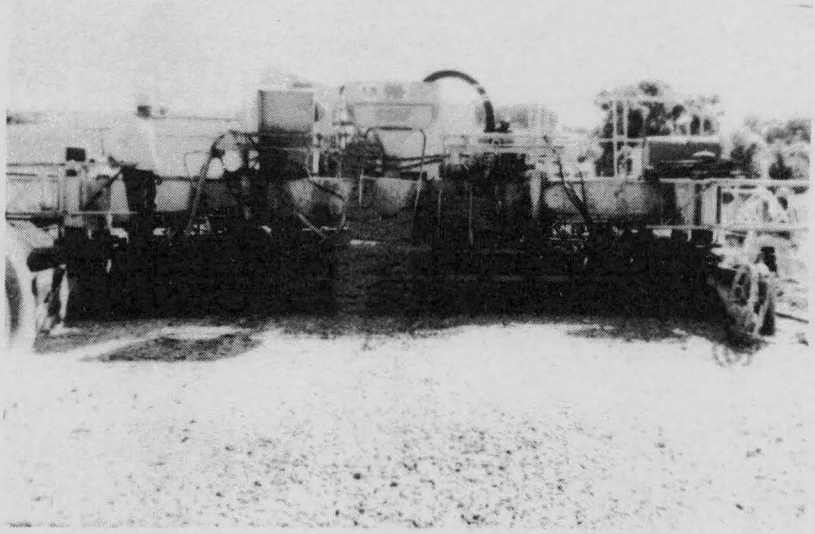
80-2

CONSTRUCTION REPORT



PAVEMENT SURFACE ON MACADAM BASE

ADAIR COUNTY

PROJECT SN-6085(4)--51-01

HR-209

BY

DONALD J. LYNAM
ADAIR COUNTY ENGINEER

DEPARTMENT OF TRANSPORTATION
IOWA

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PAVEMENT SURFACE ON MACADAM BASE

Adair County Project SN-6085(4)--51-01 HR-209

INTRODUCTION

Southwest Iowa is short of quality aggregates for paving projects. The coarse aggregate generally available in the area is limestone from the Argentine ledge. This coarse aggregate has a Class I durability rating and is prone to develop D-cracking. In addition, the general engineering soil classification[1] rates the soils of southwest Iowa of having the poorest subgrade bearing characteristics in the State. There are instances of extensive deterioration in portland cement concrete pavements which require rehabilitation and/or reconstruction.

The project was intended to explore alternative construction methods that may produce a pavement with better performance for southwest Iowa.

OBJECTIVE

The objective of the research was three fold:

1. To determine the feasibility, economics and performance of a roadway by placing portland cement concrete and asphaltic concrete on an open graded macadam base while developing design criteria by varying the thickness of the wearing surface.

[1]Donald A. Anderson, Theodore L. Welp, An Engineering Report on the Soils, Geology, Terrain and Climate of Iowa, Iowa State Highway Commission, Ames, 1960.

2. To determine if the macadam base is effective in reducing or eliminating the D-cracking deterioration of concrete produced with crushed limestone exhibiting poor durability.

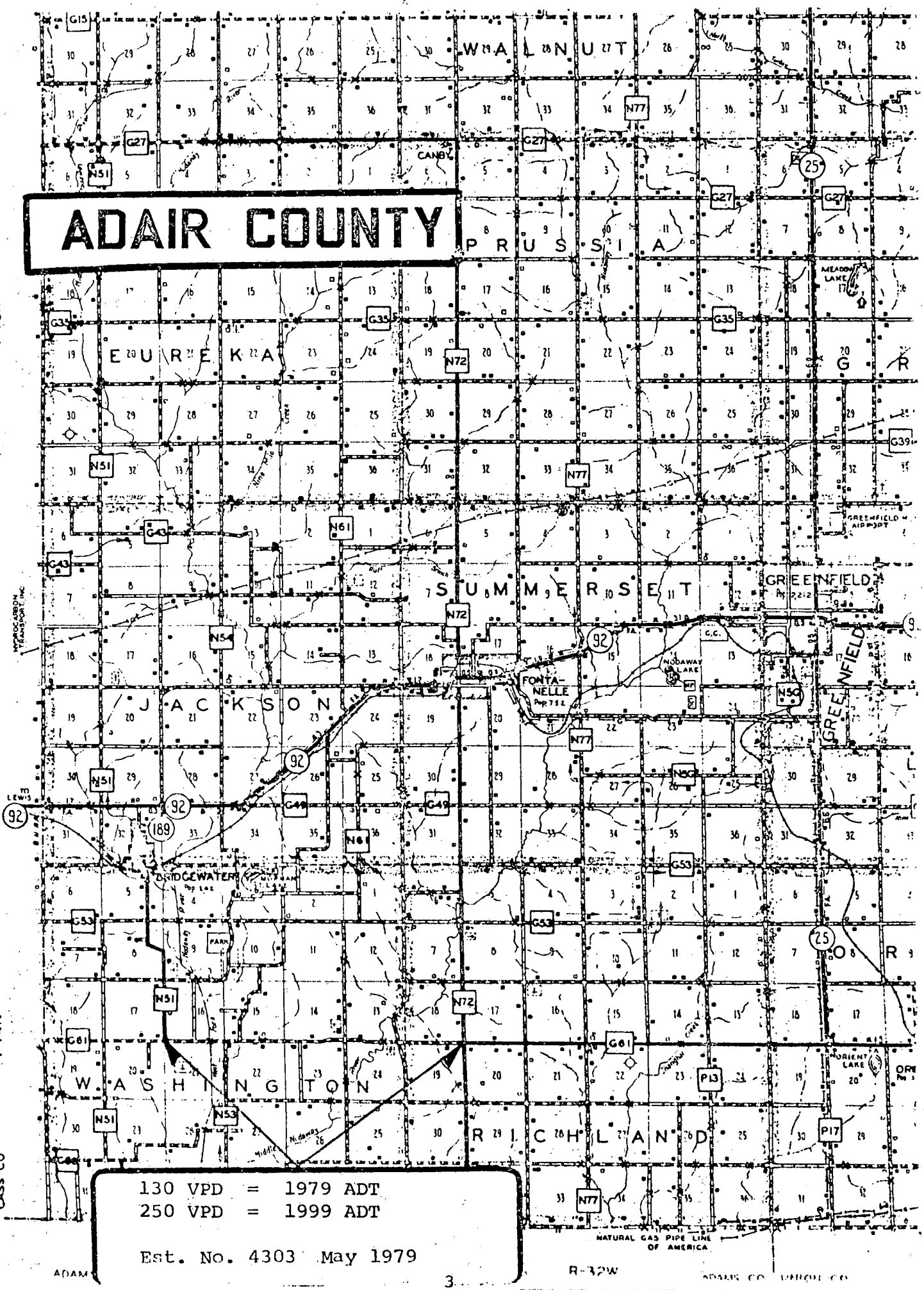
3. To determine the effect of placing asphaltic concrete directly on the macadam base, thus eliminating the chokestone.

PROJECT LOCATION

The project is located on Adair County Road G-61, located six miles south of Fontanelle and three miles south of Bridgewater (see map on following page). This highway serves as a shortcut between two primary highways. Trucks frequently use this highway, including delivery trucks on a regular run. A traffic count has not been made since contruction, but was over 100 vehicles per day before paving.

PROJECT FUNDING

The project was funded with Adair County Farm-to-Market funds. Funding for additional costs to the project was determined by estimating the conventional construction of six inch portland cement concrete pavement at $150,639.05. The total research construction, including information signs, extra testing, and contingency maintenance was $250,985.90. The Iowa Highway Research Board approved $100,346.85 from the Secondary Road Research Fund.


ADAIR COUNTY
WALNUT
PRUSSIA
EUREKA
SUMMERSET
JACKSON
WASHINGTON
RICHLAND
T-76N
T-75N
T-74N
CANBY
FONTANELLE
NODAWAY LAKE
MEADOW LAKE
GREENFIELD
GREENFIELD AIRPORT
BRIDGEWATER
PARK
ORIENT
ORIENT LAKE
NATURAL GAS PIPE LINE OF AMERICA
CASS CO
ADAM
R-32W
ADAIR CO
UNION CO
130 VPD = 1979 ADT
250 VPD = 1999 ADT
Est. No. 4303 May 1979

TEST SECTIONS

Section 1 - 1000 feet with 2" Type B asphaltic concrete over 6" macadam base

Section 2 - 1000 feet with 3" Type B asphaltic concrete over 5" macadam base

Section 3 - 1885 feet of 4" portland cement concrete (Early Chapel crushed limestone from Madison County) over 5" macadam base

Section 4 - 1918 feet of 4" portland cement concrete over 5" macadam base

Section 5 - 1200 feet of 5" portland cement concrete over 5" macadam base

Section 6 - (Not a test section) 1200 feet of 6" portland cement concrete on natural subgrade

Section 7 - 1000 feet of 3" portland cement concrete over 6" macadam base

Section 8 - 300 feet of 2" portland cement concrete over 6" macadam base

All test sections are signed. All paved sections are twenty-two feet wide. The macadam base is twenty-four feet wide, except for full width sections in the swales and at the end of test sections. See Appendix A for typical cross sections.

SUBGRADE

The road was graded in the fall of 1978, and remained closed during the spring of 1979 due to bridge construction. The subgrade was cut with a CMI in the usual procedure; except in the transition sections (which proved to be our future problem areas). The subgrade remained in very good shape

during construction. For better drainage, the subgrade crown was cut to a -4% grade (Figure 1) and the top grade of the macadam base had a crown of -2% (Figure 2) resulting in a slightly thicker section at the sides.

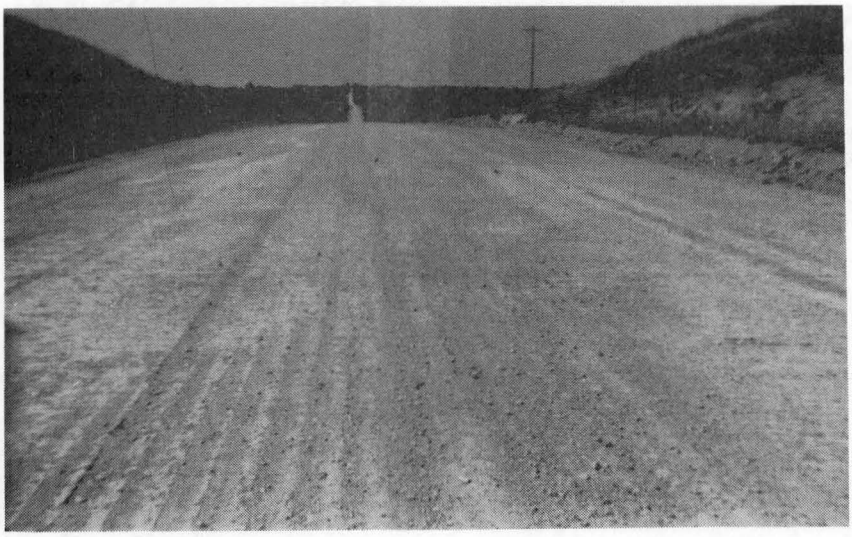


Figure 1: Subgrade

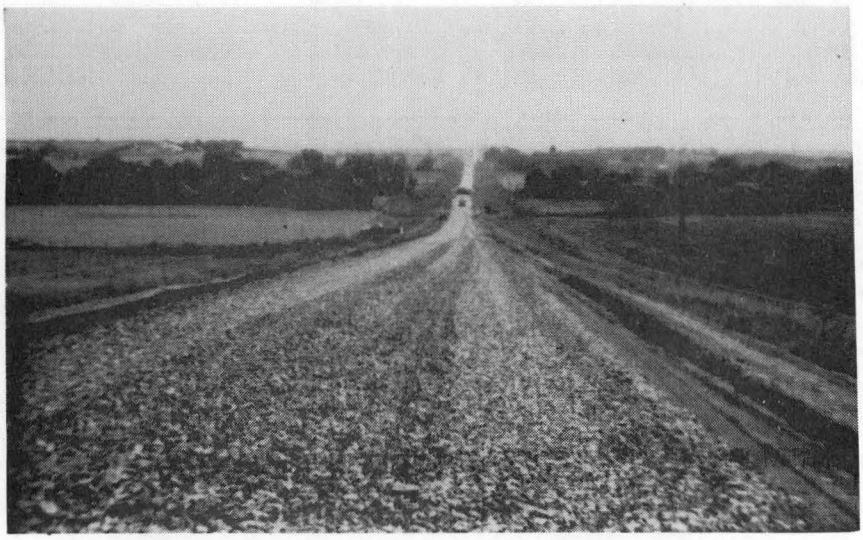


Figure 2: Macadam Base

MACADAM BASE

It was decided that the stone base material should meet the requirements of Iowa DOT Standard Specification Article 4122.02; however, the size would range from 3" maximum top size to a 3/4" bottom size. The construction of the macadam base was constructed as set forth in Standard Specification Article 2210; except no chokestone was used.

The producer crushed several hundred tons of 3" material and a test section of macadam base and portland cement concrete was constructed (Figure 3) at the Department of Transportation's Ames Laboratory. The test sample appeared to be the result that we were searching for, so we proceeded with the project.

The material for the project was produced (Figure 4) by the Schildberg Construction Company, Inc. of Greenfield, from their Mt. Etna Quarry. The stone was hauled a distance of thirteen miles to the project. The gradation on the macadam stone was as follows:

Sieve Size	Percentage Passing
3"	100
2"	77
1½"	51
1	23
3/4	4.1
#8	0.6

Figure 3: Test Sample

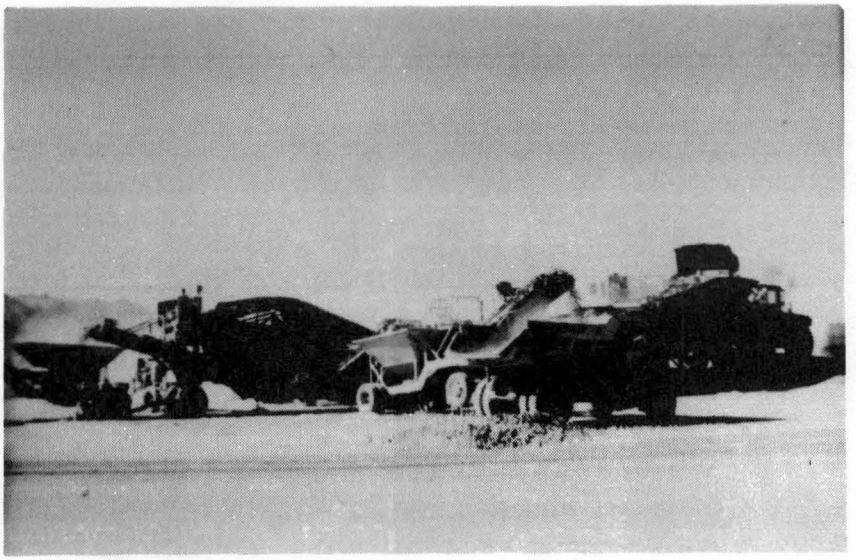


Figure 4: Crushing Plant

The design weight was 135 pounds per cubic foot and the project underran 0.009%. Central Paving Corporation was the contractor on the project and elected to place the base material themselves - for the first time - and had no problems.

The macadam base was laid (Figure 5) with a ten foot wide Jersey spreader powered by a D8 tractor - which provided plenty of power - and the trucks had no difficulty dumping. The material was placed twenty-four feet wide. We had some segregation in the center joint, but it was not as severe as with four inch material. The three inch material compacted much better than four inch material. The material did not rut - if it was kept wet - when rolled. In the first section we did not heel in subgrade material against the edges. We tried to set the macadam stone at the edge without the vibratory running. In later sections, the contractor heeled material against the macadam before starting compaction and the results were better. A Hyster vibratory roller was used (Figure 6) and we got good compaction with minimum effort. The first day on the research project we hauled and placed the macadam material, thereafter, we hauled and placed the macadam material ahead of the paving operation.

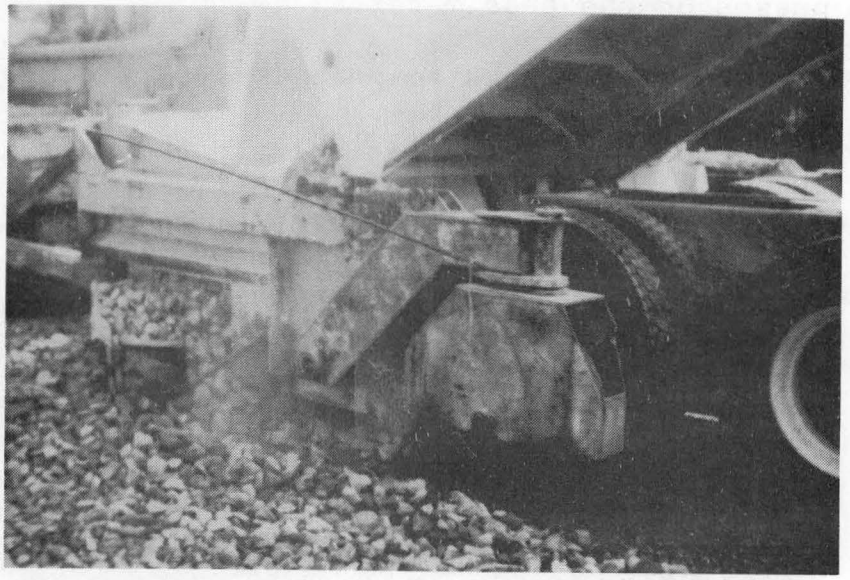


Figure 5: Placement of Macadam

Figure 6: Compaction of Macadam

There was one roller on the project. The roller made several passes on the base material as it was laid, which enabled the concrete trucks to pass through the project (Figure 7) without too much difficulty. The roller continually compacted the stone ahead of the paver.

Figure 7: Concrete Truck on Macadam Base

After the first half day, it was found that the stone compacted better and the fresh concrete finished better if the rock was kept wet. Unfortunately, we started on the two inch and three inch sections and while the rock was damp, the stone drew additional moisture from the fresh concrete and the contractor had trouble finishing. After the stone surface was kept moist, finishing was normal. Even in the two inch section, a stone was never vibrated to the surface while I was on the project.

From Station 145 to Station 153, the macadam stone was placed full width on the grade during shouldering operations. When the temporary earth shoulders were removed, the macadam drained a steady stream of water (Figure 8) for two days even though we had not had an excess of moisture. At the sag areas and the end of the research sections, a Class D stone (2" top size, 3/4" - 0 to 20%, #8 - 0 to 10%) was placed full width. The area was dry last summer and from October 1, 1979 until April 30, 1980, we received only 9.47 inches of rain - the normal being 11.04 inches. A total rainfall of 3.16 inches fell in March and April so the macadam base did not get a chance to produce. In fact, it has been so dry that the county did not have one frost boil that required attention this spring.

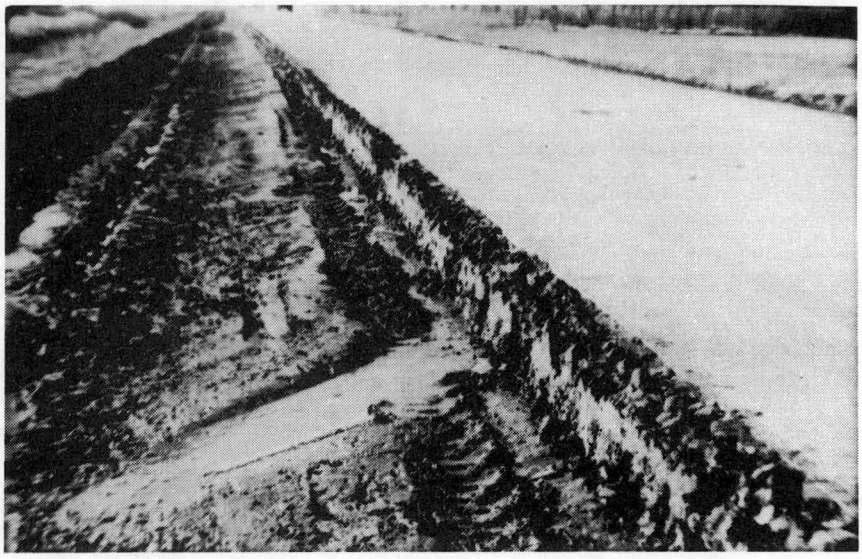


Figure 8: Drainage Through Macadam Base

For a first time operation for a macadam base - on the part of the contractor and county personnel - the operation went very smoothly after the first few hours.

The Road Rater survey (Appendix B) was run on the macadam section, but due to the flexibility of the base, the results were inclusive.

CONCRETE PAVING

The contract was let with two bid items on the concrete:

1. To furnish and deliver concrete by the cubic yard.
2. Placement of the concrete by the square yard.

The test section indicated that the concrete mortar flowed into the voids of the macadam. In order that the contractor would not have to guess at the overrun on concrete, it was felt that a better bid price would be obtained by the cubic yard. The penetration loss was set up for each thickness of concrete pavement as follows: 2" - 25%, 3" - 20%, 4" - 15%, 5" - 12%.

The first research section paved was the 300 foot of 2" pavement, which presented a problem with the paver in trying to adjust the thickness from six inches to two inches. The transition sections from 6" to 2" and 3" to 6" gave us the most problems at the time of construction and after construction. The transition sections should not be considered in the results of the research project.

We did not have earth heeled against the macadam base adequately at the beginning of the project. The paver had problems moving at a steady rate and had to have the additional help of a loader and patrol to motivate. In the areas that earth had been heeled against the base, the paver had no problems. The other problem was that the base was slightly watered, and in the 2" and 3" concrete sections, the rock absorbed moisture from the fresh concrete and made finishing a problem as the concrete set up faster. The solution was to keep the rock surface in a wet condition in front of the paver by a small water truck and absorbance was no longer a problem. The concrete paver was operated off a string line.

The rock base remained in place (Figure 9) and we did not have rock exposed on the concrete surface - even with the thin lift concrete. The slipform trail forms had to be raised to keep from digging into the rock on the shoulders, so we had excess concrete at the edges (Figure 10) of the 2" and 3" sections. We had no problems on the 4" and 5" sections with trail forms or excess concrete. The four inch and five inch sections had no greater problems than the normal six inch pavement. The daily production on the research project was not as good as a normal project. We had short days because of bridge approach sections and shortage of materials.

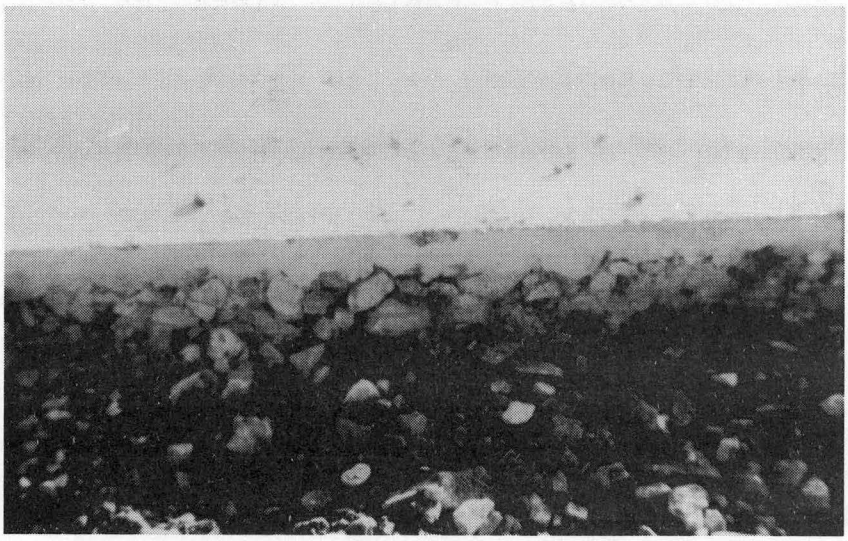


Figure 9: Macadam Base with Concrete

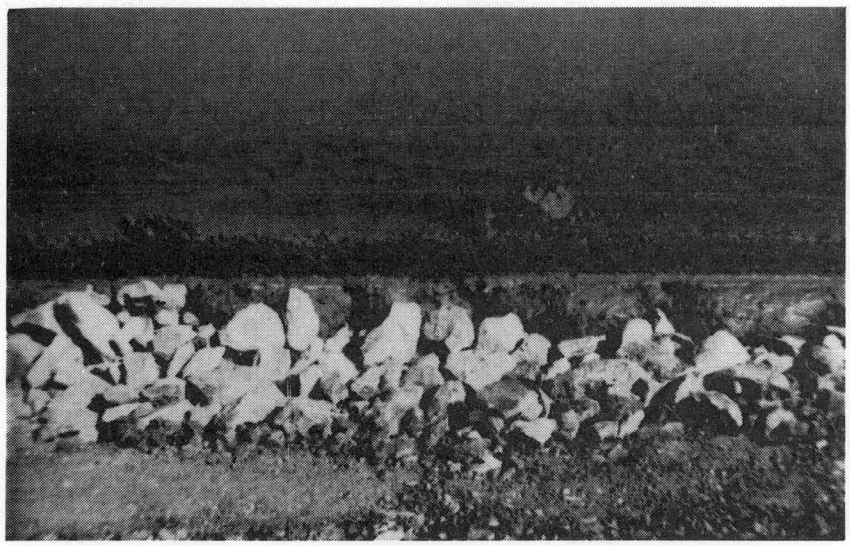


Figure 10: Excess Concrete at Slipform Edge

The sand for the mix was hauled 38 miles from G. A. Finley's plant at Brayton. The concrete rock came from the Schildberg Construction Company, Inc. quarry at Menlo, except for the Early Chapel stone from the Gendler Stone Company quarry in Madison County. The haul from the Menlo quarry to the jobsite was 30.5 miles.

The two inch section overran the estimate 5.78% and the one core measured 2.00 inches in the 304 foot section. The 3" section underran 7.44% and the two cores measured 2.30 and 2.90 inches in length for the 990 foot section. One 4" section overran 15.70% and the two cores measured 4.00 and 4.85 inches. The other 4" section overran 13.68% and the cores measured 4.95 and 4.30 inches. The 5" section overran 7.38% and the cores measured 4.90 and 4.65 inches. The normal metal strips used in depth measurements could not be used in the rock, so numerous depth and yield checks were made. The cut cores had crushed stone imbedded into the concrete.

The pavement was completed September 24, 1979 and after 14 days the road was opened to local traffic. Shouldering operations began the second of November. During shouldering operations, the west transition section between the 3" and 6" pavement broke up, plus several areas in the 2" section. The breakage was caused by the loader and trucks dumping rock before the shoulders were completed. The contractor cut out and repaired all areas

without charge. During the shouldering operation, several cracks developed in the 2" and 3" sections, but in the last six months, only a few longitudinal and transverse cracks have developed. A map of the cracks as of May 15, 1980, is included in the report (See Appendix C).

In the regular six inch section the transverse joints were sawed at 20 foot intervals, as well as the five inch section. The 2, 3, and 4 inch thick sections were sawed at 15 foot intervals. All joints were sawed on a skew to a depth T/4. The contractor had no problems sawing the thin sections or in filling the cracks.

ASPHALT PAVING

The macadam base was primed with 0.30 gal/sy on September 26. Due to a breakdown at the plant, the asphaltic concrete was placed September 29. Henningsen Construction, Inc. of Atlantic was the subcontractor for the asphalt portion of the contract. The asphalt was hauled from the plant site near Lewis, Iowa, 30 miles to the jobsite. Because of the small quantity, the job mix was the same as work in progress for Pottawattamie County, a Type B Class I ½" mix. A plant inspector from Pottawattamie County helped us out.

A Blawknow PF500 paver was used with a skid with twelve shoes. We did not have much trouble with rock rising above

the base surface, except when a truck driver would set his brakes. When this situation occurred, the roller would reroll the section.

The 1000 foot three inch lift was placed in two lifts and included a 10% penetration loss. The 1000 foot two inch lift tonnage included a 15% penetration loss. The 3" lift overran 9.4% and the 2" lift overran 5.9%. I was the grade inspector and because of the thin lifts, did not want to underrun the sections.

The trucks backed on the grade to the spreader (Figure 11) and kept their speed down on the rock base; actually the base remained in very good shape during the paving operation. Production was slow because of the long haul and shortage of drivers. The asphalt was placed on a Saturday. The job actually progressed with little more difficulty than a normal project. The riding quality of the road is good and as of May 15, 1980, had no cracks or defects.

Three of the five cut samples (Figure 12) from the grade had macadam rock incorporated into the asphalt. The 3" cores measured 3 1/4", 3" and 3 3/4". The two inch cores measured 2¼" and 1 7/8". The densities of the 3" cores ran 94.0%, 94.4% and 94% and the 2" cores ran 93.6% and 93.6%. I suspect that the thin asphalt sections laid on a rather flexible macadam base would tend to decrease the densities somewhat.

Figure 11: Asphalt Paving Operation

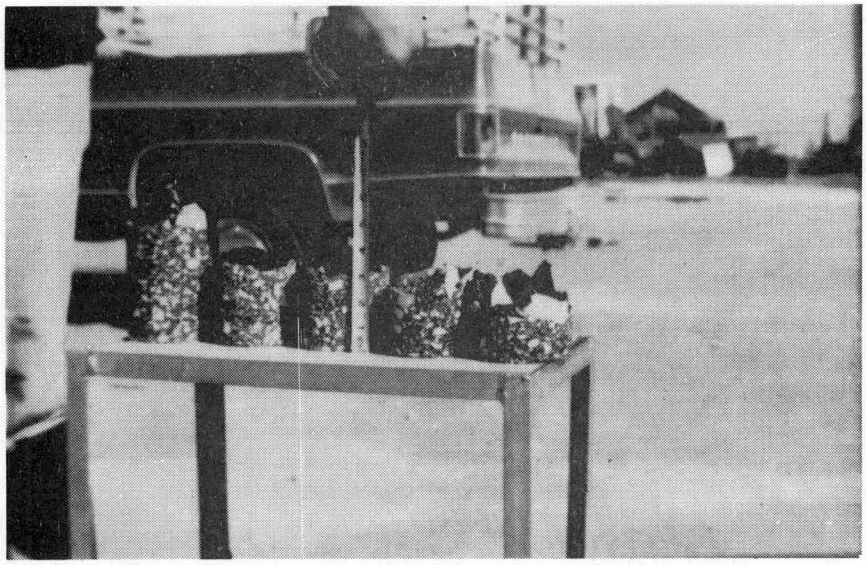


Figure 12: Asphalt Test Samples

ROAD RATER

The Road Rater test was conducted on the macadam base before paving operations. The grade prior to paving was very much in the same condition except for two areas. The natural subgrade and macadam base results were nearly the same before paving.

Tests were run after paving, but during the shouldering operation, which might have effected the results somewhat. The results were as expected - the maximum deflections were on the thinner sections. The maximum deflection was obtained on the 2" portland cement concrete followed by the 2" asphaltic concrete, next the 3" asphaltic concrete and 3" portland cement concrete.

A follow up test was run and the results were similar to the results after construction. A copy of the report is in Appendix B.

OBSERVATIONS

We have been disappointed that due to the extremely dry weather, the macadam base has been unable to drain any moisture from the subgrade.

We tried to construct the research project using normal construction operations. After the first day, the contractor placed macadam base ahead of the paving operation without too much distraction.

The 4" and 5" concrete paving was placed with no more problems than occurred with 6" pavement. By keeping the subgrade wet and starting the paver at 2" or 3" instead of trying to adjust from 6" or up to 6", this portion of the operation would go smoother.

We were very lucky to have excellent cooperation from the contractor, Central Paving Corporation, the asphalt subcontractor, Henningsen Construction, Inc., and the material producer, Schildberg Construction Company, Inc.

CONCLUSIONS

According to the contract items as bid, (See Appendix D) the following is the cost per section of highway adjusted to one mile:

	$/mi.
6" PC pavement (regular)	$100,153
6" PC pavement (using research bid prices)	122,611
5" PC pavement - 5" macadam base	143,279
4" PC pavement - 5" macadam base	127,122
3" PC pavement - 6" macadam base	116,215
2" PC pavement - 6" macadam base	98,491
2" Asphalt pavement - 6" macadam base	98,513
3" Asphalt pavement - 6" macadam base	120,840

I am sure that the contractor would bid the research items cheaper as a regular project because they did not have that much difficulty. The Jersey spreader and vibratory roller were the only items that were rented.

If a contractor were laying macadam base in quantity, widening the spreader would prevent segregation at the joint

and the outside sections. The three inch material handled better and gave a better surface than four inch material which I had observed on another project.

The asphalt price was high due to the amount of tonnage on the project and the long haul. On a normal project with a macadam base, I would design a three or four inch thickness of asphalt.

I would probably go with the same percentage of penetration loss with the portland cement concrete and asphaltic concrete on a macadam base again. On a longer section, the quantities could be adjusted much better.

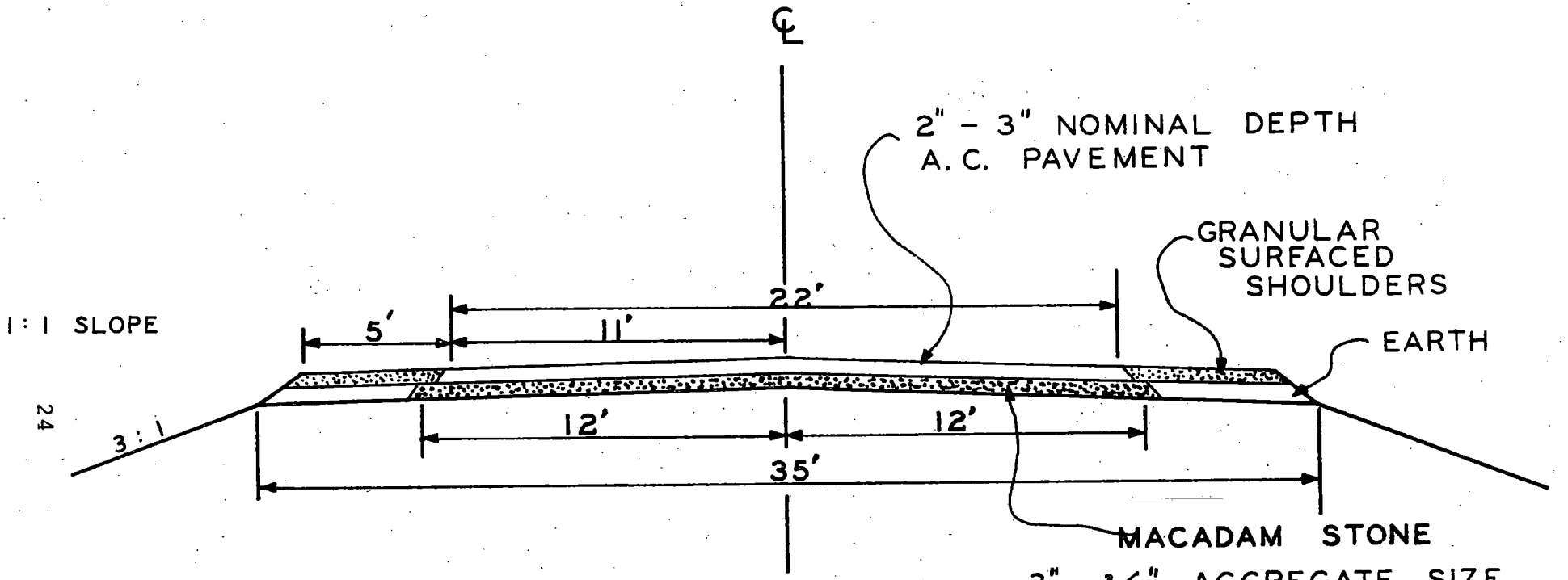
On our pavement project in 1980, because of the poor condition of the pavement, we are breaking the old concrete and leaving it in place. Plans call to break at least 80% of the surface into 3" or 4" diameter pieces, roll with roller and place seven inches of portland cement over the old concrete. This project will be let the same as the research project with two bid items on the concrete; furnish and haul as one item and placement as a separate bid item. With the seven inch nominal thickness, we will be using a 10% penetration loss.

The public expressed an interest in the Pavement Surface on Macadam Base Project and have continued to since the completion of the construction phase. The project could not have been completed without the cooperation of the Adair County

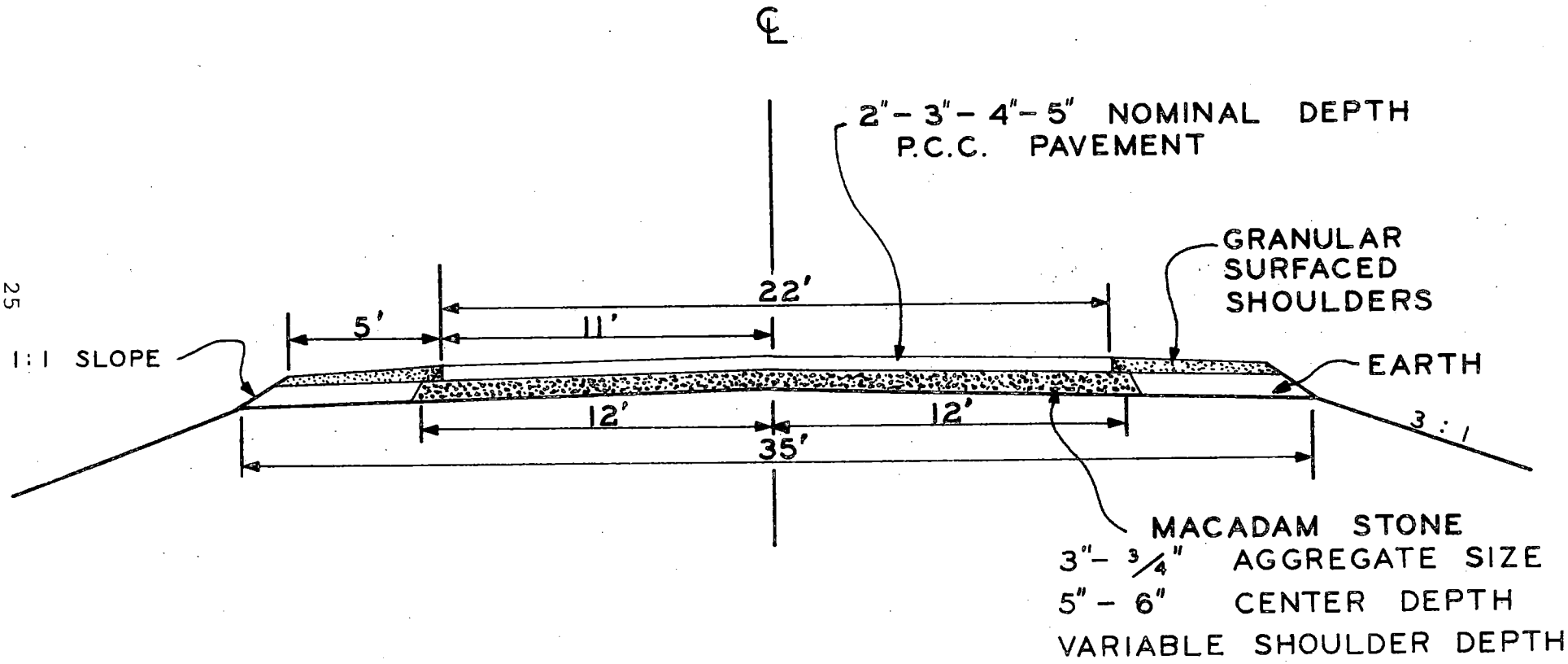
Board of Supervisors and the engineering staff and office. A special thanks for help from the Pottawattamie County engineering department and George Calvert and Vernon Marks from the Iowa Department of Transportation.

APPENDIX A

ADAIR COUNTY



ADAIR COUNTY



APPENDIX B

Form 820258
12-75

Ames
Snyder
Lynam
File

IOWA DEPARTMENT OF TRANSPORTATION

OFFICE OF MATERIALS
Test Report-Miscellaneous Materials

ASSURANCE SAMPLE

Laboratory Atlantic

Material Slump & Air Tests — County Adair

Intended Use PCCP — Project No. SN-6085(4)--51-01

Laboratory No. — Design No.

Date Reported September 17, 1979 — Contract No.

Producer — Contractor Central Paving Corp.

Source

Unit of Material See Below — Subcontractor

Observed
~~Sampled~~ By Harold L. Gillette — Senders No. — Date

On September 13, 1979, Dave Homan and Don Drees, Inspectors for Adair County Engineers Office, were observed while running the slump and air tests on the above project.

Slump - 1"

Air - 6.6%

Method of testing was in accordance with I.M. 319 & I.M. 318.

DISPOSITION: Complies

Signed Harold L. Gillette
HI-4

IOWA DEPARTMENT OF TRANSPORTATION
DISTRICT LAB ANALYSIS
OF ASPHALT MIXTURES
(MATERIALS OFFICE)

COUNTY: ADAIR — PROJECT NO.: SN-6085(4)--51-01

CONTRACTOR : HENNINGSEN — LAB NO. : 4AL9-340

LABORATORY : ATLANTIC — DATE : 10/2/79

MIX TYPE: B — CLASS: I — MIX SIZE: 1/2" — COURSE: SURFACE

DATE SAMPLED: 9/29/79 — DATE TESTED: 10/1/79

PERCENT ASPH INTENTED	6.250
PERCENT EXTRACTED ASPH.	6.170
PERCENT ASPHALT RETAINED	.250
PERCENT ASPHALT	6.420

* * * SIEVE ANALYSIS * * *

SIEVE	PERCENT PASSING EXTRACTED	SPEC LIMITS	
1.05"	.000		
3/4"	.000		
.525"	100.000	98.000	100.000
3/8"	92.000	85.000	99.000
#4	72.000	66.000	80.000
#8	56.000	52.000	64.000
#16	42.000		
#30	30.000	29.000	39.000
#50	15.000		
#100	7.900		
#200	7.000	4.600	10.600

CALCULATED SOLID SPECIFIC GRAVITY	2.418
LABORATORY DENSITY (50 BLOW-MARSHALL)	2.340
LABORATORY DENSITY (75 BLOW-MARSHALL)	
RICE SOLID SPECIFIC GRAVITY	2.383
PERCENT VOIDS (50 BLOW-MARSHALL-RICE)	1.800
PERCENT VOIDS (75 BLOW-MARSHALL-RICE)	

COMMENTS AND/OR DESCRIPTION OF CHANGES:-

ABSOLUTE VISCOSITY: DL4 = 1120
PENETRATION: RC-70 = 119.7

10-3-79

CC: AMES, LYNAM, ✓ HENNINGSEN, MEYER

TESTED BY:- RICHARD D. MEYER

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

MATERIAL CRUSHED STONE — LAB NO. AAC9-753

INTENDED USE PCCP

COUNTY ADAIR — PROJ NO. SN-6085(4)--51-01

DESIGN PAVING — CONTRACT NO. 16490

PRODUCER SCHILDBERG CONSTR. CO. — CONTRACTOR CENTRAL PAVING

SOURCE MENLO SE 17-77-31 ADAIR CO.

UNIT OF MATERIAL TAKEN FROM STOCKPILE AT PAVING PLANT.

SAMPLED BY GILLETTE — SENDERS' NO. 4FJ9-643

DATE SAMPLED 9/13/79 — REC'D 9/24/79 — REPORTED 10/3/79

% PSG. #8 AFTER 16 CYCLES, F&T, WATER-ALC. SOL.	1
% WEAR, LA ABRASION, GRADING B	23

Lyman ✓
Bud
10-3-79

COPIES:
CRUSHED STONE
V. R. SNYDER - 2
D. J. LYNAM
SN-6085(4)--51-01, ADAIR
GEOLOGY

DISPOSITION: PROPERTIES TESTED COMPLY

SIGNED: BERNARD C. BROWN
TESTING ENGINEER

Quarry files

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

MATERIAL 3/4 CRUSHED STONE LAB. NO. AAR9-259

INTENDED USE GRANULAR SURFACING FOR SHOULDERS

COUNTY PROJ NO. DEPT. INFO.

DESIGN CONTRACT NO.

PRODUCER SCHILDBERG CONTRACTOR

SOURCE MT. ETNA 14/23 73-34 ADAMS CO.

UNIT OF MATERIAL 1 BAG +4 3X3/4 MACADAM SCALPED FROM PRODUCT. 6,000 TON

SAMPLED BY H. WAYNE JACKSON SENDERS' NO. 4WJ9-287

DATE SAMPLED 9-18-24-79 REC'D 10-3-79 REPORTED 10-10-79

% PSG. #8 AFTER 25 CYCLES, F&T, WATER SOL.	11
% WEAR, LA ABRASION, GRADING B	27

COPIES:
ROAD STONE
VAN SNYDER (2)
DON LYNAM
H. WAYNE JACKSON
GEOLOGY

Lynam
Jackson
10-10-79

DISPOSITION:

SIGNED: BERNARD C. BROWN

Form 1763

IOWA DEPARTMENT OF TRANSPORTATION
Materials Department
Atlantic LABORATORY

CORING COMPLETED
OCTOBER 9, 1979

NOTICE OF CONCRETE CORE MEASUREMENTS

Potter
SN-6085(4)--51-01
Adair County
Snyder
Lynam
Huisman
McLaughlin (2)
File

Project SN-6085(4)--51-01 County Adair

Contractor Central Paving Road No.

Length of Project, Miles 4.888 Year Built 1979

Fixed Form Slip Form X Design Depth, In. 2", 3", 4", 5", 6"

Date Cored October 9, 1979 Date Reported November 15, 1979

Special Provision Number applies. Std. Specs. apply

Core Number	Station	Dist. from CL - Feet	Uncut Length Inches	Width Feet		Remarks
4-2682	122+00	9.2' Lt.	4.00	22	4"	Pavement
4-2683	134+00	1.6' Rt.	4.85	22	4"	"
Bridge						
4-2684	143+00	5.4' Lt.	4.95	22	4"	"
4-2685	155+00	9.0' Rt.	4.30	22	4"	"
4-2686	162+00	2.0' Lt.	4.90	22	5"	"
4-2687	170+00	5.7' Rt.	4.65	22	5"	"
4-2688	174+00	8.7' Lt.	5.60	22	6"	"
E4-2689	173+00	9.2' Lt.	5.30	22	6"	"
E4-2690	175+00	9.4' Lt.	6.10	22	6"	"
4-2691	183+00	1.5' Rt.	5.15	22	6"	"
E4-2692	182+00	1.8' Rt.	5.60	22	6"	"
4-2694	186+00	5.6' Lt.	2.30	22	3"	"
4-2695	193+00	9.7' Rt.	2.90	22	3"	"
4-2696	195+00	2.1' Lt.	2.00	22	2"	"
4-2697	200+00	8.6' Rt.	6.50	22	6"	"
4-2698	210+00	2.3' Lt.	6.10	22	6"	"
4-2699	220+00	5.3' Rt.	6.35	22	6"	"
4-2700	230+00	8.9' Lt.	6.40	22	6"	"
4-2701	241+00	2.2' Rt.	6.25	22	6"	"
4-2702	251+00	5.4' Lt.	6.05	22	6"	"
4-2703	261+00	9.2' Rt.	6.05	22	6"	"
4-2704	271+00	1.7' Lt.	6.40	22	6"	"
4-2705	282+00	5.7' Rt.	6.45	22	6"	"
4-2706	290+00	9.4' Lt.	6.20	22	6"	"
Bridge						
4-2707	296+00	1.6' Rt.	6.35	22	6"	"
4-2708	306+00	5.4' Lt.	6.20	22	6"	"
4-2709	316+00	9.5' Rt.	6.15	22	6"	"
4-2710	326+00	1.7' Lt.	6.35	22	6"	"
4-2711	337+00	6.3' Rt.	6.10	22	6"	"
4-2712	347+00	9.2' Lt.	5.90	22	6"	"
4-2713	357+00	1.4' Rt.	6.65	22	6"	"

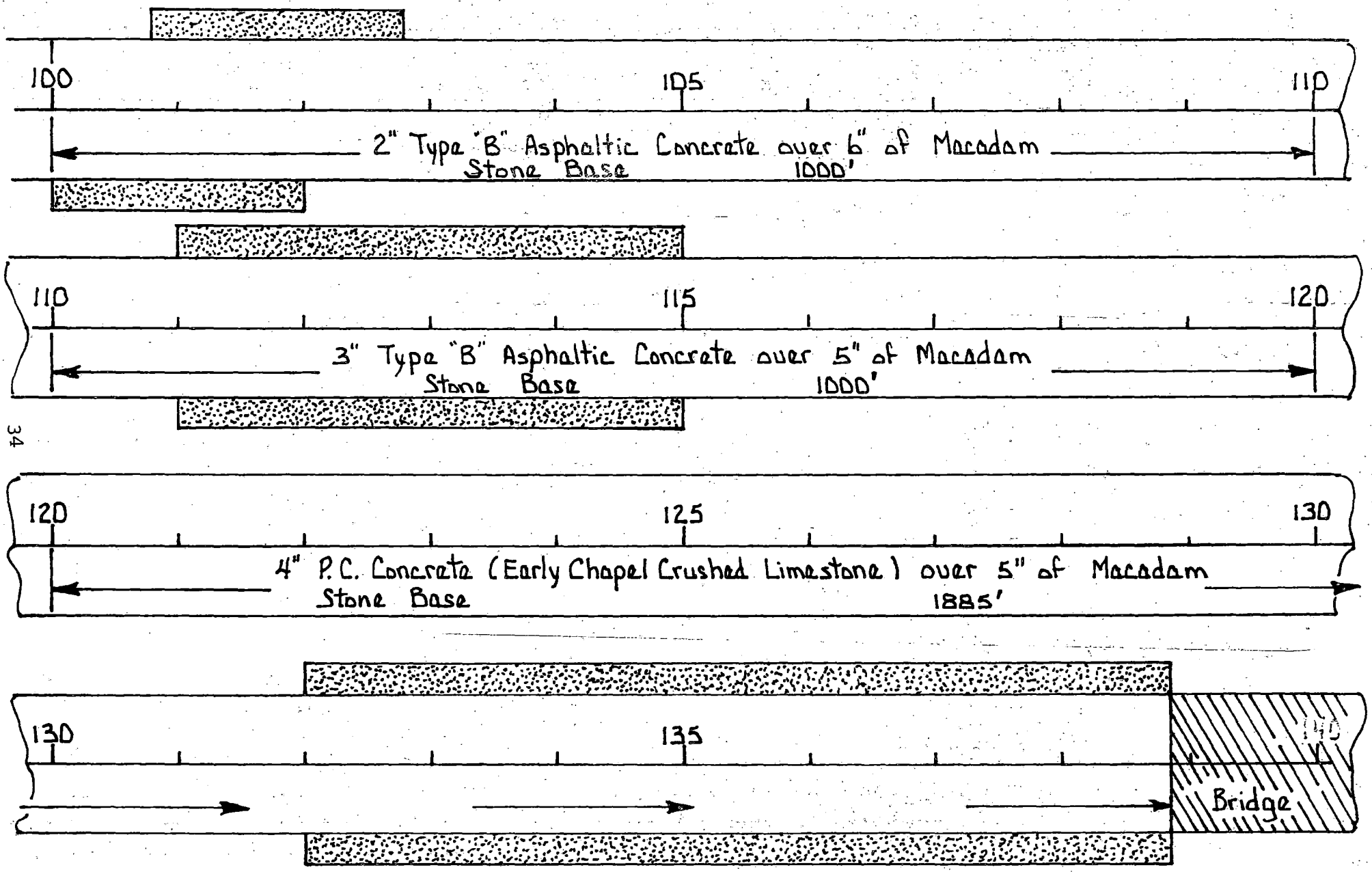
Signed Engineer

HR-209

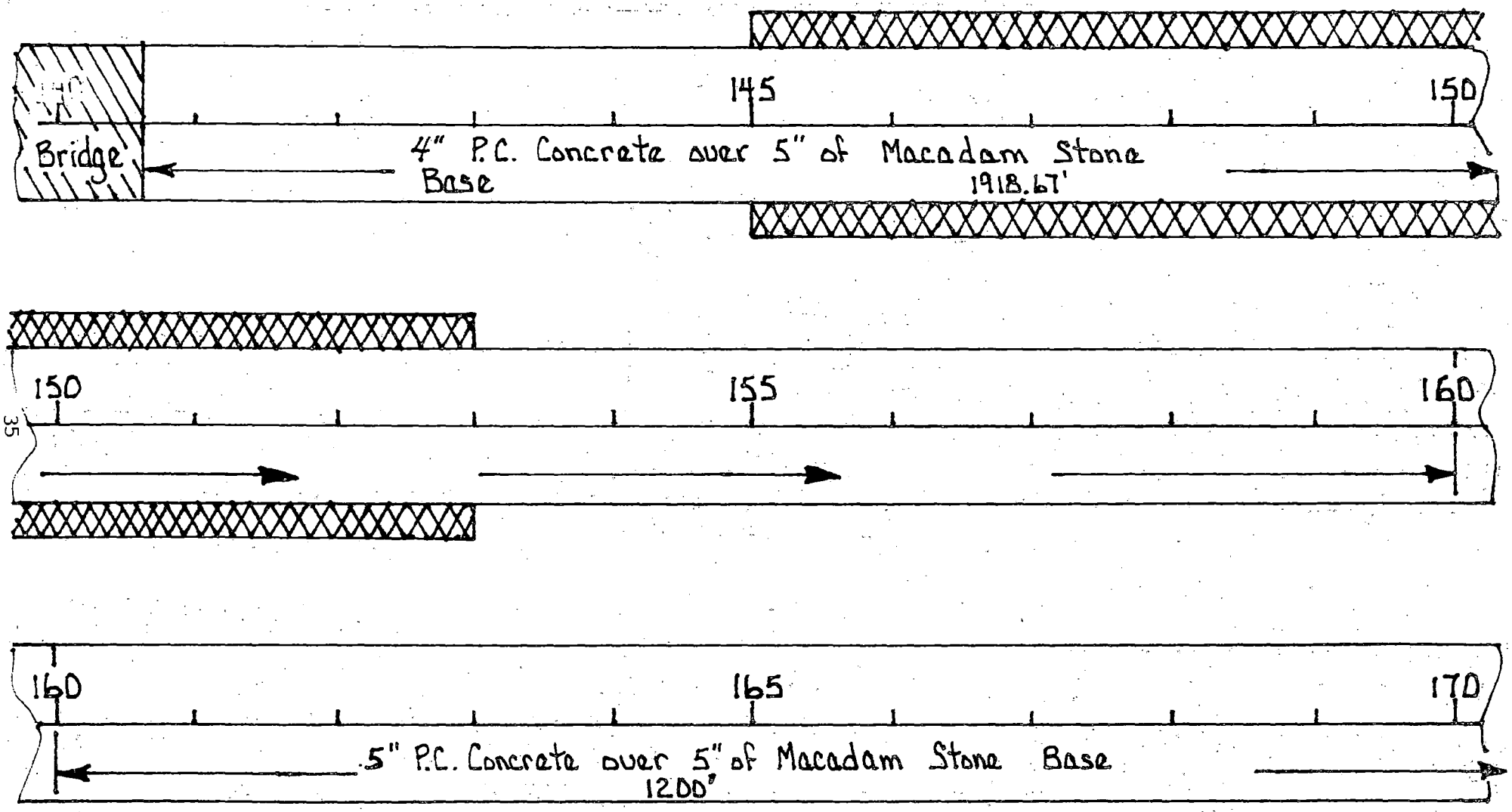
SUMMARY OF ROAD RATER TESTING

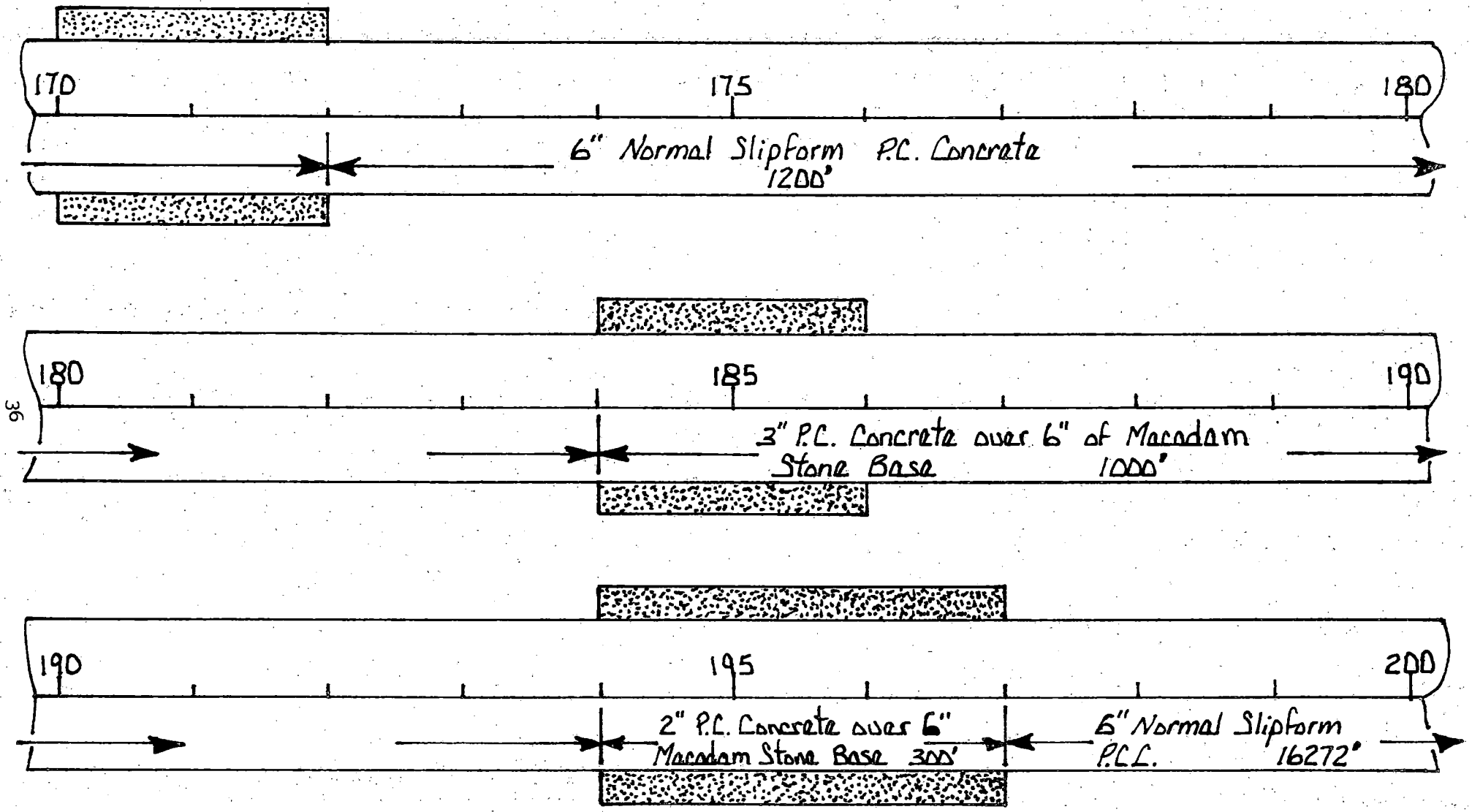
Section	Station	Description	Mils of Deflection on grade prior to paving 9/13/79	Mils of Deflection on paving Date Tested 11/15/79	Mils of Deflection on paving Date Tested 5/22/80
1	100 - 110	2" Type B AC over 6" Macadam Base	5.0	3.1	4.8
2	110 - 120	3" Type B AC over 5" Macadam Base	5.4	2.25	4.0
3	120 - 138	4" PCC over 5" Macadam Base (Early)	5.7	1.3	1.46
4	140 - 145	4" PCC over 5" Macadam Base	2.5	1.0	1.2
5	145 - 153	4" PCC over 5" Macadam Base	3.9	1.1	1.56
6	153 - 160	4" PCC over 5" Macadam Base	5.3	1.3	1.4
7	160 - 172	5" PCC over 5" Macadam Base	4.8	1.35	1.2
8	173 - 184	Standard Concrete	4.6	1.2	1.4
9	184 - 194	3" PCC over 6" Macadam Base	4.3	1.9	2.9
10	194 - 197	2" PCC over 6" Macadam Base	5.0	3.7	3.25
11	197 - 250	6" Standard PCC	4.6	1.1	1.34

APPENDIX C

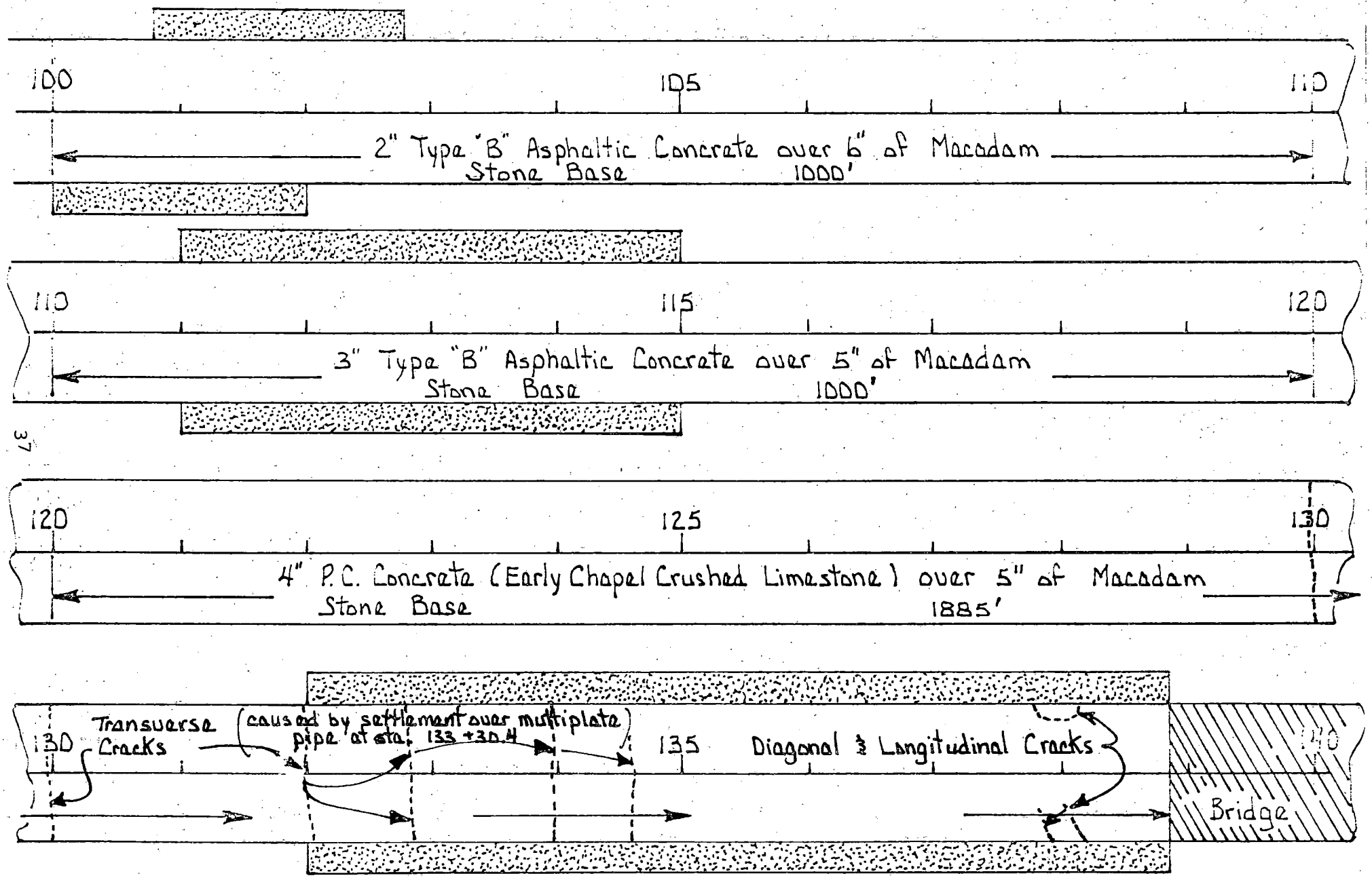


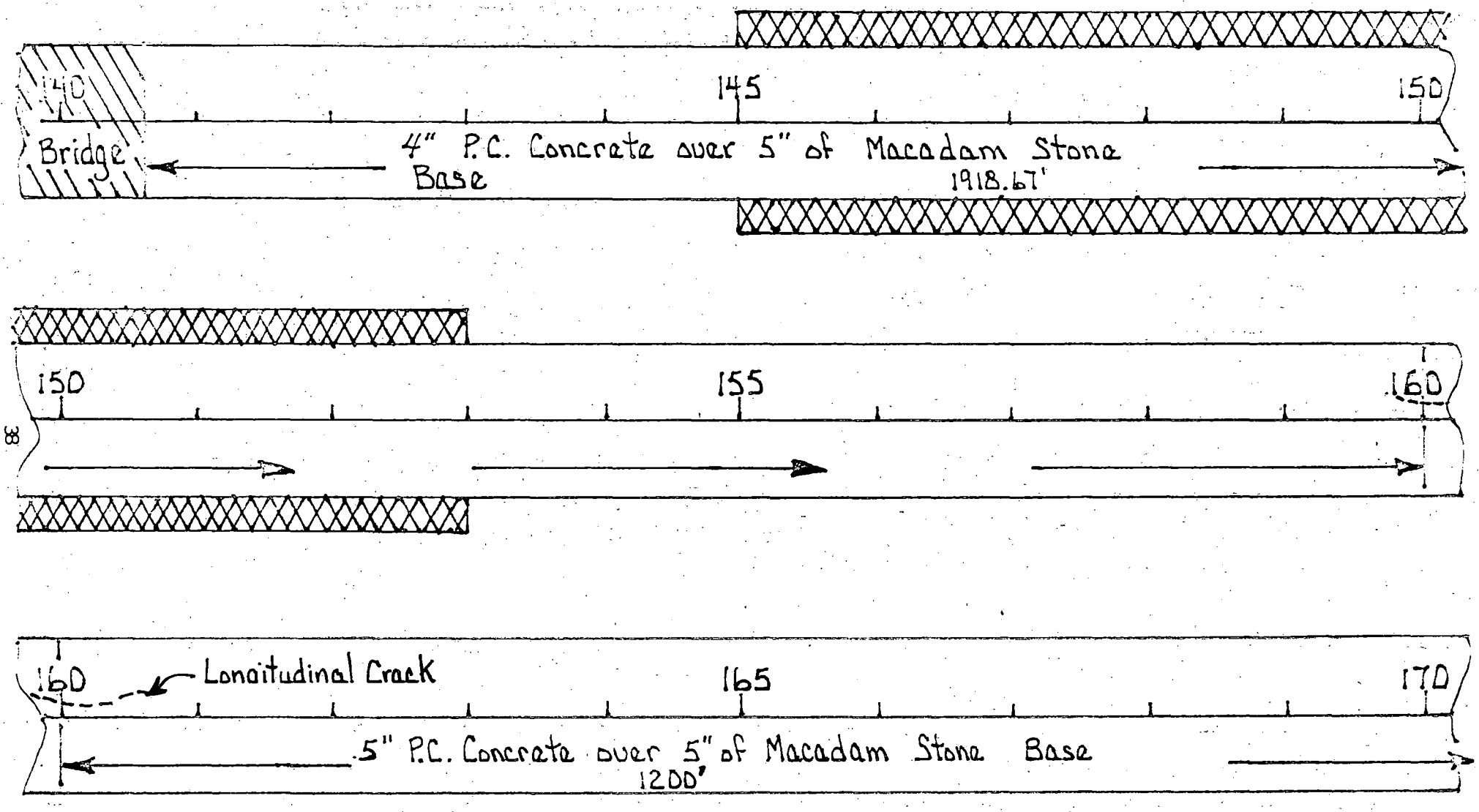
Indicates Areas with Class "D" crushed stone placed in 5' width next to Macadam Stone Base


Bridge
145
150
4" P.C. Concrete over 5" of Macadam Stone Base
1918.67'
150
155
160
160
165
170
5" P.C. Concrete over 5" of Macadam Stone Base
1200'
Indicates Areas of full width Macadam Stone Base

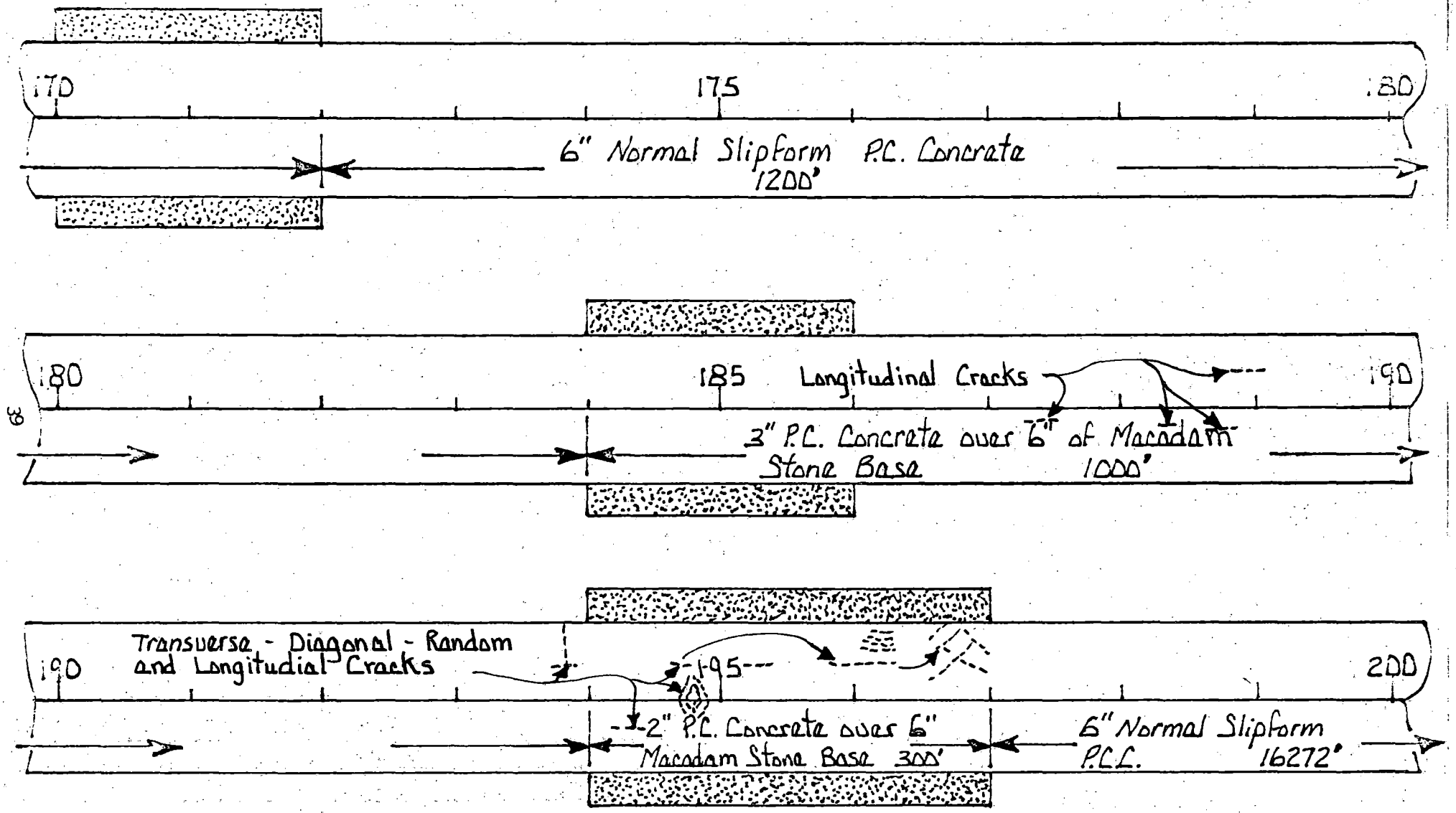


Indicates Areas with Class "D" crushed stone placed in 5' width next to Macadam Stone Base


100
105
110
2" Type "B" Asphaltic Concrete over 6" of Macadam
Stone Base
1000'
110
115
120
3" Type "B" Asphaltic Concrete over 5" of Macadam
Stone Base
1000'
120
125
130
4" P.C. Concrete (Early Chapel Crushed Limestone) over 5" of Macadam
Stone Base
1885'
130
Transverse Cracks
caused by settlement over multiplate pipe at sta. 133+30.4
135
Diagonal & Longitudinal Cracks
140
Bridge
Indicates Areas with Class "D" crushed stone placed in 5' width next to Macadam Stone Base



Indicates Areas of full width Macadam Stone Base



Indicates Areas with Class "D" crushed stone placed in 5' width next to Macadam Stone Base

APPENDIX D

Contract Copy 41

FORM 650019 8-77 H-3878

CONTRACT NO. 16490

TYPE OF WORK PORT. CEMENT CONC. PAV'T. PROJECT NO. SN-6085(4)--51-01

MILES 4.888 COST CENTER 801000 OBJECT 860

COUNTY ADAIR

ON SECONDARY ROAD G61 FROM NW COR. SEC. 21-74-33

EAST APPROX. 5 MILES TO COUNTY ROAD JCT N72

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

PARTY OF THE FIRST PART, AND

CENTRAL PAVING CORPORATION OF INDIANOLA, IOWA 07150

PARTY OF THE SECOND PART

WITNESSETH, THAT THE PARTY OF THE SECOND PART, FOR AND IN CONSIDERATION OF $ ****603,008.92, 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
1	PAVEMENT, SLIP FORM P. C. CONC. CLASS B, 6 IN.	43,402	SQ. YDS.	7.76	336,799.52
2	SHOULDER CONSTRUCTION, EARTH	516	STAS.	30.00	15,480.00
3	REMOVAL OF PAVEMENT	79	SQ. YDS.	3.00	237.00
4	SHOULDERS, GRANULAR SURFACING OF	4,609	TONS	7.12	32,816.08
5	BASE, TYPE B CLASS 1 ASPHALT CEMENT CONCRETE	813	TONS	28.60	23,251.80
6	PRIMER OR TACK-COAT BITUMEN	1,855	GALS.	.90	1,669.50
7	ASPHALT CEMENT	49	TONS	165.00	8,085.00
8	BASE, MACADAM STONE	6,689	TONS	7.06	47,224.34
9	BACKFILL, SPECIAL	488	TONS	9.56	4,665.28
10	P.C. CONCRETE, CLASS B, EARLY CHAPEL AGGREGATE, FURN. & DELIVER	722	CU. YDS.	45.00	32,490.00
11	P.C. CONCRETE, CLASS B, FURNISH & DELIVER	1,360	CU. YDS.	45.00	61,200.00
12	SLIPFORM, P.C. CONCRETE PAVEMENT PLACEMENT	15,409	SQ. YDS.	2.00	30,818.00
13	EXCAVATION, CLASS 10, ROADWAY & BORROW	150	CU. YDS.	3.00	450.00
14	BRIDGE APPROACH SECTION				

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 12, 1979

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-6085(4)--51-01 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
40 WORKING DAYS	NOV. 2, 1979

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 1 DAY OF August 19 79

COUNTY OF ADAIR, IOWA

BY _____
PARTY OF THE FIRST PART

CENTRAL PAVING CORPORATION OF INDIANOLA, IOWA

BY _____
PARTY OF THE SECOND PART

C.G. Mikulanec President

Approved:

_____ AUG 6 1979
Contracts Engineer Date
IOWA DEPT. OF TRANSPORTATION

ITEM NO	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	REINFORCED AS PER PLAN	195.560	SQ. YDS.	40.00	7,822.40
			GRAND TOTAL		$603,008.92