RALUMAC LATEX MODIFIED ASPHALT

FINAL REPORT FOR
IOWA DEPARTMENT OF TRANSPORTATION
PROJECT HR-2041

JULY 1994

Project Development Division

Iowa Department of Transportation

Ralumac Latex
Modified Asphalt

Final Report
for Iowa Department of Transportation
Project HR-2041

by

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TECHNICAL REPORT TITLE PAGE

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8. ABSTRACT

Some asphalt roadways tend to develop wheelpath ruts over time when exposed to heavy traffic. As the rutting increases in depth, the travel comfort and levels of safety decrease. A variety of remedies involving major or minor operations can be applied to eliminate ruts and renew the roadway surface. One of the simple remedies, called Ralumac microsurfacing, involves only a longitudinal band over the rut. For better coverage, ruts are filled initially and followed by a complete thin surface wearing cover over the roadway.

9. KEY WORDS	10. NO. OF PAGES
Ralumac Microsurfacing Modifier Asphalt pavement	33

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DISCLAIMER

INTRODUCTION

Many asphalt roadways tend to develop some wheelpath ruts over time, especially if exposed to heavy truck traffic. The ruts cause a reduction in travel comfort and safety. During wet or freezing periods the ruts can be filled with water or ice and, therefore, lower the general level of safety on the roadway.

Wheelpath rut problems can be repaired or eliminated by doing a major reconstruction or overlay project or by doing a simple longitudinal band repair. Ralumac microsurfacing is proposed as a product and technique which can be applied as a slurry to fill in ruts and to provide a new surface with an improved cross section.

OBJECTIVE

The objective of this research is to evaluate a remedial treatment, using Ralumac, to fill in wheelpath ruts and to provide a new wearing surface to the roadway.

LOCATION

The location selected for the experimental application of Ralumac was on US 169 in Webster County south of Fort Dodge. The specific site was from the intersection of county road P51 north for 0.8 km (1/2 mi.) in the area extending from Station 1150+00 to Station 1180+00, which is between milepost 155 and milepost 156. The project was done in June 1988. The ADT was 4450 vehicles per day.

MATERIALS

The specifications and the materials design for the Ralumac microsurfacing project, as proposed by Koch Materials Company, are given in Appendix A.

AGREEMENT

Arrangements to establish the research, locate an appropriate site, apply the Ralumac microsurface and carry out the evaluation were made between Koch Materials Company and the Iowa Department of Transportation Maintenance personnel. It was agreed that it would be a free demonstration project sponsored by Koch Materials Company with some support from the Iowa Department of Transportation. The application date was June 16, 1988. Copies of correspondence are in Appendix B.

PRODUCT COSTS

No product and application costs were given or were applied in this demonstration project. It was sponsored without charges by Koch Materials Company.

EVALUATION

Experience with Ralumac in the state of Iowa have shown that the preparation of the mix, obtaining the optimum proportions of materials and then their application to the roadway are extremely critical for success. The application in Webster County had a washout in a wheelpath from a light rain after 18 hours curing

time. In addition, in Webster County, rutting started occurring in the wheelpaths almost immediately. In this application the product performance, in most of the area covered, has to be considered as a failure. The reasons for failure seemed to be heavily dependent upon material preparation and application skills. Results from tests for rutting and friction are given in Table 1 and the Table 2 respectively.

As the materials and applications were provided by the product supplier as a demonstration, no costs were applicable.

No further evaluations will be done as this section of US 169 was transferred to Webster County jurisdiction in 1990 and was then overlaid with asphalt cement in 1991.

A preliminary evaluation and construction report can be found in Appendix C.

Core Analysis

Four cores were taken from the outside wheelpath, northbound driving lane around Station 1160+00. The core thicknesses were between 15.9 mm (5/8 in.) and 22.2 mm (7/8 in.). The laboratory analysis of core density and percent air is given in Appendix D. These cores were taken intact, however, attempts to get additional cores in the southbound lane failed as they eroded and crumbled while drilling due to lack of cure, even 24 hours after the Ralumac application.

CONCLUSIONS

Evaluations of the Ralumac microsurfacing demonstration project were done over a four-year period. At the very beginning of the project, it was evident that the application procedures were not carried out with sufficient control. The Ralumac slurry appeared to contain excessive water. The break time was extremely long as demonstrated by the washed out section from a rain shower. Rutting began to occur immediately and was finally quite bad (see Table 2).

The initial values for friction were quite high in the Ralumac test section compared to the old asphalt conventional section. Although the initial values were higher, the rate of decrease in the Ralumac section was greater than in the conventional section (see Table 1).

Based upon the evaluation and results of this project, which was designed and applied by the factory representatives, it can be summarized that the performance of Ralumac was not impressive and was not cost effective. Results may have been better if the mixing and application of the Ralumac asphalt mixture was more accurately controlled.

ACKNOWLEDGEMENT

Appreciation is expressed to Koch Materials Company for their generous efforts and contributions in materials and equipment

provided in this research. In addition, appreciation goes out to all of the Iowa DOT personnel who arranged the test site, coordinated the application and supported the gathering of data for the evaluation.

TABLE CAPTIONS

1. Friction Testing Results
2. Wheelpath Rutting Before and After Application

TABLE 1
Friction Testing Results
Ralumac Section
US 169, Milepost 155.20 to 155.80

Friction testing was conducted on US 169 in Webster County on July 1, 1988 and again on September 27, 1988. All testing was performed at 64.4 kmph (40 mph) with standard tread (ASTM E-501-76) and smooth tread (ASTM E-524-76) test tires. The results are as follows:

July 1, 1988

MILEPOST	NORTHBOUND		SOUTHBOUND	
	STANDARD	SMOOTH	STANDARD	SMOOTH
155.2 (Conventional)	34	16	31	13
155.5	50	25	59	42
155.6	59	45	54	37
155.7	57	35	59	46
155.8 (Conventional)	28	14	31	14
Ralumac Average	55	35	57	42
Conventional Average	31	15	31	13.5

September 27, 1988

MILEPOST	NORTHBOUND		SOUTHBOUND	
	STANDARD	SMOOTH	STANDARD	SMOOTH
155.2 (Conventional)	33	21	30	13
155.5	43	17	53	33
155.6	52	34	52	40
155.7	46	23	49	29
155.8 (Conventional)	32	12	31	14
Ralumac Average	47	25	51	34
Conventional Average	32.5	16.5	30.5	13.5

The average friction values for the Ralumac do show some decrease in friction over time and the rate of decrease is high compared to the conventional section.

TABLE 2
Ralumac Application
June 16, 1988
Wheelpath Rutting, Before and After Application

Before Application
May 23, 1988
Station 1150+00 to 1180+00 Avg. mm (Avg. in.)

	Southbound		Northbound	
	Outside Wheelpath A	Inside Wheelpath B	Inside Wheelpath C	Outside Wheelpath D
1.2 m (4 ft.) gage	11.2 mm (.44 in.)	12.4 mm (.49 in.)	8.1 mm (.32 in.)	8.9 mm (.35 in.)
1.8 m (6 ft.) gage	15.5 mm (.61 in.)	15.5 mm (.61 in.)	11.2 mm (.44 in.)	13.0 mm (.51 in.)

After Application
July 5, 1988
Station 1153+20 to 1167+20 Avg. mm (Avg. in.)

	Southbound		Northbound	
	Outside Wheelpath A	Inside Wheelpath B	Inside Wheelpath C	Outside Wheelpath D
1.2 m (4 ft.) gage	4.3 mm (.17 in.)	5.3 mm (.21 in.)	3.6 mm (.14 in.)	2.5 mm (.10 in.)
1.8 m (6 ft.) gage	6.6 mm (.26 in.)	9.7 mm (.38 in.)	7.4 mm (.29 in.)	4.3 mm (.17 in.)
		August 12, 1988		
1.2 m (4 ft.) gage	5.1 mm (.20 in.)	6.4 mm (.25 in.)	3.8 mm (.15 in.)	3.0 mm (.12 in.)
1.8 m (6 ft.) gage	6.6 mm (.26 in.)	10.2 mm (.40 in.)	8.4 mm (.33 in.)	4.6 mm (.18in.)
		July 26, 1989		
1.2 m (4 ft.) gage	5.8 mm (.23 in.)	7.4 mm (.29 in.)	3.3 mm (.13 in.)	2.3 mm (.09 in.)
1.8 m (6 ft.) gage	7.1 mm (.28 in.)	12.4 mm (.41 in.)	7.1 mm (.28 in.)	4.1 mm (.16 in.)
		March 6, 1991		
1.2 m (4 ft.) gage	6.1 mm (.24 in.)	7.6 mm (.30 in.)	5.3 mm (.21 in.)	4.1 mm (.16 in.)
1.8 m (6 ft.) gage	5.8 mm (.23 in.)	8.4 mm (.33 in.)	6.4 mm (.25 in.)	4.3 mm (.17 in.)

Appendix A
Materials

RALUMAC
MICRO-SURFACING SPECIFICATIONS

1. DESCRIPTION

Ralumac Micro-Surfacing is a tough and durable thin overlay material which can restore the original service properties to worn but structurally sound pavements. Its properties are based on a blend of select crushed aggregate and a sophisticated chemical formulation of asphalt cement, cationic emulsifiers, adhesives, and natural latex. This specification covers all materials, equipment, construction and application procedures for rutfilling and/or surfacing of existing paved surfaces. The micro-surfacing shall be a mixture of natural latex modified cationic asphalt emulsion, mineral aggregate, mineral and field control additives, and water, properly proportioned, mixed and spread on the paved surface in accordance with this specification and as directed by the Engineer.

2. MATERIALS

2.1 Emulsified Asphalt

The emulsified asphalt shall be a quick-set natural latex modified cationic type CSS-1H emulsion and shall conform to the requirements specified in AASHTO M208 and ASTM 2397. It shall pass all applicable storage and settlement tests. The natural latex shall be milled into the emulsion. The cement mixing test shall be waived for this emulsion.

2.1.1 Special Residue Properties

Distillation of residue will be at a temperature of 350 degrees F for 20 minutes. Softening point of the residue shall be 140 degrees F minimum. Viscosity, absolute at 140 degrees F, shall be 8,000 poise minimum.

2.2 Aggregate

2.2.1 General

The mineral aggregate used shall be of the type and grade specified for micro-surfacing. The aggregate shall be manufactured crushed stone such as granite, slag, limestone, chat, or other high quality aggregate or combination thereof.

2.2.2 Aggregate Physical Requirements

Grading. The aggregate including natural fines when tested by AASHTO method T11 or T27, or ASTM C117 or C136, should meet the referenced gradation requirements.

Deleterious Substances. To limit the permissible amount of clay like fines in an aggregate, a sand equivalent value of 65 or higher is required when tested by ASTM 2419.

Soundness. The aggregate shall have a weighted loss of not more than 15% when the sodium sulfate test is used or 20% when the magnesium sulfate test is used.

Hardness. The aggregate wear, from resistance to abrasion, shall be a maximum of 35% when using AASHTO T96 or ASTM C131 test methods.

2.3 Water

The water shall be potable and shall be free of harmful soluble salts.

2.4 Modifier

Special quick-setting emulsifier agents shall be milled into the asphalt emulsion. The emulsified asphalt shall be so formulated that when the paving mixture is applied at a thickness of one inch with the relative humidity at not more than 50% and the ambient air temperature of at least 75 degrees F, the material will cure sufficiently so that rolling traffic can be allowed in one hour with no damage to the surface, as verified by the Engineer.

2.5 Additives

A mineral additive shall be introduced to the mineral aggregate and may be any recognized brand of nonairentrained portland cement or hydrated lime that is free of lumps, or other approved mineral additive. It may be accepted upon visual inspection. The amount of mineral additive needed shall be determined by the laboratory mix design and will be considered as part of the material gradation requirement.

A liquid field control additive is introduced and blended with water to provide effective control of the required quick-set properties. This additive shall be made available by the chemical supplier or emulsion manufacturer and certifiable as being compatible with the mixture.

3. ENGINEERING

3.1 General

Before work commences, the contractor shall submit a signed mix design covering the specific material to be used on the project. This design shall be performed by a qualified laboratory. Once the materials are approved, no substitution will be permitted unless first tested and approved by the laboratory preparing the mix design.

3.2 Mix Design

The qualified laboratory shall develop the job mix design and present certified test results for the contractors approval. Compatibility of the aggregate and Ralumac emulsion shall be verified by the mix design. The job mix formula shall provide a minimum Marshall stability of 1,800 pounds and a flow of 6 to 16 units when tested according to the ASTM 1559 or AASHTO 245 procedure as modified. All component materials used in the mix design shall be representative of the material proposed by the contractor for use on the project.

3.3 Specifications

The Engineer shall approve the design mix and all micro-surfacing materials and methods prior to use. The component materials shall be within the following limits.

Residual Asphalt	5% to 9% by dry weight of aggregate
Mineral Additive	0.5% to 3% by dry weight of aggregate
Natural Latex Modifier	Minimum 3.0%, based on weight of A.C.
Field Control Additive	As required to provide the specific properties
Water	As required to produce consistency

Aggregate - Recommended Gradations:

Screen Size	*Type II %Passing*	*Type III %Passing*
3/8"	*100*	*100*
#4	*90-100*	*70-90*
#8	*65-90*	*45-65*
#16	*40-65*	*30-50*
#30	*25-45*	*19-34*
#50	*15-30*	*12-25*
#100	*10-21*	*7-18*
#200	*5-13*	*4-12*

Suggested Application & Rate:

Type II - Urban and Residential Streets, (20-30 lbs per sq. yd.) Airport Runways:

Type III- Primary and Interstate Routes: (30-40 lbs per sq. yd.) Wheel Ruts: Application rates as required.

4. EQUIPMENT

4.1 General

All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working condition at all times to ensure a high quality product.

4.2 Mixing Equipment

The material shall be mixed by a self-propelled micro-surfacing mixing machine which shall be a continuous flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral and field control additives, and water to a revolving multi-blade twin shafted mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral and field control additives, and water to maintain an adequate supply to the proportioning controls. The machine shall be equipped with self-loading devices which provide for the loading of materials while continuing to lay micro-surfacing, thereby minimizing construction joints.

4.3 Proportioning Devices

Individual volume or weight controls for proportioning each material to be added to the mix, i.e., aggregate, emulsified asphalt, mineral and field control additives, and water shall be provided and properly marked. These proportioning devices are usually revolution counters or similar devices and are used in material calibration and determining the materials output at any time.

4.4 Emulsion Pump

The emulsion pump shall be a heated positive displacement type.

4.5 Spreading Equipment

The surfacing mixture shall be spread uniformly by means of a mechanical type spreader box attached to the mixer, equipped with paddles to agitate and spread the materials throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as final strike off and shall be adjustable. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform skid resistant application of material on the surface. The spreader box and rear strike off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike off. The longitudinal joint where two passes join shall be neat appearing, uniform and lapped. All excess material shall be removed from the job site prior to opening the road. The spreader box shall have suitable means provided to side shift the box to compensate for variations in pavement width and longitudinal alignment.

4.6 Auxiliary Equipment

Suitable crack and surface cleaning equipment, traffic control equipment, hand tools and any support equipment shall be provided as necessary to perform the work.

5. MACHINE CALIBRATION

Each mixing unit to be used in performance of the work shall be calibrated in the presence of the Engineer prior to construction, or previous calibration documentation covering the exact materials to be used may be acceptable provided they were made during that calendar year. The documentation shall include the individual calibration of each material at various settings, which can be related to the machine metering devices.

6. WEATHER LIMITATIONS

The material shall be spread only when the road surface and atmospheric temperatures are at least 45 degrees F and rising and the weather is not foggy or rainy and there is no forecast of temperatures below 32 degrees F within 48 hours from the time of placement of the mixture.

7. NOTIFICATION AND TRAFFIC CONTROL

7.1 Notification

All homeowners and businesses affected by the construction shall be notified one day in advance of the surfacing. This notification shall be in the form of a written posting stating the times and dates that construction is expected on their road.

7.2 Traffic Control

Suitable methods shall be used by the contractor to protect the micro-surface from traffic until the new surface will support traffic without damage. All traffic control methods used shall be in accordance with the Engineer's specifications and shall be employed in a safe manner.

8. SURFACE PREPARATION

8.1 General

The area to be surfaced shall be thoroughly cleaned of vegetation, loose aggregate and soil, particularly soil that is bound to the surface. Manholes, valve boxes and other service entrances will be protected from the surfacing material.

8.2 Cracks in Surface

It is advisable to pretreat the cracks in the surface with a crack sealer prior to the application of the micro-surfacing.

8.3 Tack Coat

If required by the plans, the contractor shall apply a tack coat consisting of one part emulsified asphalt and two parts water with a distributor at .10-.15 gallons per square yard. This emulsified asphalt should be the SS or CSS emulsion grade. It is recommended that a tack coat always be applied to a concrete or brick surface.

9. STOCKPILE

Precautions shall be taken to insure that stockpiles do not become contaminated. The mineral aggregate shall be screened prior to being weighed for job site delivery. This weight shall be done by means of a scale approved by the Engineer.

10. APPLICATION

10.1 General

The surface should be pre-wetted by fogging ahead of the spreader box when required by local conditions. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement surface.

The micro-surfacing mixture shall be of the desired consistency upon leaving the mixer and no additional materials should be added. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided. No lumping, balling, or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate, will be left in the finished surface. If excessive oversize develops, the job will be stopped until the contractor proves to the Engineer that the situation has been corrected.

10.2 Joints

No excessive buildup, uncovered areas or unsightly appearances shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd widths passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area.

10.3 Mix Stability

The micro-surfacing mixture shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water or emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

10.4 Hand Work

Areas which cannot be reached with the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement. Care shall be exercised to leave no unsightly appearance from handwork.

The same type finish as applied by the spreader box shall be required. Handwork shall be completed at the time of the machine applying process.

10.5 Lines

Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance.

10.6 Rolling

If required by the plans, specified areas shall be rolled by a self-propelled 10 ton pneumatic roller with a tire pressure of 50 PSI and equipped with a water spray system.

11. QUALITY CONTROL

11.1 Materials

The contractor will permit the Engineer to take samples of the aggregate and asphalt emulsion to be used in the project at the Engineer's discretion. Gradation and sand equivalent tests may be run on the aggregate and residual asphalt content test on the emulsion. Test results will be compared to specifications. Tests will be run by a qualified laboratory at the expense of the buyer. The buyer must notify the contractor immediately if any test fails to meet the specifications.

11.2 Micro-Surfacing Mixture

Samples of the mixture should be taken daily and may be taken directly from the mixing unit. Consistency and residual asphalt content tests may be made on the samples and compared to the specifications. Tests will be run by a qualified laboratory at the expense of the buyer. The buyer must notify the contractor immediately if any test fails to meet specifications.

The Engineer may use the recorders and measuring facilities of the unit to determine application rates, asphalt emulsion content, mineral and field control additives, and water.

11.3 Non-Compliance

If any two successive tests fail on the stockpile material, the job shall be stopped. It is the responsibility of the contractor, at his own expense, to prove to the Engineer that the conditions have been corrected. If any two successive tests on the mix from the same machine fail,

the use of the machine shall be suspended. It will be the responsibility of the contractor, at his own expense, to prove to the Engineer that the problems have been corrected and that the machine is working properly.

12. METHOD OF MEASUREMENT

12.1 Aggregate

The quantity of aggregate used in the accepted portions of the work shall be measured by net ticket weight of each individual load of aggregate shipped to the project from the approved job site scale. The weight of mineral additive used shall be calculated and included in the total aggregate weight.

12.2 Ralumac Emulsion

The quantity of Ralumac emulsion used in the accepted portion of the work shall be measured by gallons or tons of material based on the accepted load tickets issued from the manufacturer. At the completion of the project any unused emulsion shall be weighed back and that quantity deducted from the accepted emulsion quality delivered.

13. BASIS OF PAYMENT

The accepted quantity of mixture used in the "Ralumac Micro-Surfacing" will be paid for at the contract unit price per ton for the type material specified. The unit price shown in the contract shall be full compensation for all materials; including emulsion, modifiers, mineral additive, labor, tools, equipment, traffic control, and all other incidentals necessary to complete the work.

14. PERFORMANCE WARRANTY

The contractor must furnish the following warranty after completion of the work and prior to final payment:

The Contractor hereby warrants that all workmanship and all materials furnished under the Contract comply fully with requirements of these Ralumac Micro-Surfacing Specifications. If at any time within two years after the date of the final inspection, any unfaithful or defective work should appear, which in the opinion of the Buyer is due to inferior materials or workmanship, the Contractor warrants to do whatever is necessary to remedy the defects immediately without cost to the Buyer. The Buyer will notify the Contractor in writing of the defects and the repairs to be made, and the Contractor will begin repairs within a mutually agreed time frame.

MARTIN MARIETTA
FORT DODGE, IOWA

MIX COMPONENTS: 11% emulsion (1.2% 417 and Pine Bend AC-20), 7% water, 1% additive, 1% cement.

BREAK TIME: 1'30" - 2'

SET TIME: 5' - 7'

The following is a compilation of Ralumac Micro-surfacing test results with some Type III aggregate from Martin Marietta, Fort Dodge, Iowa.

THE AGGREGATE MEETS TYPE III SPECIFICATIONS

SIEVE	% PASSING	TYPE III SPEC.
3/8	100.0	100.0
No. 4	73.0	70-90
No. 8	49.1	45-65
No. 16	33.8	30-50
No. 30	25.6	19-34
No. 50	19.7	12-25
No. 100	16.2	7-18
No. 200	10.6	4-12

SAND EQUIVALENCY = 60.7%
METHYLENE BLUE TEST = 6 ml

MARSHALL MIX DESIGN RESULTS

% RESIDUAL BINDER	STABILITY	FLOW	DENSITY	SPECIFIC GRAVITY
6.5	2370	.16	148.8	2.38
7.5	1826	.35	148.6	2.38
8.5	1689	.35	148.4	2.38

MINIMUM STABILITY IS 1800

KOCH MATERIALS COMPANY
Chicago, Il.

DATE: 06-08-88 SALESMAN: Bill Miteff

CUSTOMER: Scott Const. FILE #: RAL-8804

SOURCE: Franklin, Wi. Agg. #1

RALUMAC MICROSURFACING DESIGN

GRADATION:

Sieve Size	Percent Retained	Percent Passing	Ralumac Type I Spec.	Ralumac Type II Spec.
3/8	0.0	100.0	100	100
#4	7.0	93.0	90 - 100	70 - 90
8	26.8	66.2	65 - 90	45 - 65
16	23.5	42.7	40 - 65	30 - 50
30	13.8	29.0	25 - 45	19 - 34
50	9.9	19.0	15 - 30	12 - 25
100	6.6	12.4	10 - 21	7 - 18
200	4.5	7.9	5 - 13	4 - 12

MARSHALL SPECIMEN:

Residual Asphalt Content	Stability at 140 F lbs.	Flow .01 inch	VMA	VTM	Density lbs/cf
6.0	3055	9	19.7	7.0	142.8
6.5	3067	13	19.6	5.8	143.7
7.0	3702	15	17.7	2.4	147.9
7.5	3336	14	17.9	1.6	148.2

COHESION TESTS:

% PC	% Water	% Add	% Emul	Max. Mix Time	Set Time	Cohesion at (min.) 15	30	60
1/4	5	2	10	120"	7'	17	17	17
1/2	5	2	10	90"	6'	19	19	20
3/4	5	2	10	80"	6'	16	19	19
1/2	4	3	10	110"	6'	17	18	18

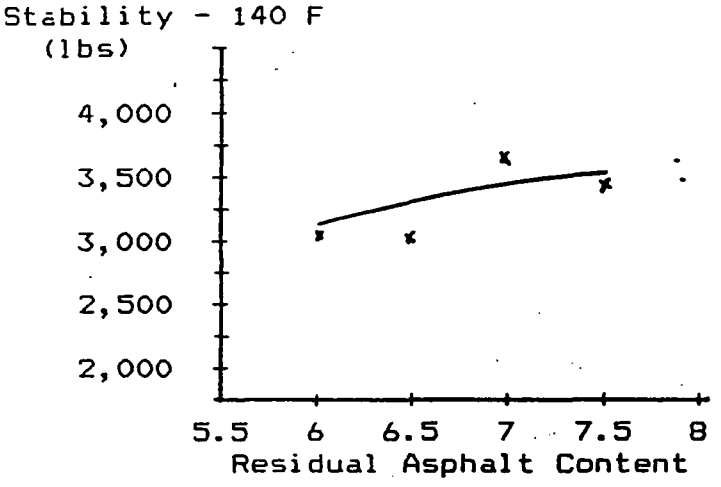
KOCH MATERIALS COMPANY
Chicago, Il.

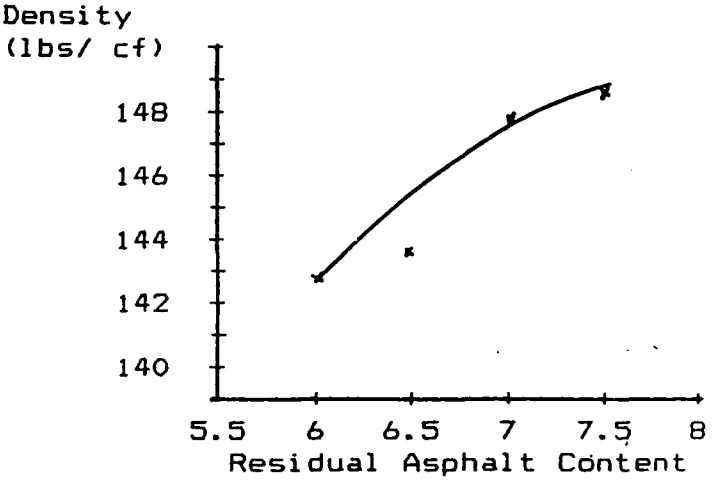
DATE: 06-08-88 FILE #: RAL-8804

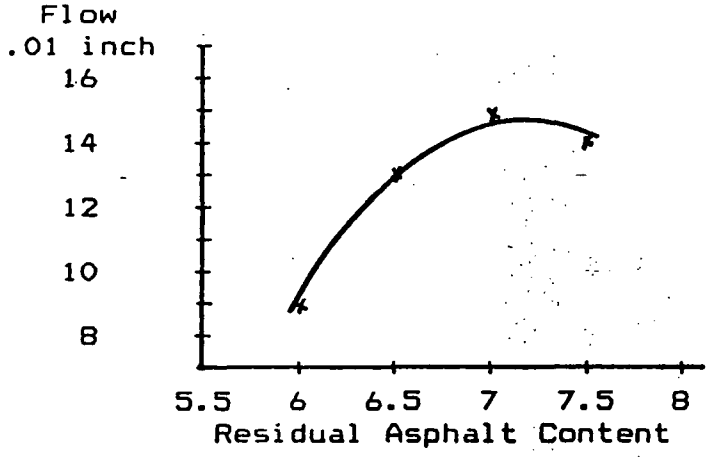
CUSTOMER: Scott Const. SOURCE: Franklin, Wi. #1

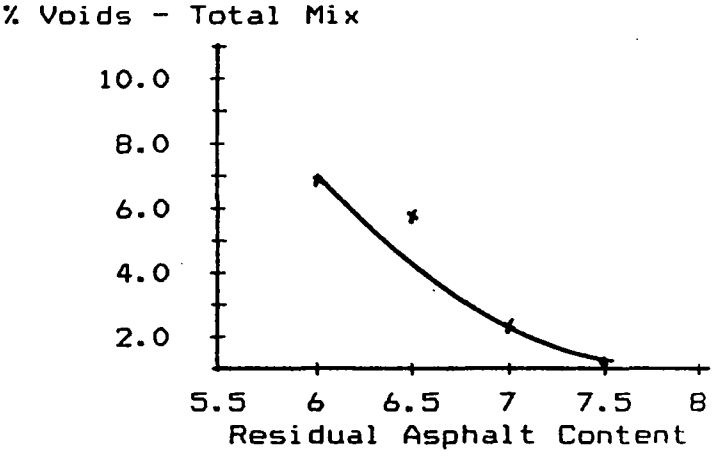
SALESMAN: Bill Miteff

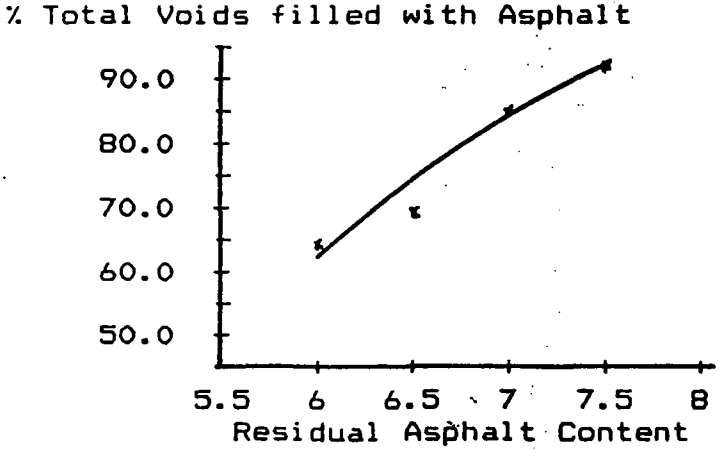
Performence Properties vs. Residual Asphalt Content

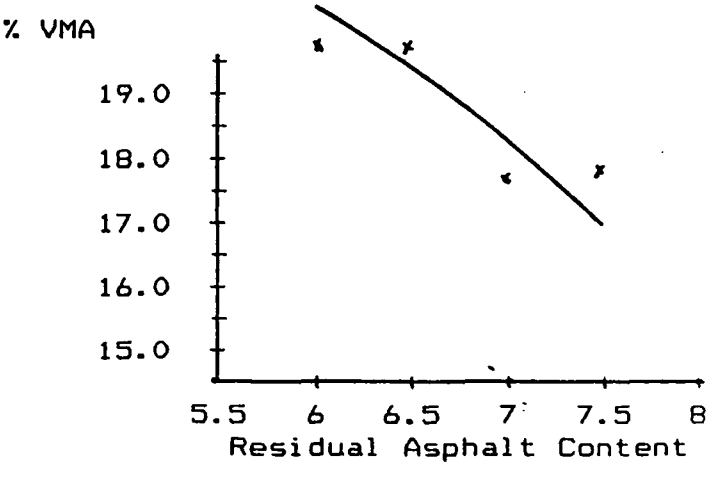












Rut Filling with Micro-Surfacing

Rut Width	Lbs./Sq. Yd. Laid					
72"	25	50	75	99	124	149
66"	23	45	68	91	114	136
60"	21	41	62	82	103	123
54"	19	37	56	74	93	111
48"	17	33	50	66	83	99
36"	13	25	37	50	62	75
Rut Depth	.25"	.50"	.75"	1.0"	1.25"	1.50"

The 48" and the 72" wide rut boxes are most commonly used. When the rut boxes are in use, any rut demanding more than 50 lbs./sq. yd. is pulled in two or more passes.

Micro-Surfacing

Pounds per square yard-straight surfacing

36"	12	25	37	49
by	1/8"	1/4"	3/8"	1/2"

Appendix B
Agreement - Webster County

Iowa Department of Transportation
Box 954, Fort Dodge, IA 50501 515/955-3766

May 27, 1988 Ref.: 600

Koch Materials Company
ATTN: MR. BILL WILKINS
P.O. Box 440
Salina, KS 76402-0440

Dear Mr. Wilkins:

This letter is regarding the meeting we had yesterday at the Fort Dodge Residency office. I want to cover the areas of concern we each had for this upcoming Ralumac test strip on June 16, 1988.

I have attached the checklist that you gave me, which covers the materials the State (D.O.T.) needs to provide and which ones will be provided by Koch Materials. I want you to know that this office will provide what is on the checklist for the State.

Some concerns that I have after meeting with you yesterday are:

1. On your invitation to others than State officials, you may want to have them bring hard hats and safety vests. Or you can provide these for (you) guests.
2. The State is going to have a van at the D.O.T. RME office for taking people to the test site. We are doing this because we do not want a lot of extra vehicles at the site. Your company may want to provide some extra transportation, for guests, from the RME office or the Holiday Inn to the test site. I think that the van which will be provided by the State will be inadequate for the transportation of guests to and from the test site. You may want to contact Dwight Rorholm in our Central Maintenance Department, 515/239-1589, and ask him how this should be handled.
3. Finally, regarding what class of aggregate you were going to use for Ralumac slurry test strip. You had mentioned possibly using a Minnesota aggregate because of its hardness, but you may want to consider the aggregate from the Fort Dodge area because then the D.O.T. can see the results from using an Iowa aggregate.

RECEIVED
55120
MAY 27 1988
RME
MOA
MMA
SEC

Please call me if I can be of any help and let me know of any possible changes.

Sincerely,

George L. Martens
Resident Maintenance Engineer
FORT DODGE MAINTENANCE RESIDENCY

GLM/ns
Attachment

xc: Leland Smithson, Central Maintenance
Rody Laudencia, District One Maintenance Engineer
Dwight Rorholm, Central Maintenance
George Sisson, Road Design
John C. Hocker, Project Planning
Harold Dowden, Materials Lab, Construction
Bernard C. Brown, Materials Lab, Central Materials

MAY 23 1988

Iowa Department of Transportation

800 Lincoln Way, Ames, IA 50010 515/239-1589

May 17, 1988 Ref. No.: 600

MAY 18 1988

Koch Materials Company
David R. Leach
Sales Manager, Northern Region
Asphalt Division
P.O. Box 921
Dubuque, IA 52001

Dear Mr. Leach:

The Iowa Department of Transportation accepts your firm's offer to place a 24 ft. wide by one-half mile test strip of Ralumac on a section of rutted ACC surface.

As per your proposal:

- Koch Materials Company will supply all materials, equipment, labor, and develop the mix design for the Ralumac test strip. The process will provide for rut fill followed by full width application. All work will be accomplished at no cost to the Department.

  Work will begin June 16, 1988 at approximately 8:00 a.m. weather permitting.

- The Department will provide necessary signing, pilot car, etc., associated with traffic control. The Department may also need to furnish one end loader and operator. These items would be the only cost incurred by the Department.

- Location of test strip: Webster County, U.S. 169, beginning about at the intersection with County Road P-51 north one-half mile.

- We understand you may be inviting representatives from other interested agencies to view the placement of the test strip. Please advise George Martens, Resident Maintenance Engineer (515-955-3766) of the number of people you expect. We will require these individuals to wear hard hats and vests on the project and we need a count to have these items at the site.

All guests should be instructed by you to park at the Iowa Department of Transportation garage and office site. We do not want a string of private vehicles parked on the route. The Department will provide a van for shuttle to the project site.

- The Department will monitor the test strip with respect to performance.

We are looking forward to a successful demonstration project.

Sincerely yours,

Dwight M. Rorholm
Maintenance Operations Engr.

DMR:vs

cc: L. D. Smithson, Maintenance Engineer, Iowa DOT, Ames
R. L. Laudencia, District 1 Maint. Engr., Iowa DOT, Ames

cc: D.R. Leach
~~Bill Mizell~~
Bill Wilkins

Test Strip Fort Dodge, Iowa

Test Strips
Check List Northern

Items shipped or transported personally

Brochures B.M.
VCR Tape B.W.
Slides-Bill Wilkins
Fact Books-Shipped B.M.
Presentation/Demonstration material-Bill Ballou

Koch Handled

Aggregate and Freight
Emulsion and Freight
Cement
Conference Room
- VCR and TV
- Slide projecter and screen
- Lighted Lectern
- Overhead Projector
- Lunch Menu

Invitations to:
- Contractors
- FAA and County Airports
- City and County personell
- Federal personell
- Military

Hats ——— B.M.
Machine Storage

BPS Handled

Peral Additive
Machine and boxes
Crew of 4

State Handled

Stockpile and Stageing area
Water Supply (Truck)
Traffic Control
Front End Loader (Large) w/operat
1/2 ~~mile~~ mile stretch of road with beginning and end marked
State approval of participants viewing the application
Area to test machine the evening prior to the test strip applicati
Broom road surface prior to Ralumac application
~~2 squeegee personell~~
Scrap material truck
Rubber Tired Roller
1 truck driver

Appendix C
Evaluation

IOWA DEPARTMENT OF TRANSPORTATION

TO OFFICE: Materials - Research DATE: July 11, 1988

ATTENTION: Vernon Marks REF. NO.: 436/HR-2041

FROM: Robert Steffes

OFFICE: Materials - Research

SUBJECT: HR-2041, Ralumac, Highway 169 Fort Dodge

An experimental application of Ralumac Micro Surfacing was applied on Highway 169, south of Fort Dodge on June 16, 1988. The materials, equipment and services for the test strip were provided without charge by Koch Materials Company. The test strip is approximately 0.3 mile long between stations 1153+20 and 1167+20, between mileposts 155 and 156.

The original road surface in the test area was quite badly rutted and selected for the micro-surfacing experiment. Rut depths were taken on May 23, 1988 before the Ralumac was applied (see copy attached).

A demonstration of mixing Ralumac was given in a prejob seminar by Koch representatives on June 16, 1988. The mixed materials appeared to have a minimum of water as part of the emulsion. In comparison, the materials placed on the road in the test site appeared to contain an excessive amount of water. The curing of the placed material appeared to be somewhat slower than scheduled and this may have been due to the excessive water in the emulsion.

The last section of rut to be filled was done during late afternoon in the southbound lane, outside wheelpath. Soon after it was filled, the top coat was applied.

A visual inspection on June 17, early morning, showed the new surface to appear satisfactory. A second inspection at noon, after a normal rainfall, showed a deep water erosion rut, ± 50' long up to 6" wide, in the outside wheelpath of the southbound lane near station 1160+00. The erosion rut was filled with a cold mix by the DOT on June 20.

On June 21, representatives of Koch came to repair the rut. They removed the cold mix and refilled the rut with Ralumac. They then put down a new application of the top coat, going to the south end of the test site.

Three 4" cores were drilled from the Ralumac on June 17, 1988, in the northbound lane near station 1160+00. Cores drilled in the southbound lane near station 1156+00 showed the Ralumac to be very tender, not well cured or consolidated and, therefore, the cores eroded and crumbled during drilling.

Skid tests were run on July 1, 1988. The results are attached.

Rut depth measurements were taken on July 5, 1988. The results are attached.

At this early stage of observations on this Ralumac application and test site, it could be concluded that:

1. Tighter control of material proportions may be needed in the field.

2. Excessive water in the emulsion may result in slow curing.

3. Removal of excess water from the rut or rut filling material (first lift) may be essential before a top coat is applied.

4. Rainfall can cause serious damage to the applied material if it has not cured properly.

5. Wheelpath rutting is occurring very early, within days or weeks after application of this Ralumac.

6. Friction values are satisfactory, as of this date.

RFS:kmd
cc: B. C. Brown
D. Rorholm
G. Martens
R. Monroe

Appendix D
Lab Test Report

ABE1-0023
00

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT - ASPHALT CONCRETE CORES
LAB LOCATION - AMES

LAB NO....:ABE1-0023

MATERIAL.....:ASPHALT CORES
PROJECT NO.....:HR-542
COUNTY.....:WEBSTER
UNIT OF MATERIAL:RALUMAC CORES #67, 68, 69, 70 OWP NB DRIVING
SAMPLED BY.....:STEFFES SENDER NO.:ACA1-16
DATE SAMPLED: 06/17/88 DATE RECEIVED: 02/13/91 DATE REPORTED: 03/21/91

			DENSITY	% AIR (HPM)
CORE	67	SURFACE	1.955	23.4
	68	SURFACE	2.056	12.8
	69	SURFACE	2.153	15.6
	70	SURFACE	2.115	16.8

COPIES TO:
CENTRAL LAB C. ANDERSON

DISPOSITION:

.....

SIGNED: ORRIS J. LANE, JR.
TESTING ENGINEER