

***Louisiana Transportation Research
Technical Assistance Report
Report No. 12***

Novachip™ Surface Treatment

**Materials Group
September 1997**

LTRC

Louisiana Transportation Research Center

Sponsored Jointly by the Louisiana Department of Transportation and Development and Louisiana State University

NOVACHIP™ SURFACE TREATMENT

LOUISIANA TRANSPORTATION RESEARCH CENTER
Technical Assistance Report Number 12

State Project 407-04-0034
Theriot Canal Bridge - St. Charles Bridge
Route LA 308
Lafourche Parish

by

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September 1997

Introduction

Novachip™ is a French process utilizing a unique paving machine manufactured in Germany. This machine simultaneously applies an evenly distributed asphaltic emulsion and a thin lift of hot mix to the existing roadway surface. This process has been used in the European community since 1986. Some states have also experimented with Novachip since 1993. In Pennsylvania alone, about 1,000,000 square yards of Novachip were laid between 1995 and 1996 on state, county and city streets. Novachip is represented in the US by Shore Slurry Seal Inc. who provides construction training and technical support on the mix design coordinated through the Screg Route Group of France. Louisiana's first experimental application of the Novachip process is documented herein.

Project Description

The project extends five and a quarter miles on Louisiana Highway 308 parallel to Bayou LaFourche. The project began September 8 and ended September 10, 1997. The highway is 22 feet wide with the paving beginning just north of Raceland. The site was selected for its sound base and moderate to heavy traffic with approximately 5000 ADT. There is seasonal sugar cane farm to market truck traffic that is heaviest in the months of October and November. The existing pavement was a plant mix seal with Tennessee slag aggregate laid by T. L. James in 1978. This surface has performed beyond its expected life. There were areas in this project with up to 250 feet of longitudinal cracks greater than 1/4 inches. There were also some areas of aggregate loss on the old surface. Other sections of the road were patched by maintenance. Beneath the plant mix seal is about 7 inches of hot mix on a sand shell base.

Materials

Emulsion

The emulsion was required to meet minimum Novachip recommendations and DOTD Standards. (See specifications attached). Novachip specifications require that the emulsion be polymer modified cationic emulsion with a set time between three and seven minutes and an application temperature of about 170 degrees Fahrenheit. The Saybolt Furol viscosity limits at 77 degrees Fahrenheit are 20 to 100. To comply with typical DOTD polymer specifications, a minimum force ratio of 0.15 was required on the residue which compares the load at 30 centimeters to the maximum load. Asphalt Products Unlimited supplied the material which was manufactured using Marathon asphalt cement and Ultrapave polymer.

Project notes indicate that the emulsion was placed at the rate of 0.15 gallons per square yard as was recommended by the Novachip representative Jean Claude Roffe

after on-site inspection. This was lower than the contract specified rate of 0.25 +/- 0.05 due to the fact that the aggregate gradation was finer than originally planned. The rate of 0.15 gallons per square yard is much higher than the 0.06 gallons per square yard specified on tack coats between the existing road and a new pavement. For additional reference, a 3/8 inch Chip Seal requires about 0.30 gallons of emulsion per square yard of surface.

The ability of the Novachip paver to apply an evenly distributed tack coat was visually verified in an off site application of tack. The tack coat was distributed evenly across the width of the pavement. While paving, the computerized distributor has fail safe controls based on system pressure that signal any nozzle blockage. This occurred only once on this project. For a visual inspection of the tack coat spread across the roadway, one must look at the pavement just seconds before the mix covers it. It is difficult to see the center nozzles. The computer system must be trusted. At no time was streaking or uncoated roadway observed. The emulsion distributor would stop immediately when the paver came to a stop. The rate of distribution of emulsion is tied into the speed of the drive shaft. No problems were observed with tack material bleeding to the surface due to over application. The Novachip paver used on this project was equipped with a 1000 gallon capacity tank which required refilling every two hours. The refill operation takes about 20 to 25 minutes. This unique method of tack coat application will seal the cracks in the roadway below and will provide a superior bond between this thin lift and the existing roadway.

Asphalt

A PAC40HG was specified and was supplied by EAGLE Asphalt of Donaldsonville Louisiana. The material met the PAC40 specifications including elastic recovery of 65 percent and a force ratio of 0.3. The material also meets the minimum PG76 Superpave requirements on the Dynamic Shear Rheometer as tested on original liquid, See Attached. The PAC40 liquid provided adequate film thickness without draindown at the 5.7 percent design AC content.

Aggregate

Although slag is an acceptable aggregate for this process, a crushed stone approved for use by DOTD. A friction rating of I or II was specified. This friction rating requires British Pendulum polish values of 35. The aggregate source for the siliceous limestone used was Vulcan Materials' Reed Quarry in Gilbertsville Kentucky. This aggregate is listed on the DOTD Qualified Products List with a Friction Rating of II for up to 40,000 ADT. The Los Angeles Abrasion for this source is 20.1 percent and the Soundness is 0.3 percent. The water absorption of the coarse aggregate is 0.3 percent and 1.2 percent for the fine aggregate. The Fine Aggregate Angularity is 46. The gradation specified below were achieved by combining 75 percent No 8 siliceous limestone; (apparent gravity = 2.69) with 25 percent 1/4 x 0 siliceous limestone;(apparent gravity = 2.70).

The mix gradation requirements were changed from those specified in the contract to accommodate the finer stockpile and to fit the road conditions. The change was on the No 10 which originally required 5-18 percent passing. Also, the minimum limits on the No. 4 sieve was tightened from 20 to 35 percent passing.

TABLE 1
 Gradation, %AC, Film Thickness
 JMF vs FIELD

U.S. Sieve	Limits, Percent Passing	JMF	Field
½ inch	100	100	100
3/8 inch	90-100	97	95
1/4 inch	55-75	64	65
No. 4	35-50	43	43
No. 10	15-25	20	25
No. 40	-----	11	12
No. 80	-----	9	9
No. 200	2-8	7.3	7.5
%AC	5.3 Min.	5.7	5.6
Film Thickness, Microns	For Information	11.5	11.0

Antistrip

Liquid antistrip was required per DOTD Standard Specifications to decrease the initial moisture sensitivity of the mixture. The boil test was used in lieu of the Lottman to insure proper aggregate coating in the presence of moisture. Test results indicated that 100 percent coating was maintained where 90 percent is acceptable. ARMAZ Antistrip was used at a rate of 0.6 percent by weight.

Hot Mix

The mix design was submitted through the contractor, T. L. James, to the Novachip representatives. The JMF design is reported in Table 1 and the original copy of the JMF with the gradation plotted on the 45 power curve is in the appendix. The Duriez test on hot bituminous mixtures was utilized in mix design. This test, not used in the

States, compares specimen compacted on the French Gyratory Press 80 mm by 190 mm in dimension. The dry compressive strength and strength of moisture conditioned specimen is obtained. First, the gradation is selected based on traffic level. The design optimum asphalt content is then determined using the Duriez test results.

The delivered aggregate material did not meet the preliminary quarry sample gradations. On-site adjustments had to be made. After mixing the material delivered at the design 6 percent asphalt content and compacting it with 50 blows of the Marshall hammer, it produced only 2 percent voids. The final design asphalt content and gradation was field adjusted based on recommendations by Mr. Roffe, Screg Routes Group, France. The mix percentages were adjusted and the asphalt content changed to 5.7 percent. These changes produced air voids of four to six percent. The design was kept at 5.7 percent AC and maintained for the entire 3000 tons used on the three day project. The AC content from the Troxler AC Content oven revealed a minimum of 5.6 percent asphalt content on all samples tested. A Rice Gravity, Gmm, of 2.464 was used in Table 2. This measurement was taken from laboratory made specimen and this value properly corresponds to the asphalt contents measured by the Troxler asphalt content oven in the field. The field sample for Rice Gravity was placed in gallon cans and later tested at LTRC and measured 2.484. This was 0.02 higher than the Gmm measured from lab made samples. This was attributed to an asphalt rich mastic left on the sides of the cans after oven heating. This problem could indicate a potential problem with draindown. Some trucks did have a very thin coating of material on the truck bottom that had to be hand scraped on the roadside. The draindown test results of 0.1 percent did not predict a problem with draindown. The problem was isolated to less than five percent of the trucks with no discernable difference in mix texture on the roadway.

Film thickness was measured by the surface area method utilizing the extracted gradation. The effective asphalt content was also used in the calculation. The calculated film thickness on this mixture is 11.5 microns. For reference, on thin microsurfacing a minimum of eight microns of residual thickness is recommended and a minimum of seven microns on high traffic roads. Also, seven or eight microns is typical for many hot mix design. The 11.0 micron effective thickness on the in-place mixture should provide excellent coating for extended durability.

Construction

A "small" Novachip paver was used for this 67,000 square yard project. This paver can handle about 100 to 125 tons of mix per hour and can travel at speeds up to 10 miles an hour. The mix is received in a conventional three ton receiving hopper and is double auger fed from the hopper to the front of the paver. The unit is capable of distributing emulsion at rates of 0.1 to 0.28 gallons per square yard.

Four miles were covered on the first day from 7:30 a.m. to 5:00 p.m. Two and a half days were required to complete the project. There were some delays one being the

malfunction of the lift of one of the trucks. No difference in surface texture can be seen between areas covered just before or after any short delay in the paving.

A half inch maximum aggregate size was specified with a plan thickness of about three quarters of an inch. A range in load rate from 48 to 92 lbs per square yard was allowed to provide for grade adjustment. 78 pounds per square yard was the average yield on this project.

SUMMARY OF PLANT MIX TEST RESULTS

Table 2

50 Blow Marshall Plant Made:				
VOLUMETRICS	Test 1	Test 2	Test 3	Average
Gmm	2.464	2.464	2.464	2.464
Gsb	2.346	2.303	2.227	
Voids, %	4.8	6.5	9.4	6.9
VMA, %	17.4	19	21.4	19.3
VFA, %	72.6	65.6	56.2	64.8
Gyratory Test Machine, 100 Psi, 0.8 Machine Angle LTRC				
Gmm	2.464	2.464	2.464	2.464
Gsb	2.262	2.229	2.252	2.248
Voids, %	8.2	9.5	8.6	8.8
VMA, %	20.4	21.6	20.8	20.9
VFA, %	59.8	55.8	58.6	58.1
GSI	0.97	0.96	0.94	0.96

Materials could be transferred directly from the asphalt haul truck to the Novachip paver. The uniform characteristics of the mixture should preclude segregation and the speed that the paver travels would prevent bumps caused truck exchanges. However, the distance from the tailgate on the truck to the back of the trucks rear tire was too short for the paving machine to accept. A Roadtec 2500 MTV currently used on all Hot Mix paving projects was brought in and used successfully on this project. The MTV did facilitate quicker truck exchanges and probably aided in the improved profile index.

Profilograph

Although a smoothness requirement was not specified on this project, a one mile test section was pulled before and after paving to demonstrate the ability to improve ride with a thin lift of hot mix. A before and after profilograph sketch can be found in the appendix. The profile index before was 14 in/mile. The index after Novachip was 2.4 inches per mile, an improvement by a factor of five.

The test section selected was in relatively good condition compared to other sections of the project. It would be interesting to compare the factor of five improvement on this project with that of the single lift of hot mix over cold planed surface.

Friction

The friction number for hot mix using this limestone is typically about 45. The friction properties will be monitored on this project over the next year to compare the friction resistance to our conventional dense graded mixtures.

Costs

The estimate on this contract was \$407,000 for the 5.26 miles of two lane, 11 feet wide road, (approximately 67,889 square yards). The low bid was \$368,688 bringing the total cost to \$5.43 per square yard. The hot mix was bid at \$56 per ton. Removing the miscellaneous items such as striping and signing and looking at only the cost of placing the material brings the cost for Novachip including the hot mix to \$3.60 per square yard. This cost has been reportedly as low \$2.50 per square yard. At \$45 per ton, one and a half inches of Hot Mix will cost \$3.70 per square yard.

Comments

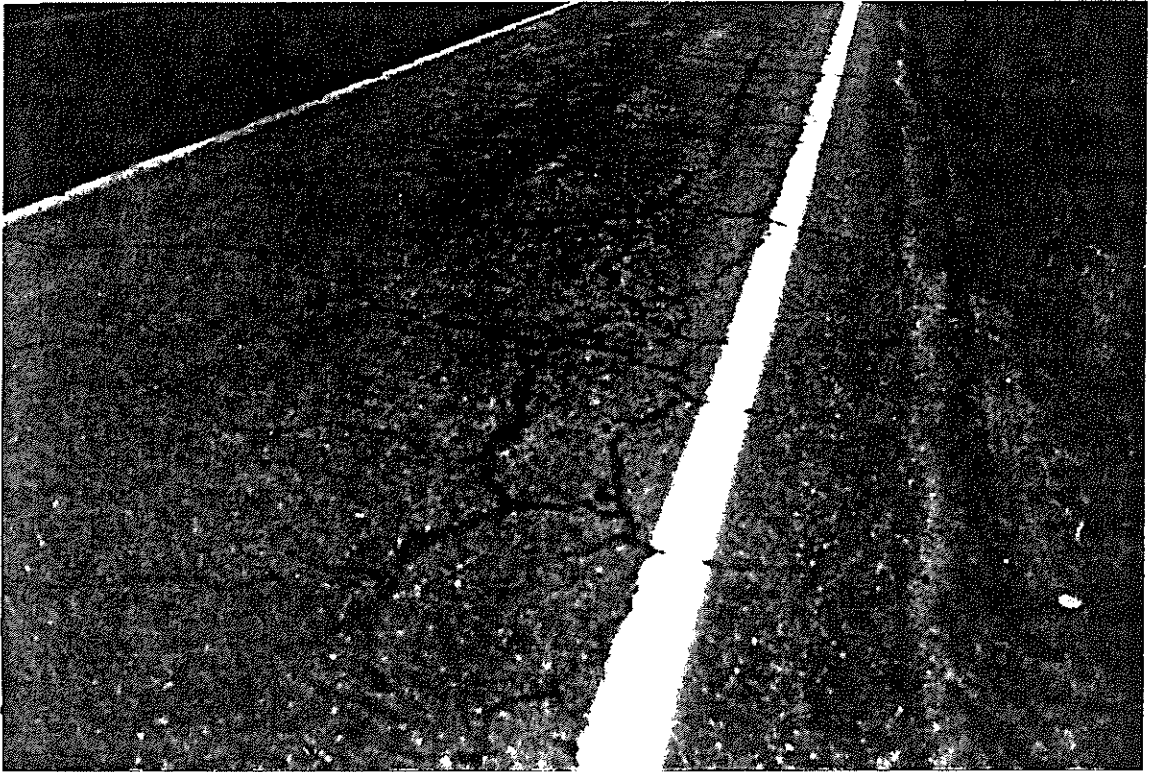
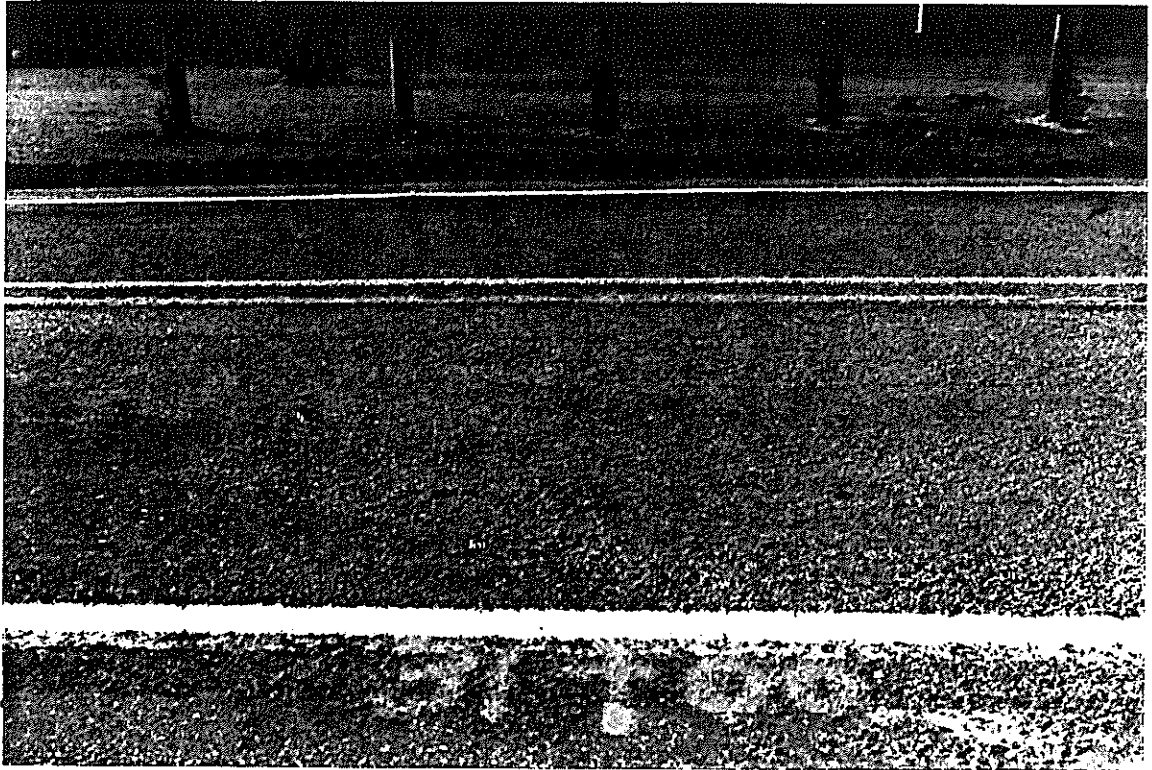
The Novachip process provides a unique and very desirable method for placing a thin lift of hot mix on an existing surface. The heavy application of a tack coat will seal cracks and should provide a greater bond strength for the thin lift. A one year performance evaluation will be performed.

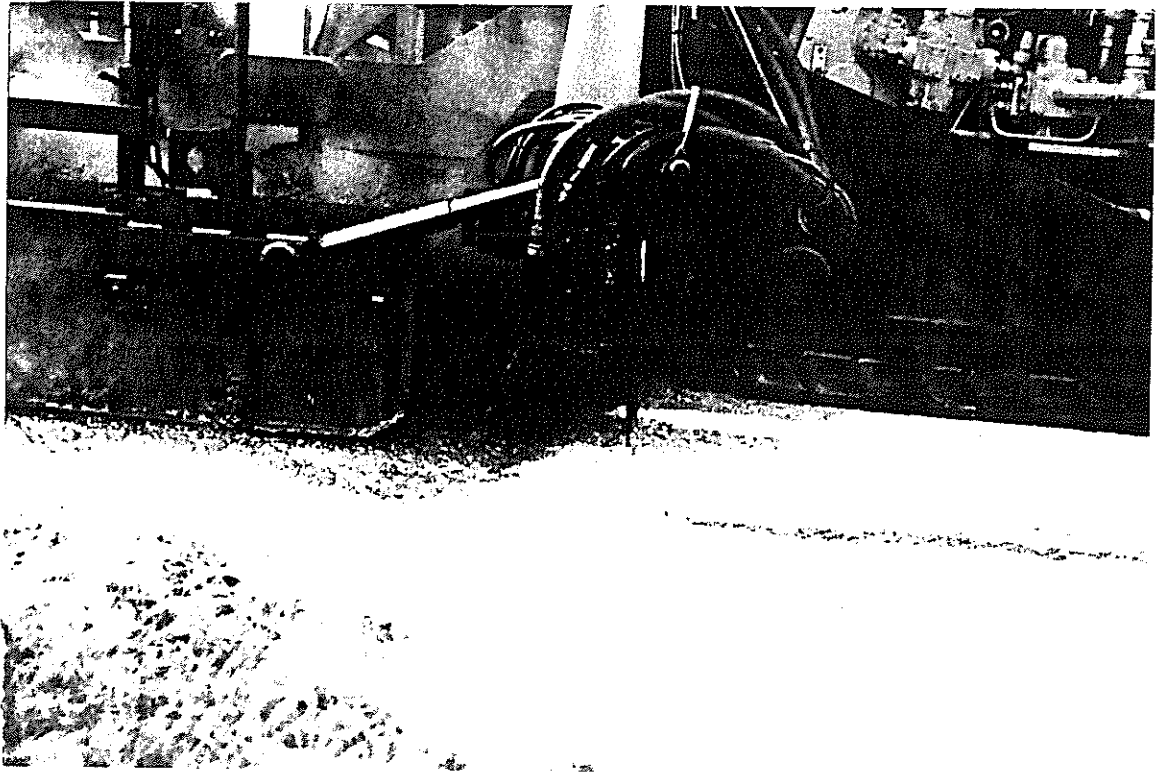
Conclusions

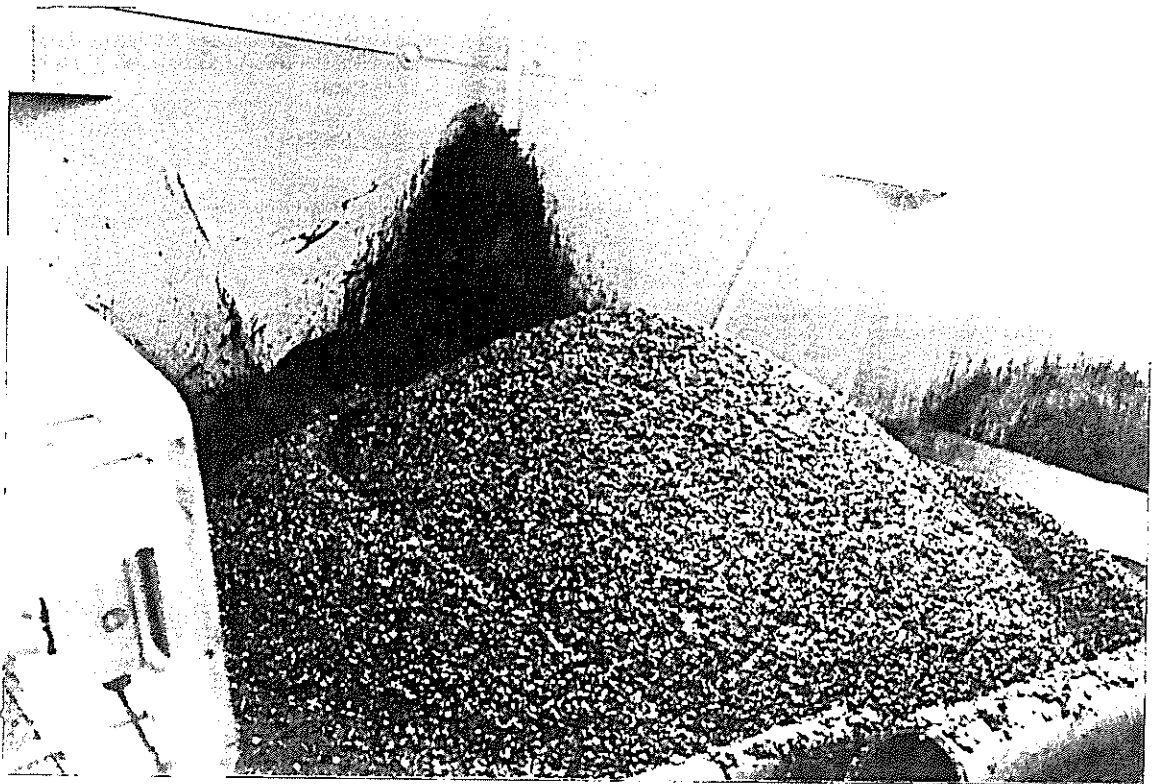
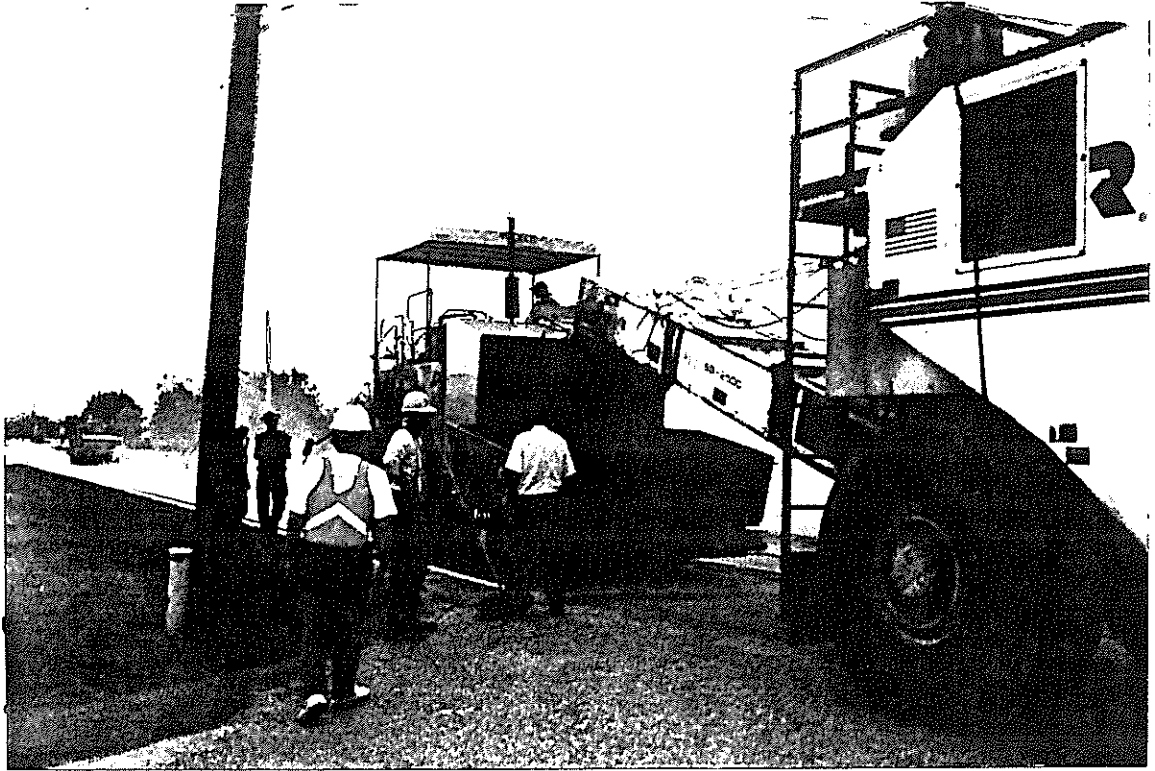
It is recommended that Novachip be considered for further evaluation on the following:

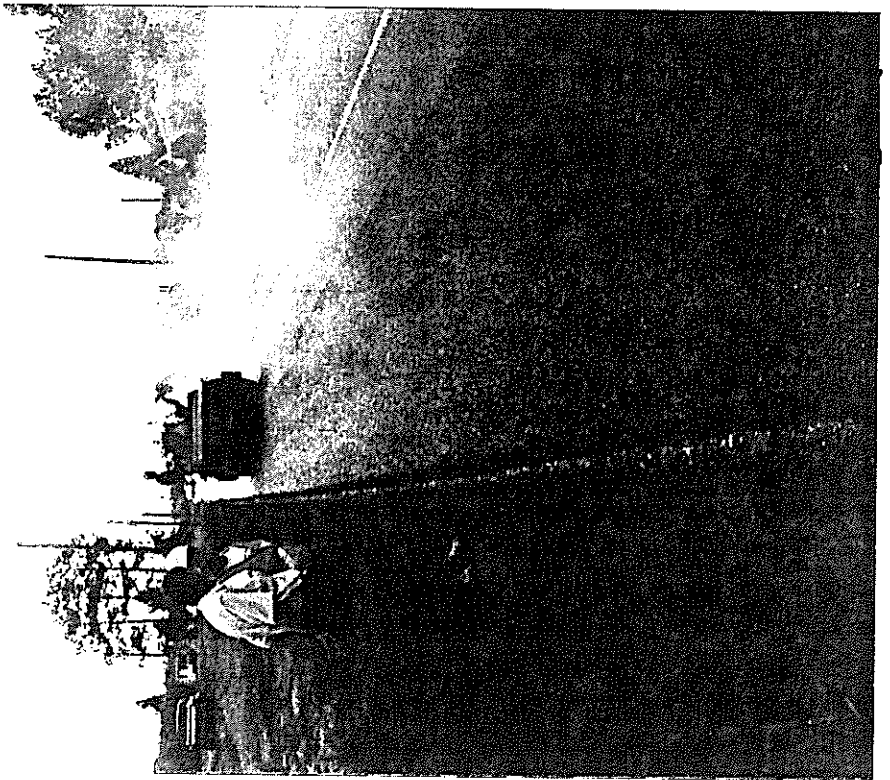
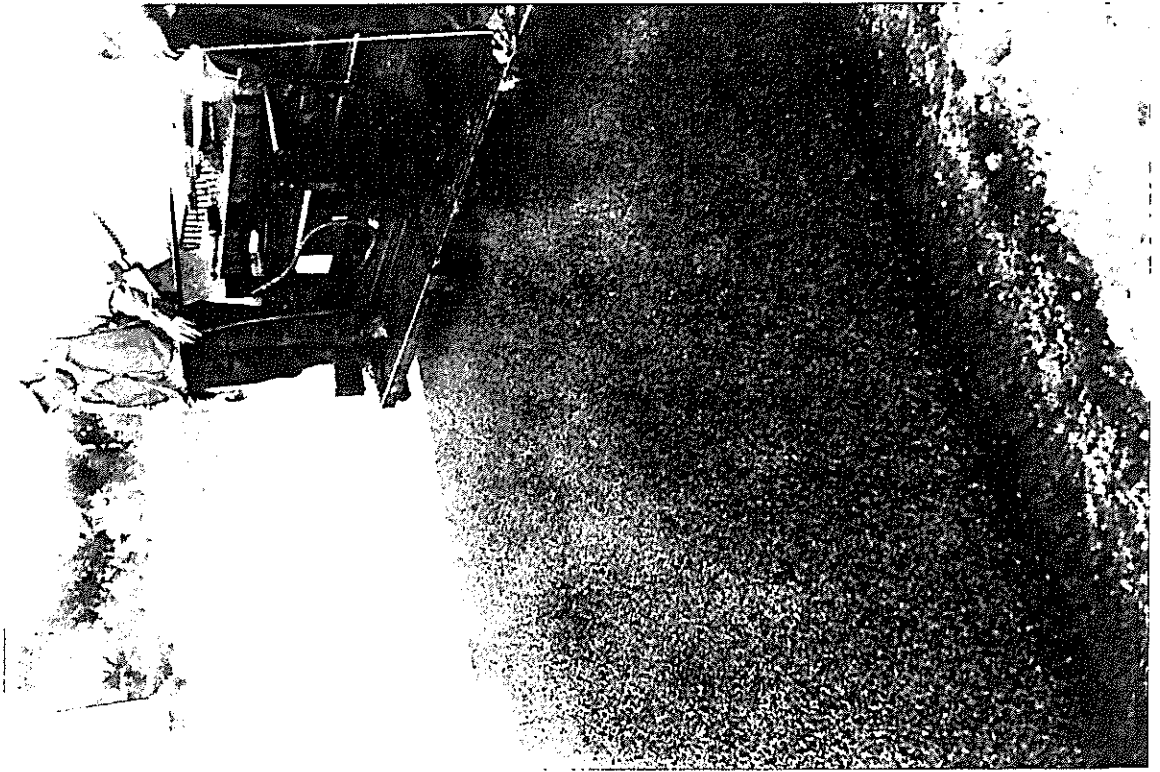
- 1) New construction, eliminating the need for one and a half inches high friction aggregate in the "Wearing Course".
- 2) Resurfacing of concrete pavements with stable joints.
- 3) Surface rehabilitation on any high traffic road.

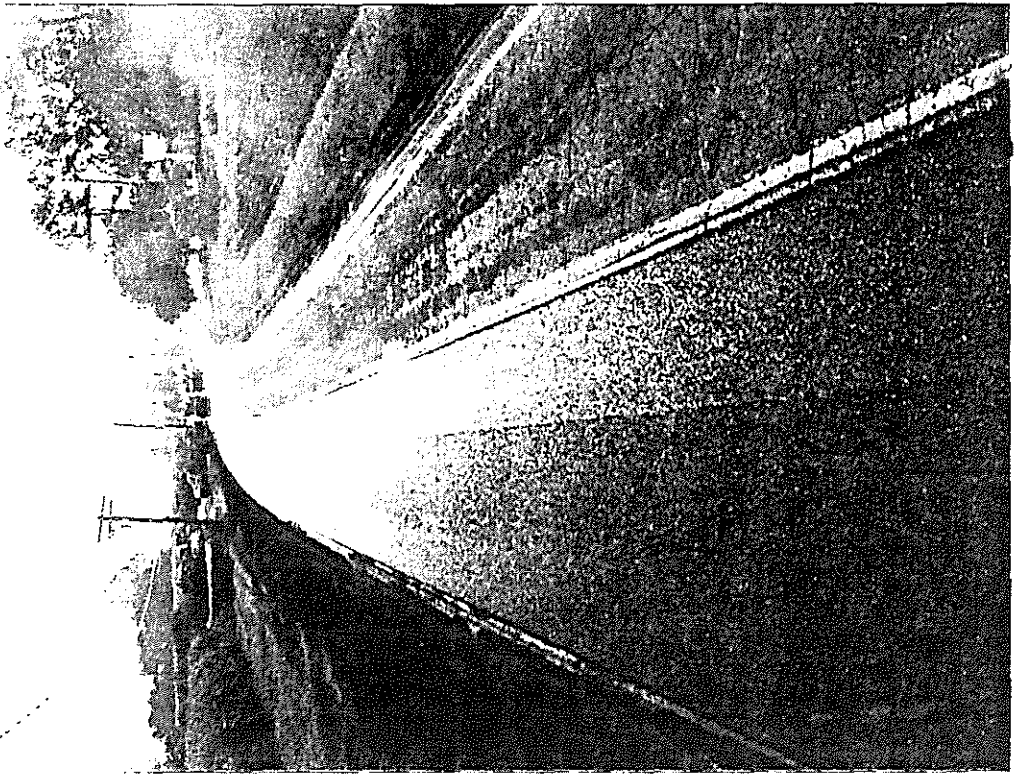
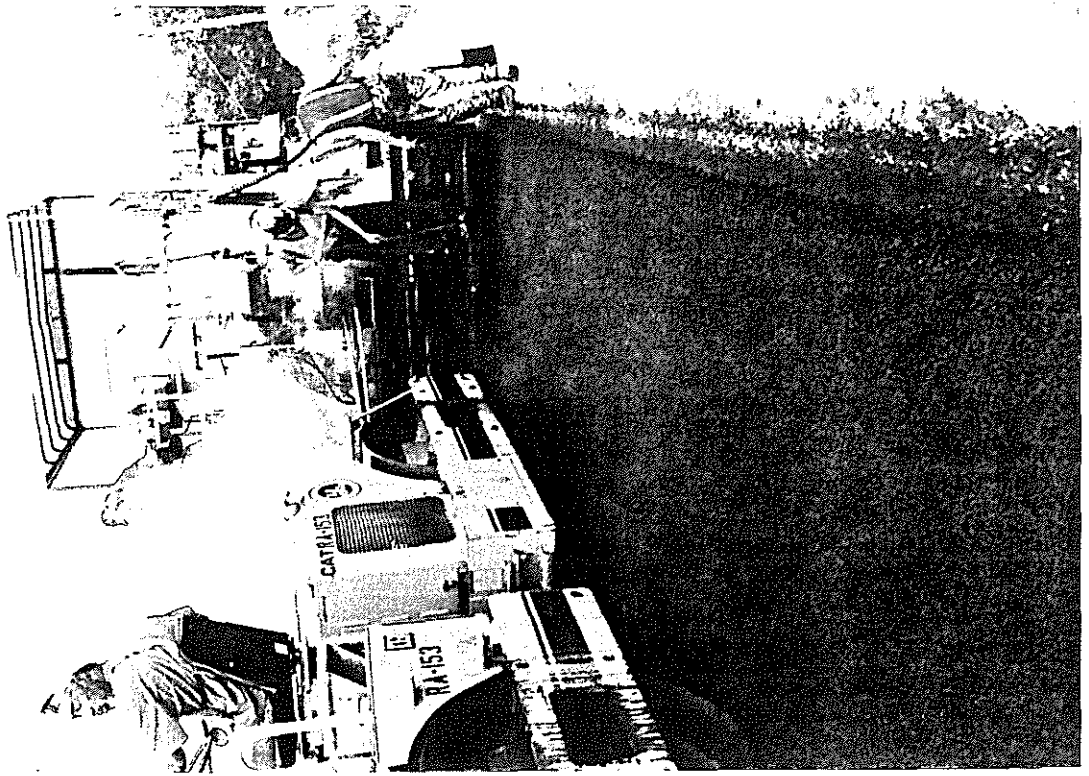
APPENDIX











Louisiana Department of Transportation and Development
ASPHALTIC CONCRETE JOB MIX FORMULA

PROJ. NO. 407-04-0034 JMF NO: PLANT CODE H.216 MIX CODE _____ SEQ. NO. _____
 PLANT TYPE L 1=Batch Screenless 2=Batch Hot Bin
 3=Drum Mixer 4=Continuous ADT/Lane _____ Mixing Time: Dry 0.4 Wet 40
 Production Rate: 800.0 Lb/Batch _____ Tons/Hr _____ F.A.P. No. _____
 Project Contractor P.D. James Project Engineer K. Angeltte

	CODE	SOURCE	PERCENT	SP.GRAV.	FR. RATE
Asphalt Cement (AC)	<u>3.08</u>	<u>DAC-40</u>	<u>4.174</u>	<u>CAGLE</u>	<u>5.07</u>
Crushed Aggregate	<u>4.34</u>	<u>SIL #8</u>	<u>A.A.5.0</u>	<u>Reed stone</u>	<u>7.007</u>
Crushed Aggregate	<u>4.34</u>	<u>1/2" SIL</u>	<u>A.A.5.0</u>	<u>Reed stone</u>	<u>2.306</u>
Screenings	_____	_____	_____	_____	_____
Reclaimed Materials	_____	_____	_____	_____	_____
Coarse Sand	_____	_____	_____	_____	_____
Fine Sand	_____	_____	_____	_____	_____
Anti-Strip (AS)	_____	<u>Adhesive</u>	<u>5.730</u>	<u>DR. MAZ</u>	<u>0.06</u>
Lime	_____	_____	_____	_____	JMF Limits: <u>.5-.7</u>
Other	_____	_____	_____	_____	_____
Other	_____	_____	_____	_____	_____

	Contractor's Results				Department Validation	For INFO ONLY
	Average	842A	842B			
Spec. Gravity	<u>2.335</u>	<u>2.352</u>	<u>2.348</u>	_____	_____	JMF Limits <u>N/A</u>
Theo. Gravity	<u>2.466</u>	<u>2.466</u>	<u>2.466</u>	_____	_____	_____
% Theo. Gravity	<u>94.7</u>	<u>95.3</u>	<u>94.0</u>	_____	_____	_____
% Voids	<u>5.3</u>	<u>4.7</u>	<u>6.0</u>	_____	_____	_____
% VMA	<u>18.3</u>	<u>17.7</u>	<u>16.8</u>	_____	_____	_____
% VFA	<u>71</u>	<u>73</u>	<u>68</u>	_____	_____	_____
Stability, lb	_____	_____	_____	_____	_____	_____
Flow, 1/100 in.	_____	_____	_____	_____	_____	_____

RECOMMENDED FORMULA	LOOSE MIX RESULTS			JMF Limits	DEPARTMENT RESULTS
	1	2	Avg.		
U.S. Sieve					Adjustment Factor _____
2 1/2 inch	_____	_____	_____	_____	Tensile Strength, Control, psi _____
2 inch	_____	_____	_____	_____	Tensile Strength Ratio (TSR), % _____
1 1/2 inch	_____	_____	_____	_____	<u>N/A</u> - (Ball Test - Pass)
1 1/4 inch	_____	_____	_____	_____	Ross Count, % (T 195) _____
1 inch	_____	_____	_____	_____	% Retained Asph. Coating (TR 317) _____
3/4 inch	_____	_____	_____	_____	Effective AC, % <u>N/A</u> _____
1/2 inch	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	Absorbed AC, % _____
3/8 inch	<u>97</u>	<u>95</u>	<u>96</u>	<u>90-100</u>	% Natural Sands _____
No. 1/4"	<u>64</u>	<u>63</u>	<u>64</u>	_____	Sand Equivalent _____
No. 4	<u>43</u>	<u>41</u>	<u>42</u>	<u>35-50</u>	Moisture Content of Mix, % _____
No. 10	<u>20</u>	<u>18</u>	<u>19</u>	<u>15-25</u>	Optimum Mixing Temp. (F) <u>305</u>
No. 30	<u>10</u>	<u>9</u>	<u>10</u>	_____	Optimum Compaction Temp. (F) <u>300</u>
No. 200	<u>7.3</u>	<u>6.7</u>	<u>7.0</u>	<u>2-8</u>	Absorb Recovery (Poisies) _____
% AC Extract	<u>5.7</u>	<u>5.5</u>	<u>5.6</u>	<u>5.3-6.1</u>	
% Crushed	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	
Mix Temp. (F)	<u>330</u>	<u>340</u>	<u>345</u>	<u>305-355</u>	
% AC (Met/Sc)	<u>5.7</u>	<u>5.7</u>	<u>5.7</u>	<u>5.6-5.8</u>	
% AS (Meter)	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.5-.7</u>	

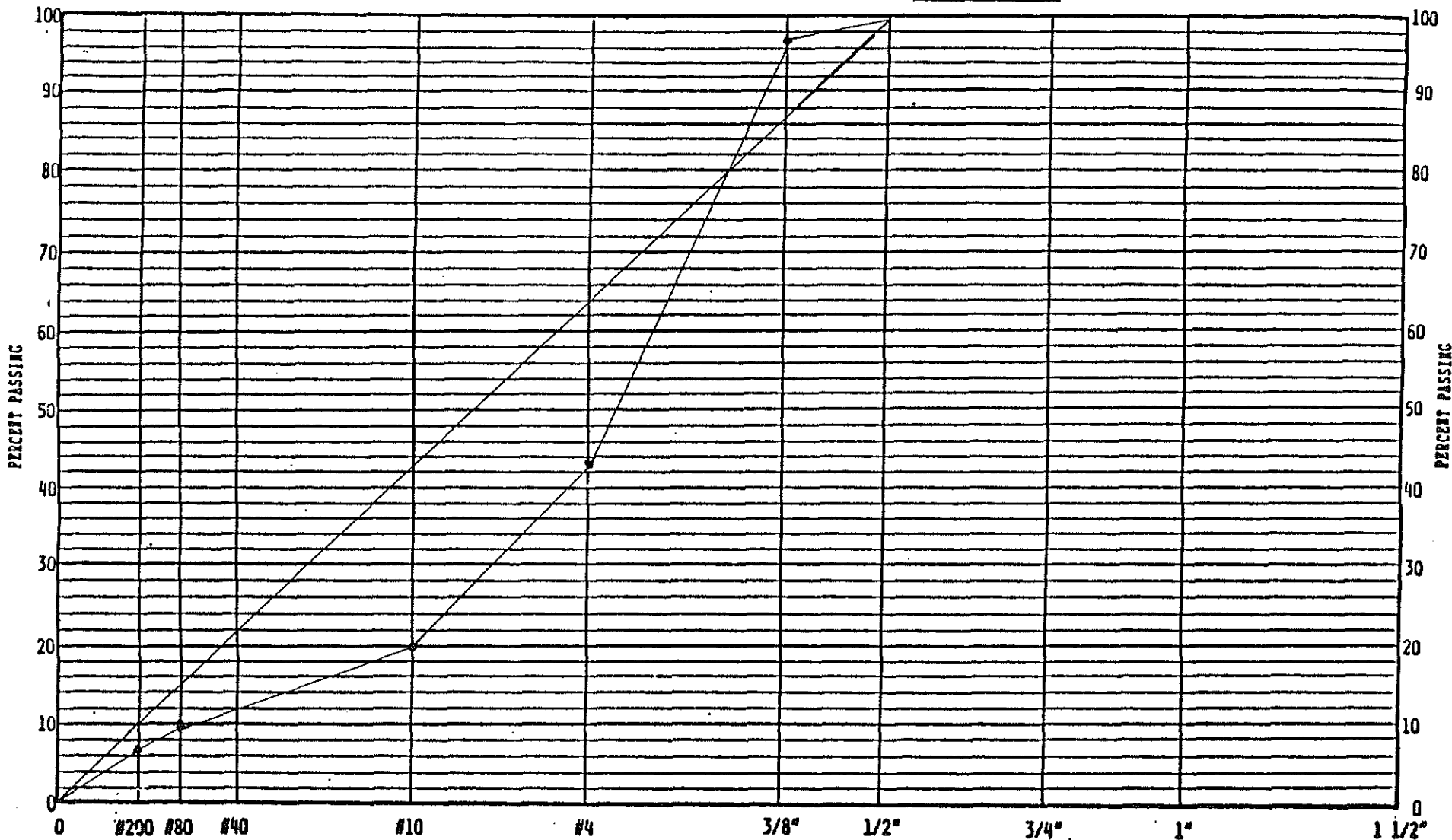
Submitted for the Contractor by: 0.1.2.4. Rodney LeBlanc (J.P.) Date: 0.9.-09.-9.7
 Proposal Approved (Yes No) Lab. Date: _____
 Approved (Yes No) _____ Lab. Engr. _____ Date: _____
 Revised Specs.: _____ Date First Used: _____
 Remarks O.K. for use - LA 308
M.A.R.S. W.A.L.L. T.E.S.T. - F.O.R. I.N.F.O. O.N.L.Y. APPROVED FOR PROJECT BY: _____
 Use _____

Recommended by: Chris Anderson
 CTC

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

ASPHALTIC CONCRETE GRADATION - .45 POWER CURVE

TL James
PLANT CODE H216 MIX TYPE Novachip 75% (#8) 25% (#4 X0) 5.7% PAC40 ; (Vulcan Road Stone)
JOB MIX SEQUENCE NO. _____



Rodney J. [Signature]
CERTIFIED ASPHALTIC CONCRETE TECHNICIAN

9-9-97
DATE

Typical Profilograph Trace

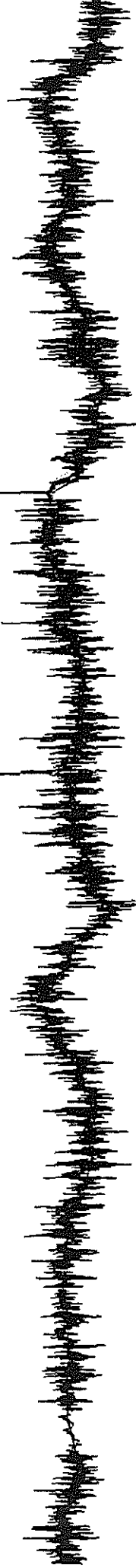
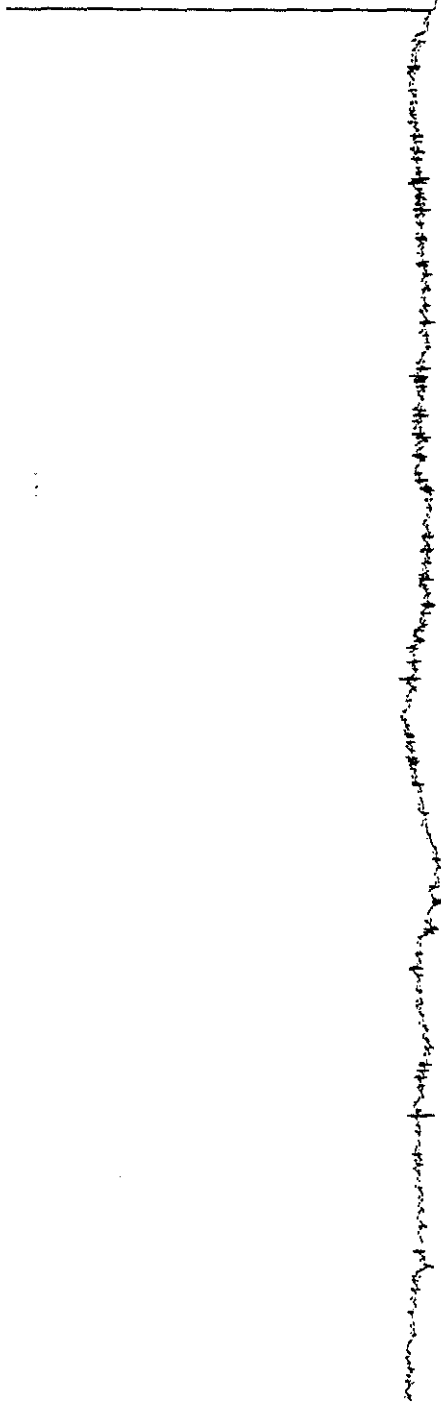
Taken 9-9-97

After Novachip
for 5449ft
= 2.4"/mile

Taken 9-9-97
"Good" Section
Existing Asphalt

Profile Index
for 5439ft
= 14.0 in/m

128700



Film Thickness Of Novachip Surface Treatment Based on Total Surface Area Of The Aggregate Gradation						
Project I.D. / Material						
826-44-26 Lafourche Parish			EAGLE PA			
Screen	S.A.F.	% Passing	100*S.A.	S.A.F.	% Passing	100*S.A.
JMF			Actual	Reed	Black 11's & No 8's	
3/8"	2	97	194	2	95	190
#004	2	43	86	2	43	86
#008	4	21	84	4	26	104
#016	8	16	128	8	16	128
#030	14	13	182	14	13	182
#050	30	11	330	30	12	360
#100	60	8	480	60	9	540
#200	160	7.3	1168	160	7.5	1200
Total Surface Area in Sq. Ft / Lb.			24.58			26
Specific Gravity A.C.			1.03			1.03
Residual Asphalt Extracted			5.7			5.7
0.092903						26
0.092903						
Film Thickness			11.5	<- In Microns ->		11

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND
DEVELOPMENT

CONSTRUCTION CONTRACT



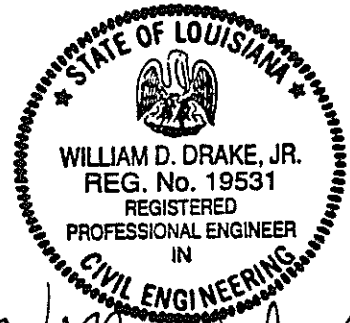
NOVACHIP SURFACE TREATMENT (CM)

STATE PROJECT NO. 407-04-0034

THERIOT CANAL BRIDGE -- ST. CHARLES BRIDGE

ROUTE: LA 308

LAFOURCHE PARISH



William D. Drake, Jr.
6/9/97

NOTICE TO CONTRACTORS

Sealed bids for construction of the following project will be received by the Louisiana Department of Transportation and Development, 1201 Capitol Access Road, Headquarters Administration Building, Room 426, Baton Rouge, Louisiana 70802 until 8:00 a.m. on **WEDNESDAY, MAY 14, 1997**. After 8:00 a.m., bids will be received in the Auditorium until 10:00 a.m., at which time and place bids will be publicly opened and read. No bids will be received after 10:00 a.m. Any person requiring special accommodations shall notify the Department of Transportation and Development at (504) 379-1401 not less than 3 business days before bid opening.

STATE PROJECT NO. 407-04-0034; NOVACHIP SURFACE TREATMENT; THERIOT CANAL BRIDGE – ST. CHARLES BRIDGE; ROUTE LA 308; LAFOURCHE PARISH

PROJECT LIMITS: The project begins at the Theriot Canal Bridge and proceeds Westwardly along LA 308 to the St. Charles Bridge.
LENGTH: 5.26 Miles

WORK TO BE DONE: NOVACHIP SURFACE TREATMENT, TEMPORARY SIGNS AND BARRICADES, TEMPORARY REFLECTORIZED RAISED PAVEMENT MARKINGS, PLASTIC PAVEMENT STRIPING, REMOVAL OF EXISTING MARKERS, AND RELATED WORK.

ESTIMATED COST: \$407,000
PROPOSAL GUARANTY: \$20,000
PROJECT ENGINEER: Keith Angelette
115 Candy Lane
Thibodaux, LA 70301
PHONE: (504) 447-0943

COST OF PROPOSAL FORMS: \$15.00
COST OF PLANS: Included in Proposal

Bids must be submitted on the proposal forms provided by the Department, must be prepared in accordance with Section 102 of the 1992 Louisiana Standard Specifications for Roads and Bridges and must include all information required by the proposal. Each bid shall include a proposal guaranty in an amount not less than specified above.

REVISED April 28, 1997

9/95
Form CS-4A

TOTAL SHEETS =

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PLANS OF PROPOSED

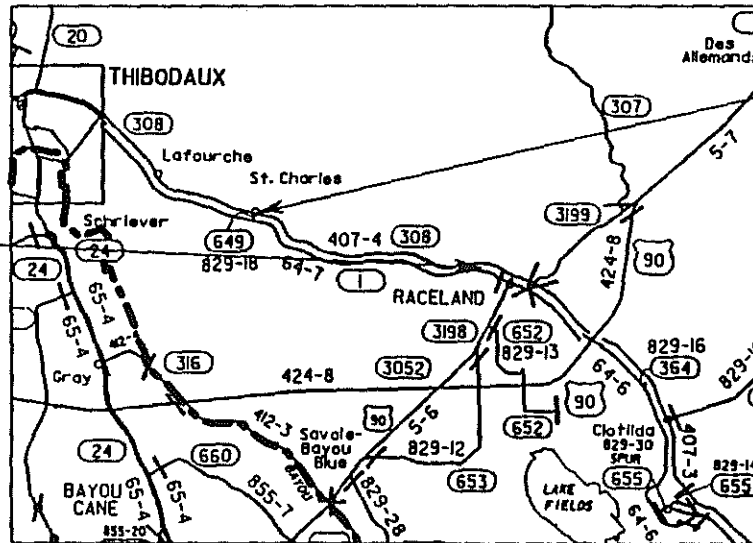
STATE PROJECT	PARISH	SHEET NO.
407-04-0034	LAFOURCHE	I

STANDARD PLANS
TO BE USED IN THIS PROJECT

STD. PLAN	REV. DATE
HS-01	9-14-94
EC-01	1-14-94
PM-03	3-13-84
PM-02	12-7-81
RS-31	6-1-83

STATE HIGHWAY

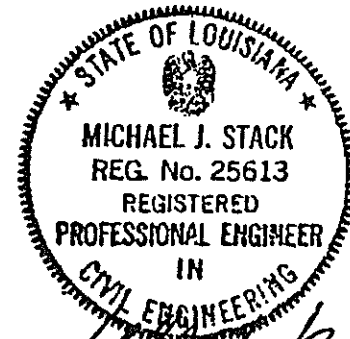
STATE PROJECT NO. 407-04-0034
THERIOT CANAL BRIDGE - ST. CHARLES BRIDGE
LA 308
LAFOURCHE PARISH



C.S. LOG MILE 8.390
END S.P. 407-04-0034

C.S. LOG MILE 3.130
BEG. S.P. 407-04-0034

1996 ADT = 4776



Michael J. Stack 9/18/96

SCHEDULE OF REVISIONS

DATE	REVISION	DATE	RECOMMENDED	DATE	APPROVED

RECOMMENDED FOR APPROVAL

Geneva P. Gille 9/18/96
DISTRICT DESIGN, WATER RESOURCES AND DEVELOPMENT ENGR.

DISTRICT ADMINISTRATOR

NOTE : THE 1992 EDITION OF THE LOUISIANA DOTD
STANDARD SPECIFICATIONS FOR ROADS AND
BRIDGES, AS AMENDED BY THE PROJECT
SPECIFICATIONS, SHALL GOVERN ON THIS PROJECT

APPROVED *[Signature]* DATE 3-25-97
CHIEF ENGINEER

SUMMARY OF ESTIMATED QUANTITIES

STATE PROJECT	PARISH	SHEET NO.
407-04-0034	LAFOURCHE	3

ITEM NO.	ITEM	UNIT	QUANTITIES	
713 (01)	TEMPORARY SIGNS & BARRICADES	LUMP SUM	LUMP	
713 (07)(A)	TEMPORARY REFLECTORIZED RAISED PAVEMENT MARKERS (TABS)	EACH	700	
727 (01)	MOBILIZATION	LUMP SUM	LUMP	
731(02)	REFLECTORIZED RAISED PAVEMENT MARKERS	EACH	700	
732 (02) (A)	PLASTIC PAVEMENT STRIPING (SOLID LINE) (4" WIDTH)	MILE	19.040	
732 (03) (A)	PLASTIC PAVEMENT STRIPING (BROKEN LINE) (4" WIDTH)	MILE	2.840	
S-001	NOVACHIP SURFACE TREATMENT	SQ. YD.	67889	
S-002	PLANT MIX OPEN GRADED FRICTION COURSE	TON	3120	
S-003	REMOVAL OF EXISTING MARKERS	LUMP SUM	LUMP	

P-3

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SCHEDULE OF ITEMS

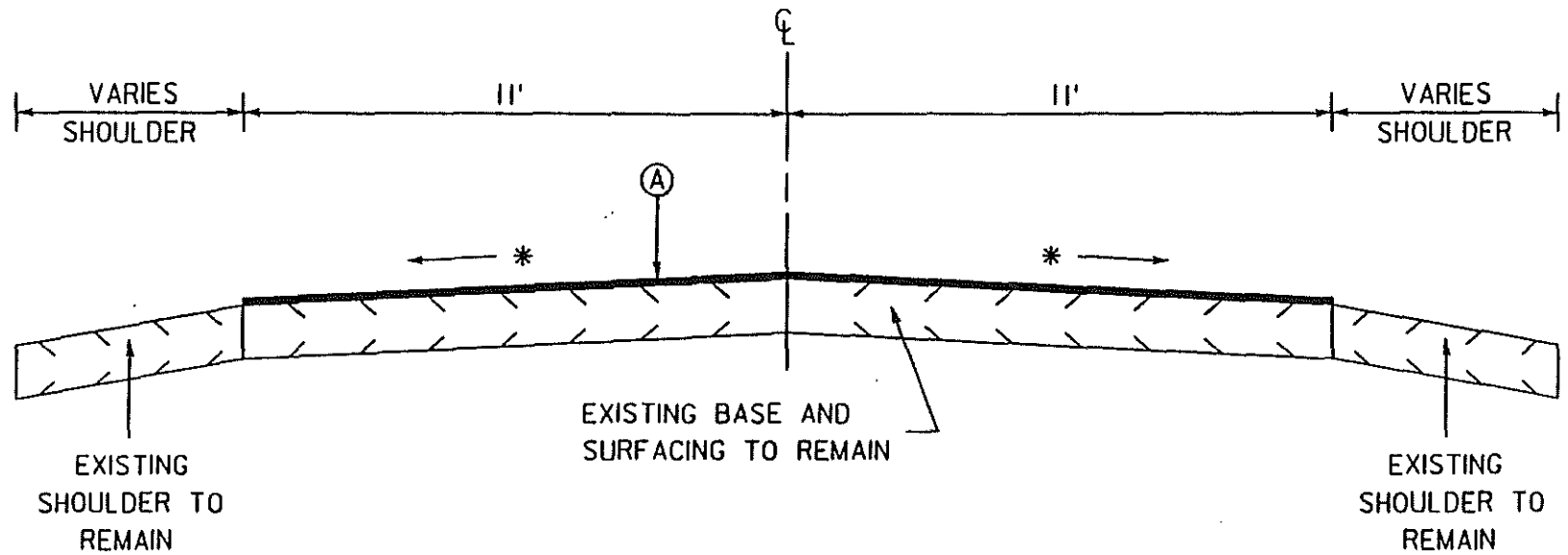
LEAD PROJECT: 407-04-0034
OTHER PROJECTS:

DATE: 05/20/97 09:54 PAGE: 2

ITEM NUMBER	APPROXIMATE QUANTITY	UNIT OF MEASURE	PAY ITEM UNIT PRICE (IN WORDS, INK OR TYPED)	AMOUNT
S-001	67,889	SQUARE YARD	NOVACHIP SURFACE TREATMENT ONE _____ DOLLARS SIXTY _____ CENTS	\$108,622.40
S-002	3,120	TON	PLANT MIX OPEN GRADED FRICTION COURSE FIFTY-FOUR _____ DOLLARS NO _____ CENTS	\$168,480.00
S-003	LUMP	LUMP SUM	REMOVAL OF EXISTING MARKERS FIVE THOUSAND _____ DOLLARS NO _____ CENTS	\$5,000.00

B-2

STATE PROJECT	PARISH	SHEET NO.
407-04-0034	LAFOURCHE	2



F-2

TYPICAL FINISHED SECTION

TO APPLY: C.S. LOG MILE 3.130 TO C.S. LOG MILE 8.390

Ⓐ REQ'D. $\frac{3}{4}$ " AVG. PLANT MIX OPEN GRADED FRICTION COURSE AND SEAL COAT (NOVACHIP SURFACE TREATMENT) (ITEM S-001 & S-002)

* MATCH EXISTING SLOPE.

**STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS**

**ITEMS S-001 AND S-002, NOVACHIP™ SURFACE TREATMENT AND PLANT MIX
OPEN GRADED FRICTION COURSE**

1. DESCRIPTION

The Novachip™ system shall consist of a warm polymer modified asphalt emulsion seal sprayed immediately preceding the application of open graded friction course, OGFC, approximately 1/2" or 3/4" thick, not to exceed 1 1/2" with the 1/2" aggregate design. This process shall form a homogeneous well textured and durable wearing surface that can be opened to traffic immediately on cooling. This system shall be laid in one pass by a single machine in accordance with the 1992 Standard Specifications or as provided herein.

*Novachip™ is a patented process including special equipment
for information contact:
Terry Crouthamel
Shore Slurry Seal, Inc.
P. O. Box H
Coplay, PA 18037

2. EQUIPMENT

The specially designed machine shall be capable of completing the three operations of spraying the heated emulsion, applying the plant mix OGFC and providing the initial compaction of the mix in one operation. The machine shall be capable of applying 3/4 Novachip™ at up to 80 ft per minute. The actual application speed shall be not less than 30 ft per minute.

3. MATERIALS

The contractor shall keep accurate records, including proof of deliveries of all materials used in this process including but not limited to emulsion, aggregate, modified asphalt, and fillers.

REVISED April 28, 1997

**STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS**

A. SEAL COAT EMULSION

The emulsion shall be an Emulsified Polymerized Asphalt specification meeting the following specification:

TEST	METHOD	MIN	MAX
Polymer Content		3.0	
Total Residue by Evaporation @200C, %	ASTMD 244	65	
Viscosity @ 25C, (75F)SSF	AASHTO T 59	20	100
PARTICLE CHARGE	DOTD TR 311	POS	
Sieve Test, % Mass, (830 um)	ASTM D 244		0.10
Demulsibility, 0.8% sodium dioctylsulfosudonate 35 ml, %	ASTM D 244	40	
Setting Time, minutes		3	7
SETTLEMENT, 1DAY, %	AASHSTO T59		↑
TEST ON RESIDUE:			
Percent Residual, Min.		65	
Force Ductility Ratio, F2/F1, 4 deg c, 5 cm/min., Max. Force = F1, F2 =force @ 30 cm elongation	DOTD TR 324		← (0.15)

B. OPEN GRADED FRICTION COURSE

1) **ASPHALT CEMENT:** The Asphalt Cement shall be from a source listed on QPL 41 and shall meet PAC40-HG specifications.

$$\frac{F_2}{F_1} = 0.15$$

$$F_2 = 1.5$$

@ 30

**STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS**

2) **AGGREGATE:** The aggregate selected for use on this project shall be presubmitted for approval to the NOVACHIP™ representative, Shore Slurry Systems, Inc., P.O. Box H, Coplay, PA 18037, Attention: Mr. Terry Crouthamel, Sr. The approved aggregate must be from QPL 2 shall be either Class I or Class II crushed stone meeting the following gradation:

U. S. Sieve	% Passing	Sieve Tolerances
1/2"	100	---
3/8"	90-100	+/- 7%
No. 4	35 20-50	+/- 7%
No. 10	15 1-18 25	+/- 5%
No. 200	2-8	-----

3) **MINERAL FILLER:** Hydrated Lime or Baghouse fines may be utilized and must meet the following gradation:

- 100% passing the 100 sieve
- A Min. of 80% passing the 200 sieve.

4) **ADDITIVES:** Anti-Stripping additives shall be used and shall be from Qualified Products List 57. Silicone additives may be used and shall be listed from the Qualified Products List 22.

C. MIX DESIGN:

The contractor shall submit a job mix formula for the mixture to be supplied for the project. The formula shall specify an aggregate gradation within the working range of this specification. The formula shall consist of aggregate, additive and asphalt proportions, proposed gradations, and mix temperatures. Anti-strip shall be required at a minimum rate of 0.5% by weight of asphalt and shall be used at a rate which is 0.1% greater that which produces 90 percent coating when tested in accordance with DOTD TR-317, (Boil Test). The formula shall be submitted to and approved by the NOVACHIP™ representative, Shore Slurry Systems, Inc., P. O. Box H, Coplay PA 18037, Attention Mr. Terry Crouthamen, Sr. , a minimum of 30 days prior to construction. LA DOTD District Lab Engineer shall review and approve the design confirming aggregate gradation and material source approvals.

Revised April 22, 1997

**STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS**

4. SURFACE PREPARATION

The surface shall be swept clean of dust, dirt, caked clay, and loose foreign material such as waste sugar cane.

Extended thermoplastic markings shall be removed.

Any vegetable matter at the road edge shall be cut back.

Novachip™ shall be laid on a dry or damp, but not wet, surface (No free water). The pavement temperature shall be not less than 50 deg F and rising.

A Novachip™ representative and the Project Engineer shall approve the surface preparation prior to start of operation.

5. SPRAYING AND LAYING NOVACHIP™

The seal coat shall be sprayed by a metered mechanical pressure sprayer. The sprayer shall accurately and continuously monitor the rate of spray and this shall be uniform across the whole width.

The rate of spray, unless otherwise required to counteract porosity of the existing road, shall be ~~0.25~~^{0.20} US gal/yd² ± 0.05 US gal./yd². The emulsion shall be applied at a temperature of 140 deg F - 180 deg F.

No wheel or other part of a machine shall come into contact with the seal coat before the OGFC is applied.

The OGFC shall be delivered at a temperature of 315 deg F ± 15 deg F and spread to the thickness required on the plans within 3 seconds of the seal coat being sprayed. The application rate of the mix OGFC will vary from 55 to 85 lb/sq yd. depending on the aggregate source used to meet the design thickness between ½" and ¾" not to exceed 1 ½".

The OGFC shall be smoothed over the full laid width using a heated screed to ensure an even mat.

The asphalt mix plant shall produce sufficient quantity of material prior to starting the paving unit and shall provide a continuous supply of material once the operation has begun to prevent any stopping and starting of the paving train.

Compaction of the wearing course shall be carried out using a minimum of 3 passes of a double drum roller of sufficient weight to properly seat the aggregate without crushing it. All compaction shall take place before the material temperature has fallen below 180 deg F. Because of the speed of the Novachip™ machine, two double drum rollers are required.

**STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS**

6. OPENING TO TRAFFIC

After laying, the road may be opened to traffic when rolling is complete and at a distance of about 300 ft. to 500 ft. The contractor shall continuously inspect the fresh mat open to traffic for wheel damage and make necessary repairs and adjustments to his process.

7. TESTING AND QUALITY CONTROL

At the end of each working day a quantity check shall be made of the seal coat emulsion material. The total mass of material shall be divided by the total area sprayed. One representative sample of emulsion shall be taken per day for verification testing.

The OGFC spread rate shall be calculated by dividing the tonnage laid (from weigh tickets) by the area covered. Samples of the plain mix OGFC shall be taken at a rate of 1 per 500 tons, or a maximum of 4 per day and tested for aggregate grading and asphalt content. The plant mix OGFC shall be tested for moisture content every morning and shall not exceed 0.5%. If the moisture content is found to exceed 0.5%, subsequent roadway production shall cease until such time that the contractor can prove compliance.

The aggregate shall be stored in a well drained dedicated stockpile and shall be tested for water absorption, apparent specific gravity, and gradation prior to paving. This information must be made available to the Project Engineer prior to Job Mix Approval.

8. PAY ADJUSTMENT SCHEDULES

Dev. from JMF Limits on extracted aggregate & AC.	95% Pay	90% Pay	50% or Remove
No. 4 Sieve	1.1 - 1.4	4.1 - 8.0	Over 8
No. 10 Sieve	1.1 - 3.0	3.1 - 6.0	Over 6
No. 200 Sieve	0.6 - 1.0	1.1 - 3.0	Over 3.0
Asphalt Content	0.3 - 0.5, 4	0.6 - 1.0	Over 1.0
Yield of OGFC (calculated from truck weigh tickets), lbs/sq yd			
Negative Dev. from Design application rate. lbs/sq yd	7 - 12	12 - 17	Over 15

STATE PROJECT NO. 407-04-0034
SPECIAL PROVISIONS

-MEASUREMENT: Item S-001 includes all equipment and labor required to apply the seal coat, spread and compact the OGFC, and shall be measured by the square yard placed and shall be reported twice a day by the contractor and presented to the project engineer for permanent record.

Item S-002 includes the required quantity of OGFC material per ton in place

PAYMENT: Payment will be made in accordance with.

Item S-001 NOVACHIP SURFACE TREATMENT, per sq.yd.

Item S-002 PLANT MIX OPEN GRADED FRICTION COURSE, per Ton

ITEM S-003 REMOVAL OF EXISTING MARKERS: This item consists of the removal of existing raised pavement markers in accordance with Section 732 and as directed.

Payment will be made at the contract unit price per lump sum under:

ITEM S-003 REMOVAL OF EXISTING MARKERS, per lump sum

CONTRACT TIME (1/83): The entire contract shall be completed in all details and ready for final acceptance within **FORTY-FIVE (45)** working days.

Prior to assessment of working days, the contractor will be allowed 45 calendar days from the date stipulated in the Notice to Proceed to assemble materials, plants and equipment necessary for the construction of this project. It will be the contractor's responsibility, from the beginning of the assembly period, to maintain traffic and provide temporary signs and barricades in accordance with the project specifications.

When approved, the contractor will be allowed to do patching and other maintenance work necessary to maintain the roadway during the assembly period with no time charges.

If the contractor begins regular construction operations prior to expiration of the 45-day assembly period, the assessment of working days will commence at the time construction operations are begun.

REVISED April 28, 1997

ITEM S-001 "MORNING" SURFACE "TREATMENT" SQUARE YARD

DATE	STA	STA	WIDTH	S.Y.	RT
9-9-97	0100	235+85	11.5'	30,136.38	RT
9-10-97	235+85	276+08	11.5'	5,140.50	RT
9-10-97	276+08	79+50	10.5'	22,934.33	LT
9-11-97	79+50	0+00	10.5'	9,215.60	LT
		GRAND TOTAL		67,486.2	S.Y.

PAID 67,486.2 S.Y. BRN No. 2

APK

DATE	STA.	STA.	WIDTH	TONS	ACQUIM TONS	LOT NO.	TMP SEA	REMARKS	URS /SY	INSP.
9-9-97	0+00	235+85	11.5	1150.090	1150.090	842		Rt R	76.3	[Signature]
9-10-97	235+85	276+08	11.5	214.640	1364.780	842		Rt R	83.5	[Signature]
9-10-97	276+08	296+30	10.5	156.220	1522.980	842		Rt R	68.2	[Signature]
9-10-97	296+30	79+50	10.5	689.200	2212.180	843		Lt R	75.3	[Signature]
9-11-97	79+50	0+100	10.5	396.910	2611.090	843		Lt R	86.0	[Signature]
						PAID 2611.090		TONS.	EST No. 2	[Signature]

ITEM \$-002 "RAHT MIX OPEN" GRADED FRICTION COURSE "TAN" 12

NOVA CHIP
EMULSIFIED ASPHALT: ASPHALT PRODUCTS INC
DATE:9-23-97
TESTED BY:WILLIE G

PERCENT LOSS 35%

PEN @ 77 ° F		SPEC
1	105	
2	102	
3	105	
AVG	104	
force/ratio@4C		
1	0.31	0.15
2	0.17	
AVG	0.24	