Final Report
for
Iowa DOT Project HR-533
Included in
Iowa DOT Construction Project - Cass IR-80-1(161)56--12-15

Federal Highway Administration
Experimental Project IA 86-05

POLYMERIZED ASPHALT CEMENT

by
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515-239-1447

Iowa Department of Transportation
Office of Materials
Ames, Iowa 50010

February 1989

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DISCLAIMER

ABSTRACT

In 1986, a 0.34 mile experimental section of polymerized asphalt cement (PAC30) concrete was placed in the westbound driving lane of Interstate 80 in western Iowa. It was used in a 2" asphalt concrete inlay using 20% recycled asphalt pavement. The virgin aggregate included 41% crushed gravel, 25% crushed quartzite and 14% natural sand.

The evaluation of the project was severely limited when a 1987 reconstruction project extended into the experimental section leaving only 395 feet. Rut depths under a 4-foot gage were taken for a period of two years. No significant rutting occurred in the experimental polymerized section.

The frequency of transverse cracking in the polymerized AC section was the same as that of the comparative AC-20 section.

The asphalt paving mixture made with polymerized AC cost 120% of the cost of the conventional mix.

INTRODUCTION

Most asphalt pavement design work used in Iowa was developed to withstand tire pressures of 75 psi. Economic conditions have caused the trucking industry to move to heavier loads and correspondingly higher tire pressures. Recent research has shown that truck tire pressures of 125 psi are common. Research reported in 1989 showed that with hot mix asphalt layers of 8 inches or more the increased tire pressures were not a significant factor in rutting. The major cause of the rutting was the increased loads. It has become more and more difficult to design and construct an asphalt concrete pavement which will result in little or no transverse cracking in cold weather and also resist rutting in high temperatures using conventional asphalt cements. Laboratory testing of polymerized asphalt cement has shown improved characteristics at both high and low temperatures.

PROJECT LOCATION AND PRECONSTRUCTION CONDITION

The experimental evaluation of polymerized asphalt cement was included in construction project Cass IR-80-1(161)56--12-15. This project was on I-80 in the outside lanes only from 2 miles east of the IA 173 interchange to the US 71 interchange for a project length of 3.468 miles. It was a 2" asphalt concrete inlay using 20% recycled asphalt pavement.

Severe rutting of this section of roadway necessitated the rehabilitation of the driving lane. Approximately 1 mile of both the eastbound and the westbound roadways exhibited rut depths of ap-

proximately 1/2" in depth. In a field survey of April 29, 1985, the maximum rut depth measured was 0.60 inches. There was visible dual rutting caused by the dual tires of truck-trailer combinations. This section of roadway carried an average daily traffic of 11,000 with 35% trucks in 1986.

CONTRACTUAL ARRANGEMENTS

The successful bidder on this project, let June 24, 1986, was Western Engineering Company, Inc. of Harlan, Iowa. Special provisions for asphalt concrete (SP665 Appendix A) were developed specifically for this project. The sprinkle treatment requirement normally used to enhance surface friction characteristics was deleted for this asphalt concrete surface due to the requirement for substantial crushed quartzite and crushed gravel in the asphalt concrete.

MATERIALS AND MIX DESIGNS

The mix design (Appendix B) for this 2" surface course utilized 20% of the recycled asphalt product previously milled from I-80. This material included 5.08% bitumen by extraction (Appendix B). In addition to the recycled material, the mix contained 41% crushed gravel with 100% passing the 1/2" screen produced by G. A. Finley from the Adel pit in Dallas County. The mix also included 25% crushed quartzite with 100% passing the 3/4" sieve. This material was produced by Everist, Inc. of Dell Rapids, South Dakota. Concrete sand in the amount of 14% was produced by Finley, Inc. at the Valley pit in Cass County. The mix designs for both the

polymerized asphalt cement (PAC30) and conventional asphalt cement were made with the aggregate proportions noted above.

The PAC30 for the experimental section was obtained from Bitucote Products Company of Des Moines, Iowa (Appendix C). The asphalt cement (AC) for the balance of the project was AC20 from Koch Asphalt of Omaha, Nebraska.

An asphalt content of 4.65% was recommended based on the mix designs. 1.02% of this asphalt cement was obtained from the recycled asphalt. This required an additional 3.63% of new asphalt cement for both the PAC30 and the conventional AC. The Iowa Department of Transportation developed a supplemental specification for polymerized asphalt cement, Specification 1026 (Appendix C).

CONSTRUCTION

Asphalt laydown operations began October 1, 1986, in the westbound lane and were completed October 7, 1986. The experimental section which included the PAC30 asphalt cement was placed first in the driving lane westbound from Station 553+13.6, which is approximately Milepost 60.25, westerly to Station 535+00 (MP 59.9) for a total length of .34 miles. The selection of this location for the experimental PAC30 was unfortunate as a 1987 reconstruction project extended into the experimental section and left only 395 feet of PAC30.

The asphalt mixture was produced in an Axtec drum mixer at the I-80/US 71 interchange. The average density for this section based upon five cores was 2.38 which was 97.9% of the 2.43, 75 blow Marshall laboratory density. These five cores yielded an average void content of 4.7%. The contractor reported it was easier to achieve density using the polymerized AC.

The ambient air temperature at time of placement was approximately 60°F. The mix temperature upon arrival at the grade was approximately 300°F and the mat temperature after placement was 290°F. No problems were encountered in the placement of the PAC30 asphalt mixture.

The section used to compare with the polymerized asphalt test section is immediately to the west, westbound from Station 535 to Station 498, also placed on October 1, 1986. The average density of five cores using AC 20 was 2.35 or 96.8% of the 2.43, 75 blow Marshall laboratory density. The average void content obtained from these five cores was 5.9%. The ambient air temperature during the placement of this section ranged from 58°F to 59°F. The mix temperature was approximately 300°F and mat temperature ranged from 280°F to 295°F.

POST CONSTRUCTION TESTING

The profiles of both the test section and the control section were determined with the 25-Foot Profilometer soon after construction. The average profile index for the PAC30 test section was 7.5 inches

per mile (Appendix D). The average profile index for the conventional asphalt control section was 3.7 inches per mile.

A field review of both the PAC30 test section and the conventional asphalt cement control section on November 19, 1986, identified no raveling, cracking or other deterioration. No rutting had occurred in either section.

The polymerized AC section was evaluated twice in 1987 and once in 1988. A summary of the rut depths under a 4-foot rut gage is given in Table 1. Only minor rutting was measured in the polymerized AC section. Dual tire rutting up to 0.4 inch deep was measured in the inside wheelpath of the conventional AC20 section from milepost 59.65 to 59.80.

Table 1
Rut Depth Survey
Outside Westbound Lane

		6-18-87		10-8-87		11-23-88	
	Milepost	IWP	OWP	IWP	OWP	IWP	OWP
Polymerized	60.15	0.10	0.00	PCC	PCC	PCC	PCC
	60.10	0.10	0.00	PCC	PCC	PCC	PCC
	60.05	0.10	0.00	PCC	PCC	PCC	PCC
	60.00	0.15	0.00	PCC	PCC	PCC	PCC
	59.95	0.10	0.00	PCC	PCC	PCC	PCC
	59.90	0.15	0.00	0.15	0.00	0.15	0.00
	59.85	0.10	0.00	0.10	0.00	0.20	0.05
Conventional	59.80	0.10	0.00	0.15	0.05	0.30	0.10
	59.75	0.10	0.00	0.20	0.05	0.35	0.15
	59.70	0.10	0.00	0.20	0.10	0.30	0.10
	59.65	0.15	0.05	0.30	0.05	0.40	0.10
	59.60	0.10	0.00	0.10	0.10	0.20	0.10
	59.55	0.10	0.00	0.10	0.05	0.10	0.05
	59.50	0.05	0.00	0.10	0.00	0.15	0.00

Four transverse cracks developed in the polymerized AC section in two years, or approximately one crack per 100 feet. There were 16 cracks in 1584 lineal feet of the AC20 comparative section, or again approximately one crack per 100 ft. There was no difference in the frequency of transverse cracking.

COST COMPARISON

The only additional cost for using polymerized asphalt cement (AC) was for the liquid AC. The polymerized AC required no special handling. The cost of the conventional AC was 130.20 per ton FOB job site while the polymerized AC cost was $300.40 per ton FOB job site. This would amount to $10.91 per ton of mix for the new polymerized AC compared to $4.73 per ton for the conventional AC or an additional $6.18 per ton of mix or a 20.5% increase in the cost of the asphalt concrete mix that was bid at $30.16 per ton. This increase would likely be greater if the mix did not use recycled asphalt concrete and correspondingly required more new AC.

CONCLUSIONS

Any conclusions drawn from this research must be qualified due to the very short experimental section and the short evaluation period. The limited data would indicate that:

1. The PAC30 did not reduce the frequency of transverse cracking.
2. With this mix design, there was no significant rutting of the PAC30 experimental section.

APPENDIX A

Special Provision 665

Iowa Department of Transportation

SPECIAL PROVISIONS
for
ASPHALT CEMENT CONCRETE

Project IR-80-1(161)56--12-15, Cass County

June 24, 1986

This work consists of scarifying by cold milling and salvaging existing asphalt cement concrete from the driving lane of I-80, to the nominal depth and width shown on the plans, and processing it by recycling and repaving as an inlay of surface course, all in accordance with the plans and these specifications. Sections 2305 and 2303, Type A Surface, shall apply to this work except as herein modified. This work will also include sprinkle treatment of the inlay surface.

SCARIFICATION

Scarification from inlay areas shall be in accord with Section 2214 and Supplemental Specification 1024, using a cold-milling operation. Removal is intended to be a minimum of 2 inches.

TYPE A ASPHALT CEMENT CONCRETE SURFACE COURSE, RECYCLED

The mixtures shall be furnished, mixed, and placed in accord with Section 2305 and Supplemental Specification 1024, with the following special requirements.

The salvaged asphaltic material shall be that which is removed by scarification of the upper 2 inches of binder and surface course. The existing surface is composed of 1 1/2 inches of 1/2-inch Type A surface course and 2 inches of 3/4-inch Type A binder course.

The aggregate combinations to be used are intended to be mixtures of approximately 20 percent salvaged asphaltic material, combined with new aggregate of the quality required for the mixture.

DELETE the first paragraph of 4127.04 and add the following in lieu thereof:

When crushed gravel is used, it shall be produced as a separate operation by crushing gravel particles of which at least 90 percent are retained on the 3/4-inch sieve to the extent that at least 90 percent will pass the 1/2-inch sieve.

DELETE all of 4127.05B and add the following in lieu thereof:

B. Crushed Particles. Not less than 80 percent of the material delivered to the dryer shall be crushed gravel and/or crushed stone. The coarse aggregate shall be Type 4 skid-resistant aggregate or better, as classified in the current Materials IM T-203, except that Type 4-D aggregate shall not be used. At least 50 percent of the material retained on the No. 4 sieve, as delivered to the dryer, shall be crushed quartzite or other crushed Type 2 skid-resistant aggregate, as classified in the current IM T-203. At least 90% of all crushed gravel and 100% of all crushed limestone incorporated in the mix shall pass a 1/2-inch sieve size.

Type A Surface Course Additive.

Bonding Agents. Hydrated lime shall be added to the surface course mixture at or ahead of the addition of asphalt cement. The hydrated lime shall meet requirements of AASHTO M 17 except that the gradation shall be determined in accordance with AASHTO T 11. The lime shall be added at the rate of 1% by weight of the total aggregate. Hydrated lime will be considered part of the aggregate when determining the job-mix formula and the fines-bitumen ratio.

In place of the hydrated lime, a bonding agent may be substituted. The asphalt cement used in the ACC mixture shall contain 0.5%, by weight of asphalt cement, of an approved bonding additive which meets the following requirements.

Material Property	Test Value Minimum	Test Value Maximum	Test Method
Viscosity at 77°F	25,000	45,000	ASTM D 2170 or D 2171
Viscosity at 140°F	1,100	1,900	ASTM D 2170 or D.2171
Flash Point, COC, °F	350	-----	ASTM D 92
Polyamine concentrate, %	------	35	----------
Metallic ion concentration, ppm.	25,000	50,000	----------

SALVAGED AND RECLAIMED ASPHALTIC MATERIAL.

For the Contractor's information, the in-place average gradation for the surface course and binder course are--

Sieve Size	Surface Course Percent Passing	Binder Course Percent Passing
3/4"	100	99
1/2"	99	91
3/8"	87	81
No. 4	59	64
No. 8	45	43
No. 16	36	33
No. 30	26	23
No. 50	13	12
No. 100	7.2	7.6
No. 200	5.3	6.6
	35% Cr. Quartzite 35% Cr. Gravel	70% Cr. Limestone

For mix design, assume the salvaged asphaltic material has 70% crushed material, and the remainder is natural sand.

The Contractor will be expected to acquire some milled material from the upper 2 inches of the existing surface within the project, for mix design purposes. This should be approximately 100 feet in length, in order to assure representative samples. The surface course shall be temporarily replaced in the milled area with a new surface course of Type A mixture, Section 2303, or a similar mixture that is satisfactory to the Engineer, and with Class II compaction. The samples shall be taken far enough in advance of the ACC mixing plant start-up to allow adequate time for the mix designs to be completed, at least 14 days. This work will be included in the payment quantities of scarification, asphalt cement concrete surface course, asphalt cement, and prime and tack coat. If weighing facilities are not yet available, the scarification quantity may be estimated by the Engineer.

MATERIALS.

In lieu of the requirements for asphalt cement in 2303.02A, the following shall apply.

Asphalt Cement for the surface course shall meet requirements of Section 4137. The grade shall be AC-10 or AC-20, as designated in the job-mix formula. It is intended that the asphalt in the recycled mixture shall possess the characteristics of AC-20.

Polymerized Asphalt Cement. For an approximate 1/2 mile trial section, the recycled surface course mixture shall have polymerized asphalt cement (PAC) added as the new asphalt cement, instead of the asphalt cement specified above. The PAC shall meet requirements of the Supplemental Specification for Polymerized Asphalt Cement, either Grade PAC-30 or Grade PAC-40. The location of the trial section should be suggested by the Contractor, for his convenience, and it shall be subject to approval by the Engineer. The section may be for either direction of traffic, but it is intended to be one continuous placement.

Specifically, the Contractor shall furnish a minimum of 16 tons of the PAC, incorporate the PAC into the recycled mixture at the same rate as for other asphalt cement, and keep the PAC separate from the other new asphalt cement, furnishing the necessary facilities to do so.

The actual quantity of PAC furnished and incorporated into the surface course mixture shall be included with other new asphalt cement for payment. The additional cost of furnishing the PAC and the separate facilities shall be incidental to the asphalt cement and will not be paid for separately.

LIMITATIONS.

The surface course must be replaced by evening of the second working day after it is removed.

During pavement removal and ACC concrete placement, the Contractor's operations near the centerline may extend two feet into the lane being used by public traffic.

The Contractor shall restore shoulders damaged during this work. Damage caused by the Contractor's equipment shall be corrected at this expense.

Construction traffic shall enter and leave work areas in the direction of public traffic and shall not cross over the median to the other roadway.

The Contractor shall submit his construction traffic flow plan, at or prior to the preconstruction conference, for the Engineer's approval. The intention is that the Contractor's traffic will move in the direction of the public traffic as much as practical.

EXCESS SALVAGED ASPHALTIC MATERIAL.

Asphaltic material removed by scarification and not used in the recycled mixtures on this project shall be used in recycled mixtures for Cass County Project FN-6-2(26)--21-15.

APPENDIX B

Mix Designs & Materials

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

MIX, TYPE AND CLASS TYPE A RECYCLED LAB NO. ABD6-196

INTENDED USE: SURFACE

SIZE 3/4" SPEC. NO. 1024, SP 665 DATE REPORTED 9/12/86

COUNTY CASS PROJECT IR-80-1(161)56--12-15

CONTRACTOR WESTERN ENGR.

PROJ. LOCATION FROM 2 MI. E. IOWA 173 TO US 71
MILLED @ 5.08% - PROJECT;
AGG. SOURCES CR. GRAVEL - G. A. FINLEY, ADEL, DALLAS CO.; QUARTZITE - EVERIST, DEL RAPIDS, SD; SAND - G. A. FINLEY, VALLEY, CASS CO.
JOB MIX FORMULA AGGREGATE PROPORTIONS: 20% ABC6-300; 41% AAT6-889; 25% AAT6-888; 14% AAT6-890

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	100	86	52	40	34	26	15	8.7	5.6
TOLERANCE:		98/100		7	7	5		4			2*

ASPHALT SOURCE AND APPROXIMATE VISCOSITY	BITUCOTE - 2730 POISES	
PLASTICITY INDEX		
% ASPH. IN MIX	4.25	5.25
NUMBER OF MARSHALL BLOWS	75	75
MARSHALL STABILITY - LBS.	4290	3607
FLOW - 0.01 IN.	8	9
SP.GR. BY DISPLACEMENT(LAB DENS.)	2.381	2.407
BULK SP. GR. COMB. DRY AGG.	2.665	2.665
SP. GR. ASPH. @ 77 F.	1.025	1.025
CALC. SOLID SP.GR.	2.514	2.476
% VOIDS - CALC.	5.28	2.80
RICE SP. GR.	2.509	2.473
% VOIDS - RICE	5.10	2.67
% WATER ABSORPTION - AGGREGATE	0.63	0.63
% VOIDS IN THE MINERAL AGGREGATE	14.45	14.42
% V.M.A. FILLED WITH ASPHALT	63.46	80.62
CALCULATED ASPH.FILM THICKNESS(MICRONS)	6.74	8.55
FILLER/BITUMEN RATIO	1.20	

A CONTENT OF 4.65% ASPHALT IS RECOMMENDED TO START THE JOB.
THIS IS AN ADDITIONAL 3.63% PAC 30.
* ALSO CONTROLLED BY FILLER/BITUMEN RATIO.

COPIES:
ASPH. MIX DESIGN
~~IR-80~~-1(161)56--12-15, CASS
V. R. SNYDER
W. G. BURGAN
R. MONROE
J. SMYTHE
D. HEINS
WESTERN ENGR.
W. OPPEDAL

SIGNED: MAX I. SHEELER
TESTING ENGINEER

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

MIX, TYPE AND CLASS: TYPE A RECYCLEDB NO. ABD6-191

INTENDED USE: SURFACE

SIZE 3/4" SPEC. NO. 1024, DATE REPORTED 9/10/86
SP 665
COUNTY CASS PROJECT IR-80-1(161)56--12-56

CONTRACTOR WESTERN ENGR.

PROJ. LOCATION FROM 2 MI. E. IOWA 173 TO U.S. 71
MILLED @ 5.08% - PROJECT;
AGG. SOURCES CR. GRAVEL - G. A. FINLEY, ADEL, DALLAS CO.; QUARTZITE - EVERIST, DELL RAPIDS, SD; SAND - G. A. FINLEY, VALLEY, CASS CO.
JOB MIX FORMULA AGGREGATE PROPORTIONS: 20% ABC6-300; 41% AAT6-889; 25% AAT6-888; 14% AAT6-890

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	86	52	40	34	26	15	8.7	5.6
TOLERANCE:		98/100		7	7	5		4			2*

% ASPHALT ADDED	3.23	4.23	5.23
ASPHALT SOURCE AND APPROXIMATE VISCOSITY	KOCH - 1090 POISES		
XXXXXXXXXXXXXXX	BA 2000 ADDED		
% ASPH. IN MIX	4.25	5.25	6.25
NUMBER OF MARSHALL BLOWS	75	75	75
MARSHALL STABILITY - LBS.	3703	3617	2713
FLOW - 0.01 IN.	7	8	11
SP.GR. BY DISPLACEMENT(LAB DENS.)	2.385	2.418	2.418
BULK SP. GR. COMB. DRY AGG.	2.665	2.665	2.665
SP. GR. ASPH. @ 77 F.	1.031	1.031	1.031
CALC. SOLID SP.GR.	2.515	2.478	2.442
% VOIDS - CALC.	5.18	2.42	0.97
RICE SP. GR.	2.519	2.474	2.440
% VOIDS - RICE	5.32	2.26	0.90
% WATER ABSORPTION - AGGREGATE	0.63	0.63	0.63
% VOIDS IN THE MINERAL AGGREGATE	14.31	14.03	14.94
% V.M.A. FILLED WITH ASPHALT	63.83	82.76	93.48
CALCULATED ASPH.FILM THICKNESS(MICRONS)	6.74	8.55	10.39
FILLER/BITUMEN RATIO		1.20	

A CONTENT OF 4.65% ASPHALT IS RECOMMENDED TO START THE JOB.
THIS IS AN ADDITONAL 3.63% AC 10.
* ALSO CONTROLLED BY FILLER/BITUMEN RATIO.

COPIES:
ASPH. MIX DESIGN
~~IR-80-1~~(161)56--12-15, CASS
V. R. SNYDER
W. G. BURGAN
R. MONROE
J. SMYTHE
D. HEINS
WESTERN ENGR.
W. OPPEDAL

SIGNED: MAX I. SHEELER
TESTING ENGINEER

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

MATERIAL RAP 30%
INTENDED USE BINDER
PROJECT NO FN-6-2(26)--21-15
CONTRACTOR WESTERN ENGR.
PRODUCER WESTERN ENGR. - I-80
PLANT
UNIT OF MATERIAL
SENDERS NO 4MD6-042
SAMPLED BY
DATE SAMPLED

LAB NO ABC6-300
COUNTY CASS
CONTRACT NO 25943

DATE RECD 8/28/86 DATE REPORTED 9/2/86

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	0.00
1/2	0.0	0.00	100.00
3/8	74.0	5.05	94.95
4	331.5	22.61	72.34
8	240.0	16.37	55.97
16	174.0	11.87	44.10
30	167.0	11.39	32.71
50	205.5	14.02	18.69
100	99.0	6.75	11.94
200	45.0	3.07	8.87
WASH	117.5	8.87	0.00
PAN	12.6	0.00	0.00

DRY WT. 1466.100
SUM OF RETAINED WTS. 1466.100

% AGGREGATE BY EXTRACTION 94.620
% BITUMEN BY EXTRACTION 5.080
SPECIFIC GRAVITY 0.000
MARSHALL STABILITY 0.000
MARSHALL FLOW 0.01 IN. 0.000
WATER 0.30%

TESTS ON RECOVERED ASPHALT
PENETRATION @ 77 F. 100 GMS. 5 SEC. 23
ABS. VISCOSITY @ 140 F. 300 MM HG, POISES 8820

COPIES TO:

~~ASPH. CONC.~~
V. R. SNYDER
W. G. BURGAN
FN-6-2(26)--21-15, CASS

BY MAX I. SHEELER

IX DESIGN

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

ORRECTED REPORT

ATERIAL: TYPE A ASPHALT-GRAVEL (NO SIZE) LAB NO.: AAT6-0889

NTENDED USE: SURFACE

OUNTY: CASS PROJ NO.: IR-80-1(161)--12-15

ESIGN: CONTRACT NO.: 25942

RODUCER: G. A. FINLEY CONTRACTOR: WESTERN ENGR.

OURCE: ADEL QTY:

AMPLE LOCATION :

AMPLE DESC.:

AMPLED BY: SENDER'S NO.: 4MD6-048

ATE SAMPLED: / / REC'D: 09/05/86 REPORTED: 09/23/86

TO BE USED WITH 4MD6-45 20%, 4MD6-46 25%, 4MD6-47 14%

FIELD	1/2	3/8	#4	#8	#16	#30	#50	#100	#200
% PSG.	100.0	88.0	51.0	35.0	27.0	22.0	18.0	14.0	8.8

OPIES:

PROJECT
GEOLOGY
BITUMINOUS AGGREGATE
DIST - 4,
B. BURGAN,

ISPOSITION:

SIGNED: MAX I. SHEELER

F = NON-COMPLIANCE
* = SPEC NOT CHECKED
@ = CORRECTED ITEM

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

TERIAL: TYPE A ASPHALT-CR. STONE 1/2" LAB NO.: AAT6-0888

SIZE: 1/2

ITENDED USE: SURFACE

OUNTY: CASS PROJ NO.: IR-80-1(161)--12-15

ESIGN: CONTRACT NO.: 25942

RODUCER: EVERIST INC CONTRACTOR: WESTERN ENGR.

OURCE: DELL RAPIDS, MINNEHA SW-10-104N-49W, SOUTH DAKOT QTY:

AMPLE LOCATION :

AMPLE DESC.:

AMPLED BY: SENDER'S NO.: 4JC6-046

ATE SAMPLED: / / REC'D: 09/05/86 REPORTED: 09/16/86

TO BE USED @ 4MD6-45 20%, 4MD6-47 14%, 4MD6-48 41%

FIELD % PSG.	3/4	1/2	3/8	#4	#8	#16	#30	#50	#100	#200
	100.0	99.0	69.0	8.1	2.3	1.8	1.5	0.9	0.4	0.2

OPIES:
PROJECT
GEOLOGY
BITUMINOUS AGGREGATE
DIST - 6,
B. BERGAN,

ISPOSITION:

SIGNED: MAX I. SHEELER

F = NON-COMPLIANCE
* = SPEC NOT CHECKED
@ = CORRECTED ITEM

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

TERIAL: AGGR. FOR TYPE-A ASPH. (NO GIVEN S LAB NO.: AAT6-0890

TENDED USE: SURFACE

UNTY: CASS PROJ NO.: IR-80-1(161)--12-15

SIGN: CONTRACT NO.: 25942

ODUCER: FINLEY INC CONTRACTOR: WESTERN ENGR.

URCE: ATLANTIC NE-06-076N-36W, CASS QTY:

MPLE LOCATION :

MPLE DESC.:

MPLED BY: SENDER'S NO.: 4MD6-047

TE SAMPLED: / / REC'D: 09/05/86 REPORTED: 09/16/86

TO BE USED WITH 4MD6-45 20%, 4MD6-46 25%, 4MD6-48 41%

FIELD % PSG.	#8	#16	#30	#50	#100	#200
	100.0	96.0	75.0	25.0	3.4	1.3

)PIES:

~~PROJECT~~
GEOLOGY
BITUMINOUS AGGREGATE
DIST - 4,
B. BURGAN,

ISPOSITION:

SIGNED: MAX I. SHEELER

F = NON-COMPLIANCE
* = SPEC NOT CHECKED
@ = CORRECTED ITEM

ASSURANCE SAMPLE

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

MATERIAL ASPHALT PAC 30 LAB NO. AB6-246

INTENDED USE TYPE A ASPHALT

COUNTY CASS PROJ NO. IR-80-1(161)56--12-15

DESIGN CONTRACT NO. 25942

PRODUCER BITUCOTE CONTRACTOR WESTERN ENGR.

SOURCE

UNIT OF MATERIAL 5 QT. 16 TON

SAMPLED BY J. CONN SENDER'S NO. 4JC6-101

DATE SAMPLED 10-1-86 REC'D 10-2-86 REPORTED 10-6-86

PENETRATION @ 77 F. 100 GMS. 5 SEC.	88
SP. GR. @ 60 F./60 F.	1.026
FLASH POINT	
SOLUBLE IN TRICHLOROETHYLENE	99.96%
DUCTILITY @ 77 F., CMS.	
SOFT POINT: METHOD (R & B)	
ABS. VIS. OF ORIGINAL ASPH. @ 140 F. & 300 MM HG	3290
KINEMATIC VISCOSITY ORIGINAL @ 275 F.	719
THIN FILM LOSS ON HEATING 5 HRS. @ 325 F.	0.26%
% ORIGINAL PENETRATION (THIN FILM RES.)	
PENETRATION OF RES. @ 77 F. 100 GMS. 5 SEC.	
DUCTILITY @ 77 F. (THIN FILM RES.), CMS.	
ABS. VIS. OF THIN FILM ASPH. @ 140 F. & 300 MM HG	9080
ELASTIC RECOVERY @ 50 F. %	67.5
KVISCOSITYVRATIOITY THIN FILM @ 275 F.	2.76

COPIES:
ASPHALT
VAN R. SNYDER
WM. BURGAN
IR-80-1(161)56--12-15, CASS

DISPOSITION: RESULTS COMPLY WITH STD. SPECS. 1026.02

SIGNED: MAX I. SHEELER

APPENDIX C

Supplemental Specification 1026

Specification 1026
Replaces 942
Completely Revised

Iowa Department of Transportation

SUPPLEMENTAL SPECIFICATION
for
POLYMERIZED ASPHALT CEMENT

June 24, 1986

THE STANDARD SPECIFICATIONS, SERIES OF 1984, ARE AMENDED BY THE FOLLOWING ADDITIONS. THESE ARE SUPPLEMENTAL SPECIFICATIONS, AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

1026.01 DESCRIPTION. This specification describes a polymerized asphalt cement, intended to be used in asphalt cement concrete mixtures where high stability requirements are necessary.

This material may be a proprietary product. Bidders should contact their suppliers concerning this.

Each source of this material must be approved by the Materials Engineer. Specific approval will be required. Approval will be based on the manufacturer's proposed method of polymerization, as well as compliance with the test requirements specified.

1026.02 MATERIAL. The polymerized asphalt cement shall be of the grade specified on the plans or proposal. When not so specified, the grade will be designated on the job-mix formula. The material shall meet the following requirements for the grade required. The Contractor shall furnish certified test results for each load of this material furnished to the project.

TEST	PAC-2.5	PAC-5	PAC-10	PAC-20	PAC-30	PAC-40
Viscosity, 60°C (140°F), poises (1)	250±50	500±100	1000±200	2000±400	3000±600	4000±800
Viscosity, 135°C (275°F), Cs, min. (1)	125	200	250	300	350	400
Penetration, 25°C (77°F), 100 g 5 sec. min. (1)	220	140	80	60	50	40
Flash Point, COC, C(F), min. (1)	163(325)	176(350)	232(450)	232(450)	232(450)	232(450)
Solubility in Trichloroethylene, %, min. (1)	99.0	99.0	99.0	99.0	99.0	99.0
Test on Residue from Thin-Film Oven Test: (2)						
Viscosity Ratio, max. $\frac{\text{Residue Viscosity, p @ 60°C (140°F)}}{\text{Original Viscosity, p @ 60°C (140°F)}}$	3.0	3.0	3.0	3.0	3.0	3.0
Test for Elasticity:						
Tensile stress @ 800% elongation 500 mm/min rate of pull, Pa (3)						
20°C (68°F), min.			20.0	30.0	40.0	50.0
4°C (39.2°F), min.	75.0	200.0				
Elastic Recovery by Means of Ductilometer, %, min. (4)	55	60	60	60	58	58

1026.03 CONSTRUCTION. The polymerized asphalt cement shall be incorporated in the ACC mixture to be placed in the locations designated on the plans, in lieu of the asphalt cement specified for other mixtures specified for the project. The mixture shall be prepared and placed according to requirements of the Standard Specifications.

The Contractor shall furnish facilities and use a procedure that keep this material separate from other asphalt cement used on the project during storage and incorporation into the mixture.

1026.04 MEASUREMENT AND PAYMENT. Polymerized Asphalt Cement of the grade specified, satisfactorily incorporated into the work, will be separately measured and paid for in accord with 2303.27B and 2303.28B. The quantity shall be for mixture in the areas designated on the plans and such additional mixture as was necessary to cover the designated areas using full truck loads of mixture. This payment shall be full compensation for furnishing and incorporating this material into the mixture and for the special facilities and procedures necessary to accomplish this.

The quantity of ACC mixture with polymerized asphalt cement, furnished and placed as designated, will be included with the other quantities of ACC mixture and will be paid for accordingly.

FOOTNOTES:
1. These specifications correspond to AASHTO M 226, Table 2, requirements for asphalt cements.
2. Rolling thin-film oven test may be substituted for TFOT.
3. ASTM D 412, Method A, with the exception that elastomeric sample molds shall be substituted for the die cutting method. The molds are available from the Elf Aquitaine Asphalt Laboratory, 400 North 10th Street, Terre Haute, Indiana 47807.
4. ASTM D 113, except elongate to 20 cm at 5 cm/min--clip strands--Recovery after 1 hr., %, min.

APPENDIX D

Profilometer Test

WESTERN ENGINEERING CO. INC.
BOX 350
HARLAN, IOWA 51537
"ASPHALT PAVING SPECIALISTS"
PHONE
OFF. 712-755-5191

THE ROAD RUNNERS

25 FOOT CALIFORNIA PROFILOMETER

☐ Revised Report
Changes Lab. No. _____

For Information Only ☐ Preliminary ☐ Intermediate [XX] Final ☐

Lab. No. WECO 145 Route No. I-80 Project No. IR-80-1(161)56--12-15
Date Reported 10-11-86 Date Paved 10-1-86 County Cass (15)
Tested at: ¼ Point [X] Wheel Track ☐ Contractor Western Engineering Company, Inc.
Tested By L. E. Holtmyer Date 10-1-86
Trace Reduced By L. E. Holtmyer Date 10-2-86

Primary Schedule A [XX]
Primary Schedule B ☐
Secondary ☐
Municipal ☐
Other ☐

PCC Slip Form ☐
PCC Fixed Form ☐
PCC Bonded Overlay ☐
PCC Unbonded Overlay ☐
PCC Patches ☐

ACC Paving ☐
ACC Resurfacing [XX] Inlay
ACC Patches ☐

Roadway Type: 2-Lane ☐ 4-Lane [XX] Ramp ☐ Other Outside lane inlay only

N.B. ☐ E.B. ☐ ← Direction → S.B. ☐ W.B. [XX]
Inside Lane ☐ ← (4-Lane Only) → Outside Lane [XX]
Centerline ☐ ← (Patches Only) → ¼ Point ☐

Length (Miles)	Measured Roughness (Inches)	Profile Index (Inches/Miles)	Location (Station)	Length (Miles)	Measured Roughness (Inches)	Profile Index (Inches/Miles)
Start of Job 553 + 24-6			553 + 24-6	.1	.85	8.5
				.1	.70	7.0
				.1	.65	6.5
				.1	.85	8.5
				.1	.30	3.0
				.1	.25	2.5
				.1	.25	2.5
				.1	.25	2.5
				.1	.55	5.5
				.1	.60	6.0
			492 + 26	.031	.15	4.8
				1.031	5.40	5.2376

Station ← ½" Bump Locations → Station

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