctions with existing pavements, bridges, and similar structures, the contractor shall excavate the roadbed to prepare a subgrade to permit the full thickness of courses designated on the plans to be constructed to the proper elevation. In this operation, the granular material existing on the roadbed shall be salvaged and respread over the disturbed area when excavation work is completed.

Placement of filter fabric is also anticipated. This material will be placed in two, 200-foot areas in each test section, Placement will be by others prior to the base-spreading operation. This work will be coordinated by the engineer. The contractor will have no responsibility for either furnishing or placing filter fabric, but his cooperation will be necessary to provide satisfactory construction.

The emulsion treated Macadam base and choke stone course shall be mixed in accord with 2205.12A, C, E, F, and G. The aggregate is not to be heated prior to or during the mixing process, and asphalt cement will not be allowed as an alternate to the emulsion. The bituminous material anticipated necessary for the mixtures for both courses is 4 parts of emulsion per 100 parts of aggregate (on a weight basis). The proportioning shall maintain the amount designated by the engineer within a tolerance of 0.4 part, determined by tank measurements.

Addition of water during the mixing process is anticipated. The amount of both emulsion and water to be used may be adjusted by the engineer.

The emulsion treated Macadam base material and the emulsion treated choke stone material shall be spread in courses as shown on the plans. The material shall be spread to such width and depth that each course will conform to the desired profile and cross section. The intention is that each course will be spread to achieve its full thickness in one operation, though multiple passes may be used to obtain the desired width. A tack coat may be required between these courses, as provided in 2303.14.

The emulsion treated Macadam base material shall be thoroughly and uniformly compacted promptly after it is spread. Compaction shall continue until the material is well seated to the satisfaction of the engineer.

The emulsion treated Macadam choke stone course shall be thoroughly and uniformly compacted promptly after it is spread. Three complete coverages with a vibratory roller are anticipated. An additional final rolling with a smooth-faced, steel-tired or pneumatic-tired roller will be required. The finished surface shall be free from irregularities and loose material and shall have a smooth riding surface.

The emulsion treated choke stone course may be tack coated in accord with 2303.14, as directed by the engineer, prior to placement of the next course.

Each section of completed or partially completed course shall be maintained as provided in 2205.12M.

METHOD OF MEASUREMENT. The quantities of the various classes of work involved in the construction of accepted portions of emulsion treated Macadam stone base and emulsion treated choke stone base will be measured by the engineer as follows:

- A. Emulsion Treated Macadam Stone Base will be measured in tons computed by the engineer from weights of individual truck loads, and will include base material for fillets at intersecting roads, drives, and turnouts.
- B. Emulsion Treated Choke Stone Base will be measured in tons computed by the engineer from weights of individual truck loads, including base material for fillets at intersecting roads, drives, and turnouts.
- C. Primer or Tack-Coat Bitumen. Paragraph 2307.06B shall apply.
- D. Emulsion, Treated Base Material. The engineer will measure the gallons of emulsion used in emulsion treated Macadam base and emulsion treated choke stone base. The quantity will also include emulsion used in the mixture for the stabilized shoulders. Measurement will be by stick measurement in the contractor's storage tank before and after transport delivery or by weighing trucks on or near the project before and after delivery to the storage tanks. From this quantity will be deducted the measured or estimated quantity diverted to other uses on or off the project or wasted. The quantity will be converted to U. S. standard gallons as provided in 2307.06B.

BASIS OF PAYMENT. For the performance of the various classes of work involved in construction of emulsion treated Macadam stone base and emulsion treated choke stone base, measured as provided above, the contractor will be compensated as follows:

- A. Emulsion Treated Macadam Stone Base. For the number of tons of Emulsion Treated Macadam Stone Base placed, the contractor will be paid the contract price per ton.
- B. Emulsion Treated Choke Stone Base. For the number of tons of Emulsion Treated Choke Stone Base placed, the contractor will be paid the contract price per ton.
- C. Primer or Tack-Coat Bitumen. For the number of gallons of Primer or Tack-Coat Bitumen placed, the contractor will be paid the contract price per gallon. Article 1109.03 shall not apply to this item.
- D. Emulsion Treated Base Material. For the number of gallons of emulsion used in treated base material, the contractor will be paid the contract price per gallon.

This payment shall be considered full compensation for furnishing all materials, including water, and for all operations involved in the construction of the base.

MODIFICATION TO SECTION 2124, STABILIZED SHOULDERS

DELETE 2124.02 and add the following in lieu thereof:

2124.02 MATERIALS. The mixture used for emulsion treated base for shoulder areas and tack-coat material, if required, shall be those specified for emulsion treated choke stone course.

DELETE from 2124.07 the requirement for sealer bitumen and sand cover aggregate.

DELETE 2124.09 and 2124.10 and add the following in lieu thereof:

2124.09 MEASUREMENT AND PAYMENT. The base material used in the shoulders will be measured and paid for in the same manner as emulsion treated choke stone course. The emulsion used therein will be paid for separately, and the quantity will be included with the emulsion for the choke stone course.

MODIFICATIONS TO SECTION 2202, ASPHALT TREATED BASE

DELETE all of 2202.02A and add the following in lieu thereof:

A. Bituminous Material. AC used in asphalt treated base shall meet requirements of Section 4137, Grade AC-5.

Tack-coat bitumen shall be emulsion meeting requirements of AASHTO M 140-79I, Grade HFMS-2, CSS-1, or CRS-2.

MODIFICATIONS TO SECTION 2203, TYPE B ACC BASE

DELETE all of 2203.02A and add the following in lieu thereof:

A. Bituminous Material. AC used in Type B ACC Base shall meet requirements of Sections 4137, Grade AC-5.

Tack-coat bitumen shall be emulsion meeting requirements of AASHTO M 140-79I, Grade HFMS-2, CSS-1, or CRS-2.

MODIFICATIONS TO SECTION 2210, MACADAM STONE BASE

DELETE 4122.02C and add the following in lieu thereof:

C. Gradation. The aggregate for both base course and choke stone course shall be produced from the same source by a primary crusher, both products of that operation. The gates or breaker bars shall be adjusted to produce a nominal maximum size of 3 inches, and the product of the primary crusher shall be screened over a 3/4-inch screen. The aggregate retained on the 3/4-inch screen shall be furnished as the Macadam base course material.

The aggregate passing the 3/4-inch screen shall be furnished as the choke stone course material, but with a maximum of 12 percent passing the No. 200 sieve.

ADD the following to 2210.04B8. Equipment meeting requirements of 2001.19 shall be used for spreading the choke stone course.

DELETE all of 2210.04C2 and add the following in lieu thereof:

2. Moisture Content. Aggregate for the choke stone course shall be delivered, without prewetting, with only the moisture naturally occurring in the material. Water shall be added to the surface before or during compaction, if necessary, at the direction of the engineer.

MODIFICATIONS TO SECTION 2307, BITUMINOUS SURFACE TREATMENT

DELETE all of 2307.02B and add the following in lieu thereof:

B. Bituminous Material for seal coats shall meet requirements of AASHTO M 140-79I, Grade HFMS-2 or CRS-2.

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