State Study No. 209

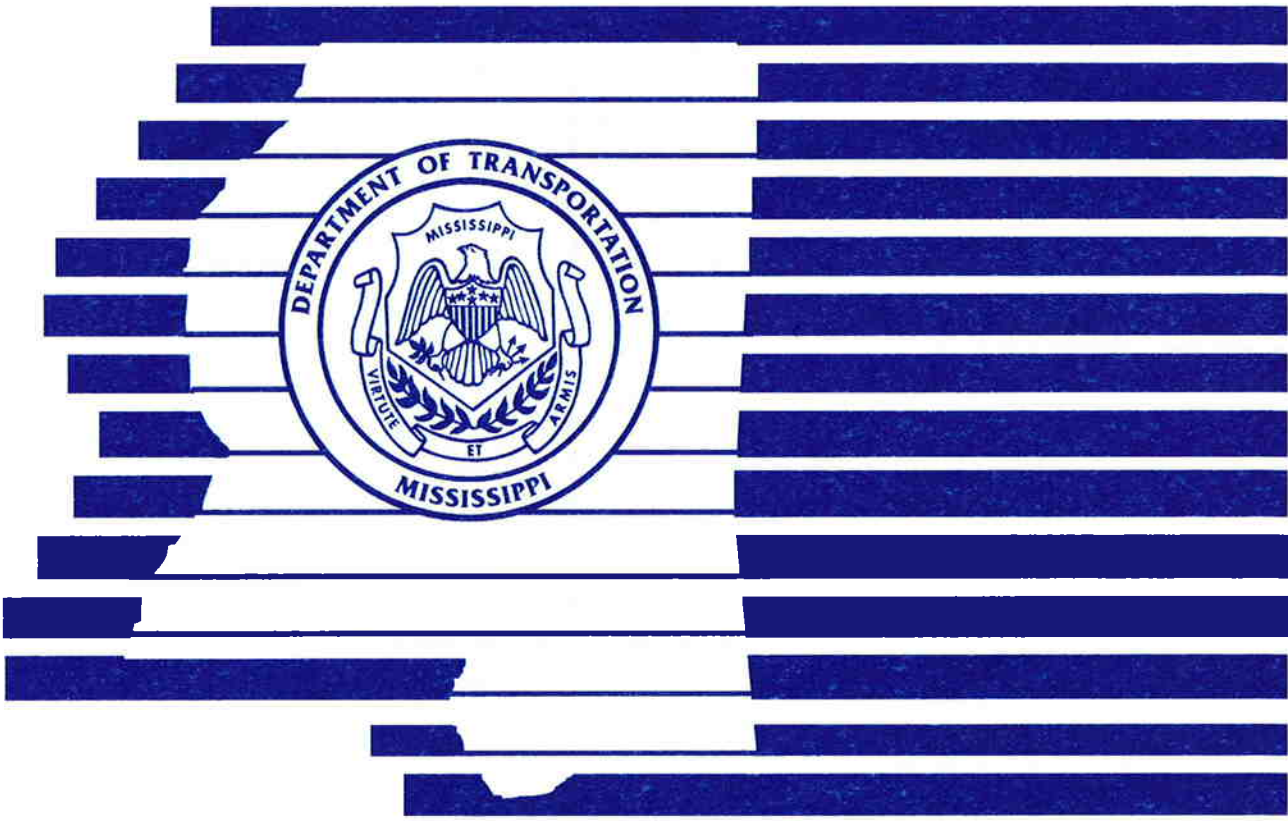
Final Report

Support to Red Hills Fly Ash Experimental Feature

FHWA/MS-DOT-RD-10-209

January 2010

RESEARCH DIVISION



In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

State Study No. 209

Support to Red Hills Fly Ash Experimental Feature

Prepared by:

Jordan S. Whittington, P.E.

January 2010

Conducted by:

Research Division
Mississippi Department of Transportation

In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

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16. Abstract

The Red Hills Plant near Ackerman, Mississippi produces a fly ash that does not meet the ASTM specification for either Class C or F fly ash; however, this material has been successfully used by a local consultant to stabilize embankment material. The purpose of this study is to evaluate this fly ash in a lime-fly ash (LFA) stabilized subgrade application for MDOT road construction. The MDOT Central Laboratory will evaluate a LFA mix design using the Red Hills fly ash for application in a field test section.

Based on the results of this study, it is recommended that Red-Hills fly ash be approved for use on MDOT projects. MDOT Materials Division is in agreement with this recommendation and has issued a letter to the products supplier approving their product for use.

17. Key Words	18. Distribution Statement
Lime, Fly Ash, Soil Cement, Subgrade Stabilizaton	Unclassified

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	65	

Form DOT F 1700.7 (8-72)

NOTICE

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The United States Government and the State of Mississippi do not endorse products or manufacturers. Trade or manufacturer's names appear herein solely because they are considered essential to the object of this report.

ACKNOWLEDGMENTS

The study reported herein was conducted by the Mississippi Department of Transportation (MDOT) under the sponsorship of the Federal Highway Administration, Mississippi Division Office. This work was accomplished under the supervision of Mr. James Watkins, State Research Engineer. This report was prepared by Mr. Jordan S. Whittington of the MDOT Research Division.

The author wishes to express his appreciation to the many people whose efforts contributed to the success of this study. Acknowledgment is made to Messrs. William Barstis, Jeffrey Wages, Gary Browning, Demarco Harris, Derrick Noel, and Randy Dixon who assisted with construction, documentation, and data collection. Appreciation is also expressed to the personnel of MDOT District Six, Waynesboro Project Office and the MDOT Central Materials Lab who were most supportive and instrumental in the construction and testing for this research study. Additional acknowledgment is made to the personnel of Tanner Construction for their work in constructing the test sections.

During the period of this study, the Executive Director of MDOT was Mr. Mr. Larry "Butch" Brown and the Deputy Executive Director / Chief Engineer was Mrs. Melinda McGrath.

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LIST OF FIGURES AND TABLES

Background and Scope

The Red Hills Power Plant near Ackerman, Mississippi, produces a fly ash that does not meet the ASTM specification for either Class C or F fly ash; however, this material has been successfully used by a local consultant to stabilize embankment material. The purpose of this study is to evaluate this fly ash for use in a stabilized subgrade road construction application for the Mississippi Department of Transportation (MDOT). The MDOT Central Materials Laboratory will evaluate a Lime-Fly Ash (LFA) mix design using Red Hills fly ash for application in a field test section.

It has been previously noted that Red Hills fly ash demonstrates some self cementing properties. With this in mind, MDOT's Central Materials Laboratory will evaluate a design using only Red Hills fly ash mixed with the subgrade soil to determine if it alone can provide sufficient strength development for use in a stabilized subgrade application. Pending these test results, a field test section may also be constructed with only the addition of Red Hills fly ash.

A minimum of ten 4-inch diameter Standard Proctor samples of field mixed material will be fabricated from field test sections as well as a field control test section. All Proctor samples will be transported to the Central Materials Laboratory in their Proctor mold. The samples will be extruded and cured under LFA mix design conditions. The samples will then be tested per the LFA mix design protocol. Analyses of these test results will allow evaluation of the Red Hills fly ash for use in MDOT stabilized soil applications as well as indicate the in-situ variability of this material in the road bed.

Preliminary Laboratory Tests

Preliminary laboratory testing was performed using jobsite materials to generate mix designs that will provide adequate strength for subgrade stabilization. Three types of mix designs were considered. Those designs were:

1. Portland cement mix
2. Red Hills fly ash only mix
3. Lime and Red Hills fly ash mix

Soil-cement stabilization was selected by the contractor as the primary method of treatment for the subgrade on this project. That selection established that the control section for this study would be a Portland cement treated application. MDOT's Central Lab evaluated soil-cement mixes at 5%, 6%, and 7% by volume. The proposed design for the control test section was 7% cement by volume with 7 days of curing. This design provided a compressive strength of 200 psi at 7 days. Information regarding the soil-cement mix design is provided in Appendix A.

A special provision was prepared to help detail the design and construction of the Red Hills fly ash research test sections. For the initial design, it was determined that the Lime-Red Hills fly ash must have a 28-day compressive strength of 400 psi and the Red Hills fly ash only section must have a 28-day compressive strength of 300 psi. A copy of this special provision is provided in Appendix B.

A Red Hills fly ash only mix design was evaluated due to the ash having self cementing properties. MDOT's Central Lab evaluated mixes with 16%, 18%, and 20% Red Hills fly ash by volume. None of these mixes provided adequate compressive strength with 28-day strength values of 152 psi, 167 psi, and 180 psi respectively. These strengths were well below the 300 psi minimum required by this project's special provision. Due to these results, no field test section was constructed with only Red Hills fly ash for stabilization.

The final design evaluated was for a Lime-Red Hills fly ash mix. MDOT's Central Lab evaluated mixes containing 4% lime with 8% Red Hills fly ash, 3% lime with 12% Red Hills fly ash, and 4% lime with 12% fly ash. Each of these mixes proved to meet the compressive strength requirements made in the special provisions. The design recommended and used for the test section was a 4% lime with 8% Red Hills fly ash. This mix had a 28-day compressive strength of 710 psi. Information regarding the Lime-Red Hills fly ash mix is provided in Appendix C.

Field Construction

Location and Layout

The test section for this study was located on a newly constructed four-lane section of Hwy 67 at the county line separating George and Greene Counties. The soil cement control section was constructed in George County, and the lime-Red Hills fly ash test section was constructed in Greene County. Both of these test sections were constructed by a local contractor using their typical process. This process involved spreading of material, addition of water, mixing the soil and materials, and compaction. These steps are represented in Figures 1 through 4 below.

Figure 1. Spreading

Figure 2. Mixing

Figure 3. Sheep Footed Roller

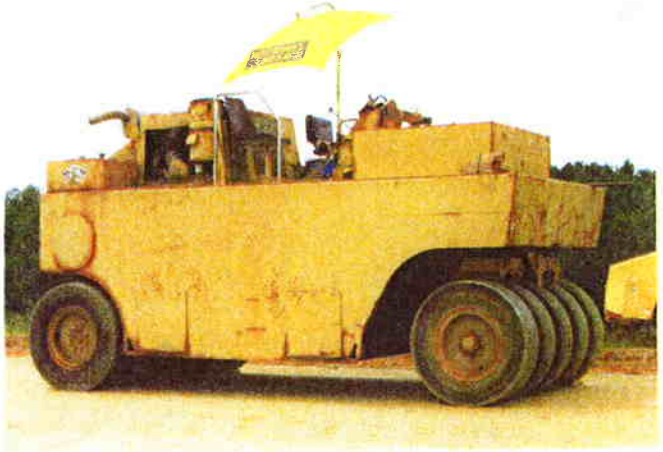


Figure 4. Rubber Tire Roller

Total lengths of the sections were calculated based on the amount of material (cement or Red Hills fly ash), and the design percentages. For each test section, ten sample locations were used. Soil cement locations were spaced longitudinally at 15 meters from station 31+545 to station 31+680, and the lime-Red Hills fly ash locations were spaced longitudinally at 15 meters from station 1+15 to station 1+150. In addition to the longitudinal spacing, each of the sample locations was spaced in varying locations along the width of the roadway. This spacing was done in an effort to capture any variations in materials and/or strengths across the width of the roadway. Test section layouts for soil cement and lime-Red Hills fly ash are shown is figures 4 and 5 respectively.

Approximate Sample Locations: Soil Cement Test Section

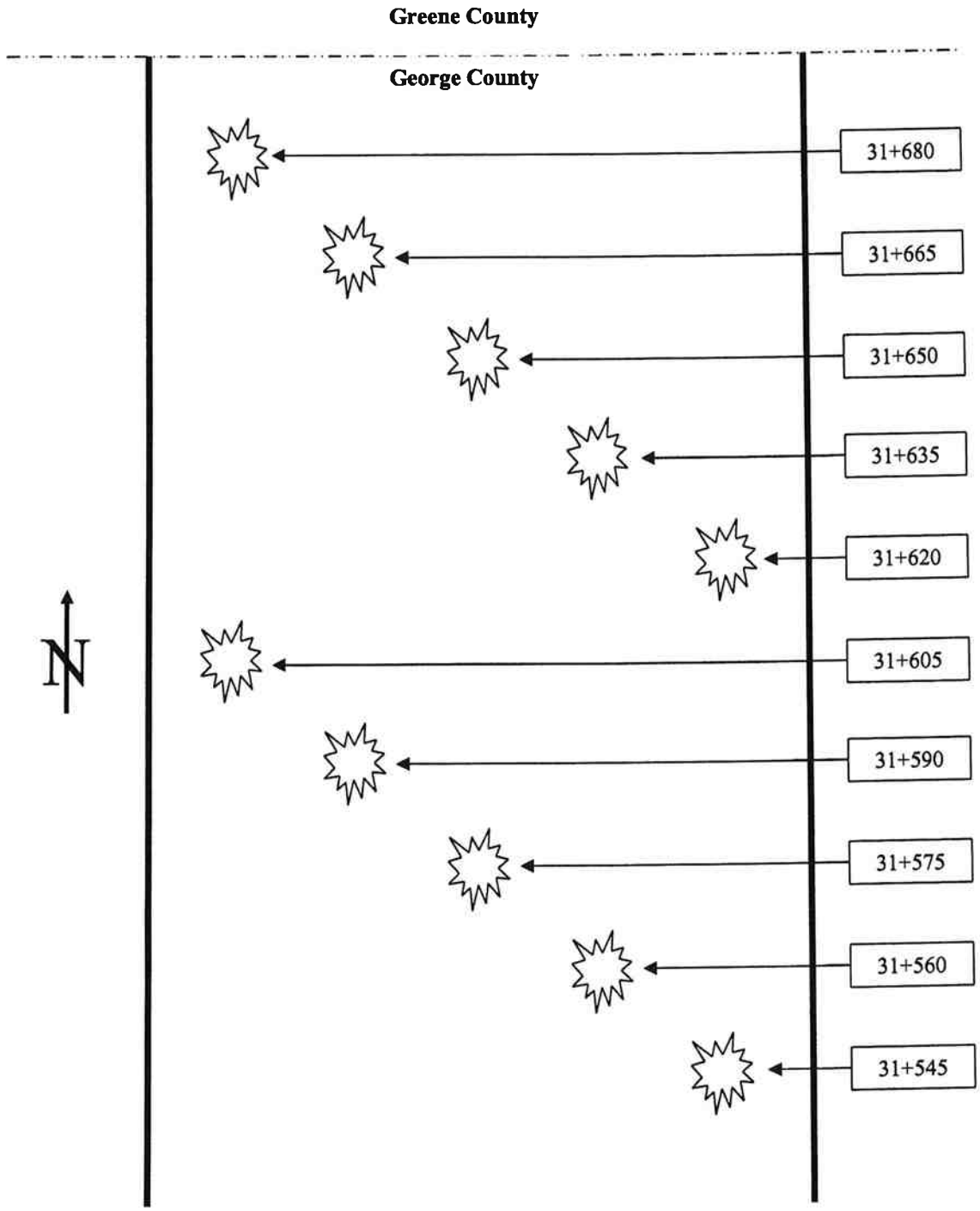


Figure 5. Soil Cement Control Section, George Co.

Approximate Sample Locations: Red Hills LFA Test Section

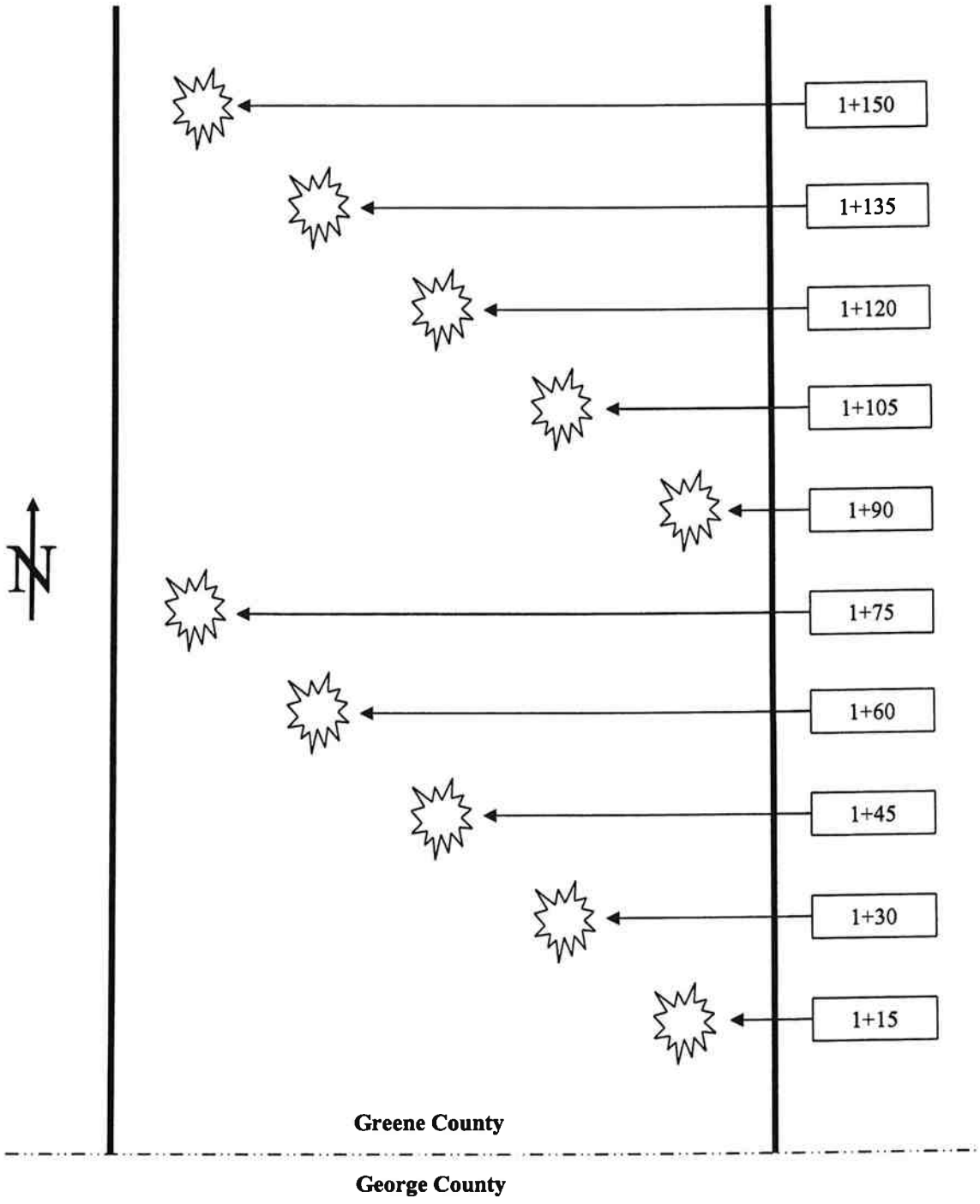


Figure 6. Lime-Red Hills Fly Ash Test Section, Greene Co.

Samples and Testing

Materials for testing were gathered during the construction process. Sampling occurred after all materials had been spread, mixed, and brought to adequate moisture content, but before it was compacted. The sampled material was bagged and transported to a nearby bridge deck where two things occurred. First, a small amount of material was collected and weighed to get a wet weight of soil to be later used in calculating the moisture content of the sample. Second, material was placed and compacted in standard Proctor molds. The Proctor samples were trimmed and left in the mold for transport back to MDOT Central Lab. Each sample was wrapped with a damp paper towel and placed in a sealed plastic bag to prevent loss of moisture during travel back to the lab. Field setup, equipment, and testing are shown in figures 6 through 8 below.

Figure 7. Field Testing Setup

Figure 8. Standard Proctor Equipment and Scale

Figure 9. Fabrication of Standard Proctor Sample

Fieldwork Verification

All work performed by the contractor was observed and verified by MDOT project engineers and inspectors. After construction, densities and moisture contents were measured on the lime-Red Hills fly ash research test section using a nuclear gauge. All field construction went according to plan and the average of five nuclear gauge readings yielded an average density 97.1% of standard and a13% moisture content. All field notes and data for the lime-Red Hills fly ash test section can be found in Appendix D.

Results

Each of the field prepared samples was transported back to MDOT's Central Lab. Once in the lab, the moisture content samples were placed into an oven to be dried and the Proctor compaction samples were extruded from their molds. Both the soil cement and the lime-Red Hills fly ash samples were placed in their respective curing rooms to prepare them for testing. Soil cement samples were cured for 7 days and the lime-Red Hills fly ash samples were cured for 28 days. After curing each of the samples were tested to determine their compressive strengths. The results are summarized in Table 1 below and all lab data sheets are provided in Appendix E.

Table 1. Laboratory Results

Material	Station	Moisture Content (%)	Compressive Strength (psi)
Soil Cement	31+545	8.1	18 *
Soil Cement	31+560	14.3	823
Soil Cement	31+575	7.8	327
Soil Cement	31+590	7.7	653
Soil Cement	31+605	9.3	154 *
Soil Cement	31+620	8.5	62.6
Soil Cement	31+635	8.4	576
Soil Cement	31+650	8.4	606
Soil Cement	31+665	6.6	323
Soil Cement	31+680	10.9	329
Red Hills LFA	1+15	13.6	303
Red Hills LFA	1+30	15.0	519
Red Hills LFA	1+45	13.9	459
Red Hills LFA	1+60	15.4	457
Red Hills LFA	1+75	12.3	532
Red Hills LFA	1+90	15.0	545
Red Hills LFA	1+105	14.4	767
Red Hills LFA	1+120	13.1	488
Red Hills LFA	1+135	16.2	666
Red Hills LFA	1+150	13.7	659

*Samples were noted to be lighter in color. Suspected lack of cement.

Conclusions and Recommendations

Conclusions

Strength results from the lime-Red Hills fly ash section showed an average compressive strength value of 540 psi. This value easily exceeded the special provision strength requirement of 400 psi. Of the ten lime-Red Hills fly ash samples prepared, only one single sample fell below the 400 psi requirement.

In reviewing the data for both the soil cement and lime-Red Hills fly ash sections, it was evident that samples taken from the edge of the lanes produced lower strengths than samples taken from the middle of the lanes. This variability is most likely due to the method of application of the raw materials prior to mixing. Loaded trucks will spray the materials onto the ground in several passes through the section. This application lends itself to having more cementing materials in the middle of the lanes and less material on the edge of the lanes and thus causing the final strengths to be variable across the lanes.

Recommendations

Based on the results of this study, it is recommended that Red-Hills fly ash be approved for use on MDOT projects. MDOT Materials Division is in agreement with this recommendation and has issued a letter to the products supplier approving their product for use. A copy of this letter can be found in Appendix F.

Based on the strength results found in this study, it is also recommended that continuing research should be conducted on the strength variability on MDOT stabilized layers.

Appendix A

Soil-Cement Stabilization
Mix Design and Recommendations

86.01

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: District Materials Engineer (Ruff)

DATE: September 22, 2008

FROM: Laboratory Operations
E.I.T. (Guth) AMG

SUBJECT OR PROJECT NO: 102917-302000
SDP-0002-02 (061)PH3
Soil-Cement Stabilization

INFORMATION COPY TO:

COUNTY: Greene

Central Records
Research Division (Battey) ✔
State Construction Engineer (Lewis)
Roadway Design Division Engineer (Purvis)
District Engineer (Lee)
Project Engineer (Mark Smith)
I. A. S. Section (Byrd)
Soils Section
Lab File

Tests have been completed on samples submitted from captioned project for Soil-Cement Stabilization. Recommendations are as follows:

ID. No: 081614CWC0034

CEM16.080012

Use 7.0 % cement by volume with 7 days of curing.

AMG/jp

Attachments

Soil Cement Design

Dates

7 Day Break	08/20/08
14 Day Break	08/27/08

Pack Out Data

% Cement	Cement Weight (g)	Soil Weight (g)	Water Weight (g)
5.	208.4	4500.	607.4
6.	252.4	4500.	613.1
7.	297.2	4500.	628.4
.	.	.	.

7 Day Breaks

Load (lb)	Compressive Strength (psi)
1229.	98.
1914.3	152.
2515.	200.
.	.

14 Day Breaks

Load (lb)	Compressive Strength (psi)
.	.
.	.
.	.
.	.

Remarks: USE 7.0% TYPE I CEMENT BY VOLUME WITH 7 DAYS CURING

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SOIL REPORT

Test Method AASHTO T11, AASHTO T27, AASHTO T88, And MT22

Contract ID	CSDP000202061P3	Fed/State Proj. #	SDP-0002-01(037)PH3 / 102065	FMS Proj. #	102065302000		
Sample Status	COMP		LAB ID	CL003	Sample ID	081614CWC0034	
Revising Sample Number			Date Sampled	2008-07-16	Date Completed	2008-08-25	
Material Code	070300102	Material Name	UNCLASS. EXC	Sample Test Number	1	Date Authorized	2008-09-19
Linked To Sample #							

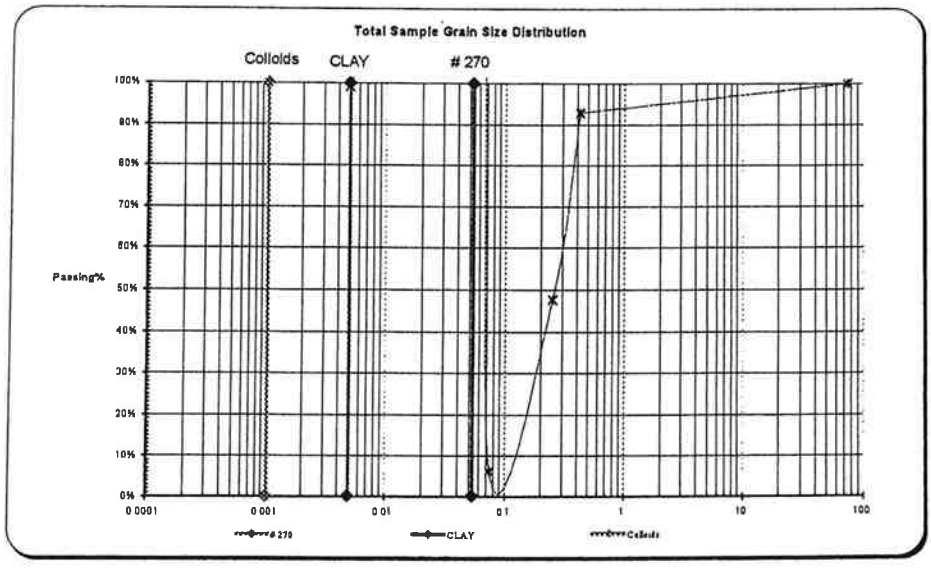
Sampled From: roadway — Distance From Grade:

Sample Station No.: 17+200 — Station Offset: — Lot Limit - Beg.: — Lot Limit - End.:

Status: COMP — This material has been tested in accordance with MDOT specifications and is satisfactory for use in MDOT projects.

Sieve Designation	% Passing	Spec. Ranges MAX.	Spec. Ranges MIN.	Screen Result	REMARKS
3" (75 mm)	100				Sieve Gradation
1/2" (63 mm)					trace
2" (50 mm)					
1 3/4" (45 mm)					
1 1/2 (37.5 mm)					
1" (25 mm)					
1/2" (12.5 mm)					
3/8" (9.5 mm)					
#4 (4.75 mm)					
#10 (2.00 mm)					
Minus # 10 Results					
#40 (425 um)	93				
#60 (250 um)	48				
#200(75 um)	6				
#270(54 um)	69				
% Silt	30				Hydrometer
% Clay	39				
% Colloids	NA				
Dust Ratio	8.225008628				
HCL reaction:					
Mica Content:					
Liquid Limit	OK				
Plastic Limit	---				Atterberg Limits
Plasticity Index	NP				
Shrinkage Limit					
Shrinkage Ratio					
Volume Change		60			
AASHTO	A3				
GROUP INDEX	1				
U. S. C.	SP-SM				
Est. CBR	11				

TOTAL SAMPLE RESULT =



MISSISSIPPI DEPARTMENT OF TRANSPORTATION

STANDARD DENSITY TEST DATA

(M-T-8) (M-T-9) (AASHTO T134) (AASHTO T180)

Contract ID CSDP000202061P3 Fed/State Proj. # 102065302000 FMS Proj. # SDP-0002-01(037)PH3 / 102065

LAB ID CL003 Curve (Sample) ID 061614CWC0034

Revising Sample Number _____ Date Sampled 2008-07-16 Date Completed 2008-09-08

Material Code 070300102 Material Descriptio UNCLASS. EXC Sample Test Number 1 Test Method ID FSL211m

Source and Location _____ Technician L. SMITH

Component of Structure: _____

Treatment: Lime - % By Dry Weight: 1st Application _____ 2nd Application _____

Cement - % By Volume _____ LIME /FLYASH % LIME _____ % FLY ASH _____

Mold Used: No 1 Weight of Mold 1936.4 grams Volume of Mold 943.8 (Cu cm)

Tested Under: Case 1 X Case 2 _____ REMARKS RAW SOIL

REMARKS _____

REMARKS _____

Trial No.	Wet Wt Soil & Mold (Grams)	Wet Wt Soil (Grams)	Moisture Determination					Dry Weight (Grams)	Dry Density (kg/m^3)
			Weight of Dish (Grams)	Wt. Wet Soil & Dish (Grams)	Wt. Dry Soil & Dish (Grams)	Loss (Grams)	Moisture Content		
1	3708.1	1771.7	66.7	198.3	184.3	14.0	11.9%	1583.2	1677.5
2	3755.8	1819.4	66.1	193.8	178.1	15.7	14.0%	1595.7	1690.7
3	3793	1856.6	66.7	200.9	182.8	18.1	15.6%	1606.2	1701.8
4	3786.2	1849.8	67.7	303.6	269.9	33.7	16.7%	1585.5	1680.0
5									

Enter Point Selected From Chart Below For (-) 1/2 Material

Std. Density: 1702.1

% Moisture: 15.5

(+) 1/2" Material

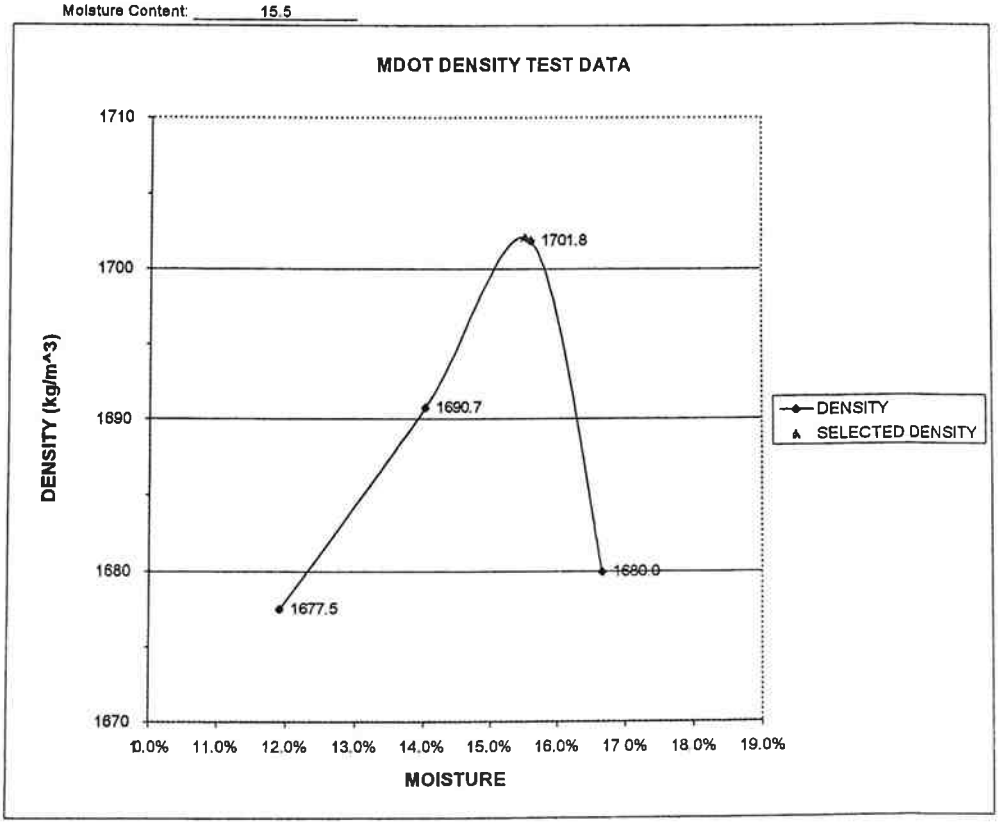
% of +1/2" Matl.: _____

Bulk Specific Gravity of +1/2" Matl: _____

Results of Total Sample

Standard Density kg^m3): 1702.1

Moisture Content: 15.5



Signed _____

Title _____

DISTRIBUTION:

Original - Project Engineer

Copies - Construction Engineer

State Materials Engineer

District (As Instructed)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

STANDARD DENSITY TEST DATA

(M-T-8) (M-T-9) (AASHTO T134) (AASHTO T180)

Contract ID: CSDP000202061P3 Fed/State Proj. # 102065302000 FMS Proj. # SDP-0002-01(037)PH3 / 102065

LAB ID: CL003 Curve (Sample) ID: 081614CWC0034

Revising Sample Number: _____ Date Sampled: 2008-07-16 Date Completed: 2008-09-08

Material Code: 070300102 Material Descriptio: UNCLASS. EXC Sample Test Number: 2 Test Method ID: FSL211m

Source and Location: _____ Technician: L. SMITH

Component of Structure: _____

Treatment: Lime - % By Dry Weight: 1st Application _____ 2nd Application _____

Cement - % By Volume: 7.0 LIME /FLYASH % LIME _____ % FLY ASH _____

Mold Used: No. 1 Weight of Mold: 1935.7 grams Volume of Mold: 943.8 (Cu. cm)

Tested Under: Case 1 X Case 2 _____ REMARKS: TYPE I CEMENT

REMARKS: _____

REMARKS: _____

Trial No.	Wet Wt Soil & Mold (Grams)	Wet Wt Soil (Grams)	Moisture Determination					Dry Weight (Grams)	Dry Density (kg/m^3)
			Weight of Dish (Grams)	Wt. Wet Soil & Dish (Grams)	Wt. Dry Soil & Dish (Grams)	Loss (Grams)	Moisture Content		
1	3753.2	1817.5	66.0	197.2	187.9	9.3	7.6%	1688.7	1789.2
2	3813.9	1878.2	63.9	206.1	193.8	12.3	9.5%	1715.7	1817.9
3	3871.8	1936.1	66.8	198.9	185.2	13.7	11.6%	1735.3	1838.6
4	3869.2	1933.5	69.7	285.3	259.7	25.6	13.5%	1703.9	1805.4
5									

Enter Point Selected From Chart Below For (-) 1/2 Material

Std. Density: 1838.9

% Moisture: 11.4

(+) 1/2" Material

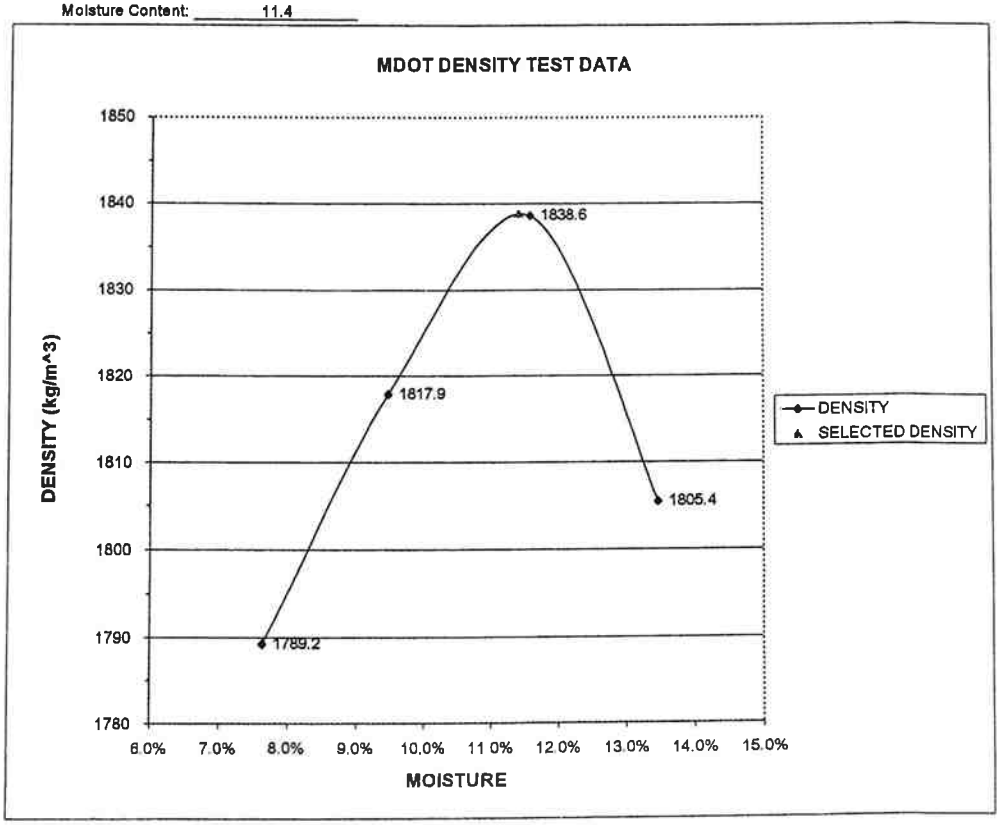
% of +1/2" Matl.: _____

Bulk Specific Gravity of +1/2" Matl: _____

Results of Total Sample

Standard Density kg^m3): 1838.9

Moisture Content: 11.4



Signed _____

Title _____

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State Materials Engineer

District (As Instructed)

Soluble Sulfate in Soil

Test Method: MT- 58

Soluble Sulfate (%) .0

Sulfate Exposure: Negligible

Cementitious Material Required

No Special Requirement

Remarks:

Appendix B

Special Provision No. 907-311-5M
Subgrade Stabilization
Test Sections Using Experimental Fly Ash

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-311-5M **CODE: (SP)**

DATE: 9/19/2007

SUBJECT: **Subgrade Stabilization - Test Sections Using Experimental Fly Ash**

PROJECT: **SDP-0002-02(061)PH3 / 102917302, SDP-0002-01(037)PH3 / 102065302, & SDP-0002-02(063)PH3 / 102066302 -- George & Greene Counties**

Section 311, Lime-Fly Ash Treated Courses, of the 1996 Metric Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-311.01--Description. After the first paragraph of Subsection 311.01 on page 311-1, add the following:

This work also consists of stabilizing the existing subgrade utilizing an Experimental Fly Ash. The stabilized courses will consist of either a mixture of the subgrade soil, Red Hills Fly Ash, and water, or a mixture of subgrade soil, Red Hills Fly Ash, lime, and water in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans.

Following are the test section station limits:

Lime-Red Hills Fly Ash section from Sta. 31+475 L/L to Sta. 31+703.314 L/L
Red Hills Fly Ash (no lime) section from Sta. 1+000 L/L to Sta. 1+225 L/L

907-311.02--Materials. After Subsection 311.02.1 on page 311-1, add the following:

907-311.02.3--Red Hills Fly Ash. The Red Hills Fly Ash to be used in the Experimental Fly Ash Test Sections shall be obtained by contacting Headwaters Resources at (501)844-6607. The Red Hills Fly Ash source is located near Ackerman, MS.

All remaining materials to be used in conjunction with the Experimental Fly Ash Test Sections shall meet the requirements of Subsection 311.02 of the Standard Specifications, or as amended.

907-311.02.4--Design of Test Sections Utilizing Experimental Fly Ash. Quantities and percentages of Red Hills Fly Ash or Lime-Red Hills Fly Ash shown on the plans are preliminary. The actual application rate will be established from tests made prior to beginning treatment. The designs shall be performed by the MDOT Central Laboratory. At least 45 days prior to the anticipated construction date, the Contractor shall provide samples of all materials to be incorporated into the mix to the Engineer.

The materials for the **Lime-Red Hills Fly Ash** design will be proportioned and a mix design determined in accordance with Mississippi Test Method, MT-79. The design shall produce a blend having a 28-day compressive strength of 400 psi.

The materials for the **Red Hills Fly Ash (no lime)** design will be proportioned and a mix design determined in accordance with Mississippi Test Method, MT-25 with the exception that Red Hills Fly Ash shall be substituted for Portland Cement and the mixture shall produce a 28-day compressive strength of at lease 300 psi.

907-311.03--Construction Requirements.

907-311.03.1--General. After the second paragraph of Subsection 311.03.1 on page 311-1, add the following:

Construction of the stabilized subgrade test sections using Experimental Fly Ash will be in accordance with Subsections 308.03 and 311.03 of the Standard Specifications, or as amended.

Personnel from the Department will be on site during and after construction of the Experimental Fly Ash Test Sections for testing and to obtain field samples of the stabilized subgrade for further research. Sampling activities should have minor impact to the Contractor's work. Additional testing of the in-place stabilized subgrade will take place after the required curing period, but prior to placement of additional materials on the subgrade. The time required for testing will not exceed three (3) weeks after the stabilized subgrade is completed by the Contractor and sealed.

The Contractor is required to notify the State Materials Engineer at least seven (7) calendar days prior to construction of the first Experimental Fly Ash Test Section. The State Materials Engineer can be reached at (601) 359-1798.

907-311.05--Basis of Payment. After the first paragraph of Subsection 311.05 on page 311-4, add the following:

Processing of Red Hills Fly Ash Stabilized Course, with or without lime, will be paid for by the square yard, complete in place. Lime used in lime-fly ash mixtures shall be paid for under pay item no. 907-304-D, Lime.

Add the following to the list of pay items on page 226.

907-311-A: Processing of Red Hills Fly Ash Stabilized Course, 150-mm Thickness - per square meter

907-311-A: Processing of Lime-Red Hills Fly Ash Stabilized Course, 150-mm Thickness - per square meter

907-311-C: Fly Ash, Red Hills Source - per metric ton

Appendix C

Lime and Red Hills Fly Ash
Mix Design and Recommendations

86.01

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: District Materials Engineer (Ruff)

DATE: September 22, 2008

FROM: Laboratory Operations
E.I.T. (Guth) AMG

SUBJECT OR PROJECT NO: 102917-302000
SDP-0002-02 (061)PH3
Soil-Lime-Fly Ash Stabilization

INFORMATION COPY TO:

COUNTY: Greene

Central Records
Research Division (Battey) ✔
State Construction Engineer (Lewis)
Roadway Design Division Engineer (Purvis)
District Engineer (Lee)
Project Engineer (Mark Smith)
I. A. S. Section (Byrd)
Soils Section
Lab File

Tests have been completed on samples submitted from captioned project for Soil-Lime-Fly Ash Stabilization. Recommendations are as follows:

ID. No: 081614CWC0032

Mix I.D. LFAC6.080014

Use 4.0% Lime (Falco), and 8.0% Fly Ash (Headwaters Red Hill Ash), by weight dry soil for use as base.

AMG/jp

Attachments

Soluble Sulfate in Soil

Test Method: MT- 58

Soluble Sulfate (%) .0

Sulfate Exposure: Negligible

Cementitious Material Required

No Special Requirement

Remarks:

Soluble Sulfate in Soil

Test Method: MT- 58

Soluble Sulfate (%) .0

Sulfate Exposure: Negligible

Cementitious Material Required

No Special Requirement

Remarks:

Soil, Lime and Fly Ash Design

Percents Lime and Fly Ash

14 Day Breaks

	Cylinder Number	Total Load (kN)	Compressive Strength (MPa)
		.0	.00
		.0	.00
Averages			

28 Day Breaks

		.0	.00
		.0	.00
Averages			

Percents Lime and Fly Ash 4/8

14 Day Breaks

	Cylinder Number	Total Load (kN)	Compressive Strength (MPa)
	1	.0	3.85
	2	.0	3.75
Averages		.0	3.80

28 Day Breaks

	3	.0	4.78
	4	.0	5.01
Averages			4.90

Remarks: USE 4.0% LIME & 8.0% RED HILL FLY ASHAT 28 DAYS CURING.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SOIL REPORT

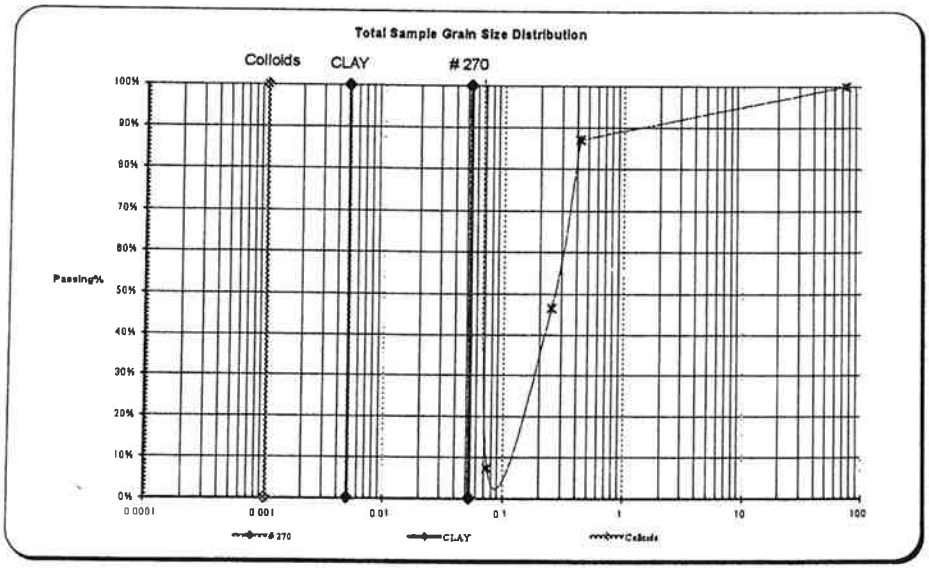
Test Method AASHTO T11, AASHTO T27, AASHTO T88, And MT22

Contract ID	CSDP000202061P3	Fed/State Proj. #	SDP-0002-01(037)PH3 / 102065	FMS Proj. #	102065302000		
Sample Status	COMP		LAB ID	CL003	Sample ID	081614CWC0032	
Revising Sample Number		Date Sampled	2008-07-16		Date Completed	2008-08-20	
Material Code	070300102	Material Name	UNCLASS. EXC	Sample Test Number	1	Date Authorized	2008-09-19
Linked To Sample #							

Sampled From	roadway	Distance From Grade			
Sample Station No.	31+600	Station Offset		Lot Limit - Beg.		Lot Limit - End	
Status	COMP	This material has been tested in accordance with MDOT specifications and is satisfactory for use in MDOT projects.			

Sieve Designation	% Passing	Spec. Ranges MAX.	Spec. Ranges MIN.	Screen Result	REMARKS
3" (75 mm)	100				Sieve Gradation
1/2" (63 mm)					TRACE
2" (50 mm)					
1 3/4" (45 mm)					
1 1/2 (37.5 mm)					
1" (25 mm)					
1/2" (12.5 mm)					
3/8" (9.5 mm)					
#4 (4.75 mm)					
#10 (2.00 mm)					
Minus # 10 Results					
#40 (425 um)	87				
#60 (250 um)	47				
#200(75 um)	7				
#270(54 um)	69				
% Silt	30				Hydrometer
% Clay	39				
% Colloids	NA				
Dust Ratio	35.44330329				
HCL reaction:					
Mica Content:					
Liquid Limit	OK				
Plastic Limit	---				Atterberg Limits
Plasticity Index	NP				
Shrinkage Limit					
Shrinkage Ratio					
Volume Change		60			
AASHTO	A3				
GROUP INDEX	1				
U. S. C.	SP-SM				
Est. CBR	11				

TOTAL SAMPLE RESULT =



MISSISSIPPI DEPARTMENT OF TRANSPORTATION
STANDARD DENSITY TEST DATA
(M-T-8) (M-T-9) (AASHTO T134) (AASHTO T180)

Contract ID: CSDP000202061P3 | Fed/State Proj. #: 102065302000 | FMS Proj. #: SDP-0002-01(037)PH3 / 102065
LAB ID: CL003 | Curve (Sample) ID: 081614CWC0032
Revising Sample Number: | Date Sampled: 2008-07-16 | Date Completed: 2008-09-12
Material Code: 070300102 | Material Descriptio: UNCLASS. EXC | Sample Test Number: 1 | Test Method ID: FSL211m
Source and Location: | Technician: L. SMITH
Component of Structure:

Treatment: Lime - % By Dry Weight: 1st Application: | 2nd Application:
Cement - % By Volume: | LIME /FLYASH | % LIME: | % FLY ASH:

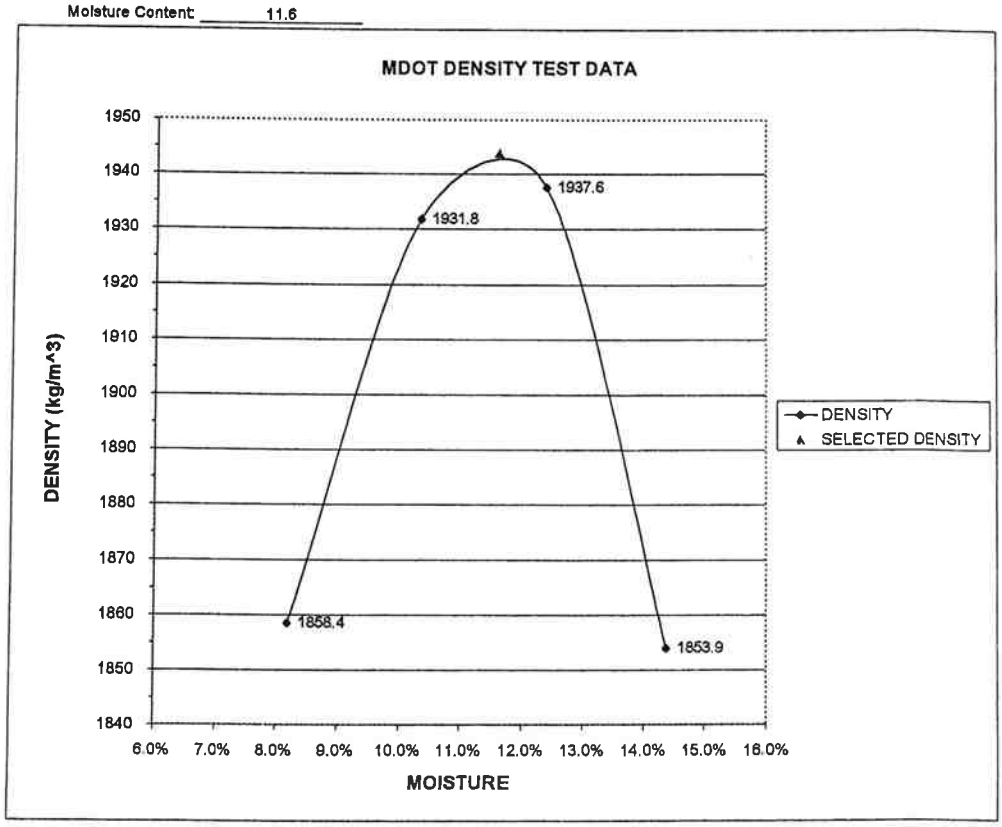
Mold Used: No. 1 | Weight of Mold: 1937.0 grams | Volume of Mold: 943.8 (Cu. cm)
Tested Under: Case 1 X | Case 2: | REMARKS: RAW SOIL | REMARKS: | REMARKS:

Trial No.	Wet Wt Soil & Mold (Grams)	Wet Wt Soil (Grams)	Moisture Determination					Dry Weight (Grams)	Dry Density (kg/m^3)
			Weight of Dish (Grams)	Wt. Wet Soil & Dish (Grams)	Wt. Dry Soil & Dish (Grams)	Loss (Grams)	Moisture Content		
1	3834.5	1897.5	66.0	191.6	182.1	9.5	8.2%	1754.0	1858.4
2	3948.5	2011.5	66.1	192.2	180.4	11.8	10.3%	1823.3	1931.8
3	3992	2055.0	66.0	189.5	175.9	13.6	12.4%	1828.7	1937.6
4	3938.3	2001.3	65.2	210.0	191.8	18.2	14.4%	1749.8	1853.9
5									

Enter Point Selected From Chart Below For (-) 1/2 Material
Std. Density: 1943.9
% Moisture: 11.6

(+) 1/2" Material
% of +1/2" Matl.:
Bulk Specific Gravity of +1/2" Matl:

Results of Total Sample
Standard Density kg^m3): 1943.9
Moisture Content: 11.6



Signed

Title

DISTRIBUTION:
Original - Project Engineer
Copies - Construction Engineer
State Materials Engineer
District (As Instructed)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

STANDARD DENSITY TEST DATA

(M-T-8) (M-T-9) (AASHTO T134) (AASHTO T180)

Contract ID: CSDP000202061P3 | Fed/State Proj. #: 102065302000 | FMS Proj. #: SDP-0002-01(037)PH3 / 102065

LAB ID: CL003 | Curve (Sample) ID: 081614CWC0032

Revising Sample Number: | Date Sampled: 2008-07-16 | Date Completed: 2008-09-12

Material Code: 070300102 | Material Descriptio: UNCLASS. EXC | Sample Test Number: 2 | Test Method ID: FSL211m

Source and Location: | Technician: 1935.6

Component of Structure:

Treatment: Lime - % By Dry Weight: 1st Application: | 2nd Application:

Cement - % By Volume: | LIME /FLYASH | % LIME: 4.0 | % FLY ASH: 8.0

Mold Used: No. 1 | Weight of Mold: 1935.6 grams | Volume of Mold: 943.8 (Cu cm)

Tested Under: Case 1: X | Case 2: | REMARKS: RED HILL ASH

REMARKS: FALCO LIME

REMARKS:

Trial No.	Wet Wt Soil & Mold (Grams)	Wet Wt Soil (Grams)	Moisture Determination					Dry Weight (Grams)	Dry Density (kg/m^3)
			Weight of Dish (Grams)	Wt. Wet Soil & Dish (Grams)	Wt. Dry Soil & Dish (Grams)	Loss (Grams)	Moisture Content		
1	3802.2	1866.6	66.9	203.9	190.0	13.9	11.3%	1677.2	1777.1
2	3882	1946.4	66.0	200.0	184.7	15.3	12.9%	1724.2	1826.8
3	3916.4	1980.8	68.2	205.1	187.6	17.5	14.7%	1727.6	1830.5
4	3876.5	1940.9	67.6	200.8	181.8	19.0	16.6%	1664.0	1763.1
5									

Enter Point Selected From Chart Below For (-) 1/2 Material

Std. Density: 1834.9

% Moisture: 14

(+) 1/2" Material

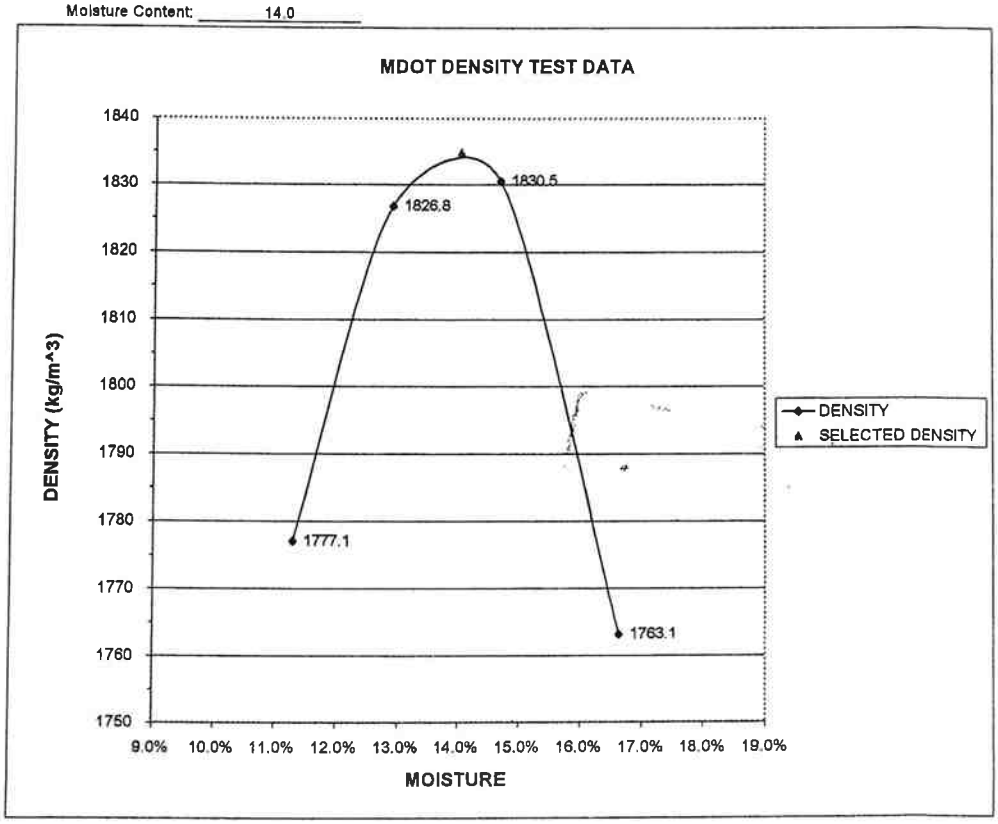
% of +1/2" Matl.:

Bulk Specific Gravity of +1/2" Matl:

Results of Total Sample

Standard Density kg^m3): 1834.9

Moisture Content: 14.0



Signed

Title

DISTRIBUTION:

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Appendix D

MDOT Inspector Field Reports

CSD-121

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
INSPECTORS DAILY WORK REPORT

DWR Info.

Contract ID: 102065/102066/102917/302000 FOR OFFICE USE: _____

DWR Date: 7-23-04 DWR Nbr. 1 of 1

DWR Day: THUR. Temperature: High 94° Low 72°

Weather Conditions: AM FAIR PM FAIR

DWR Info. Remarks

Precipitation: Previous Night _____ AM _____ PM _____

Soil Conditions: AM SAT. FACTOR PM SAT. FACTOR Phase: _____

Contractor Operations: PROCESSED SOIL CEMENT FROM STA. 31+530 TO 31+703 LT. LANE, JOB # 102065-302000

PROCESSED FLY-ASH & LIME FROM STA. 1+000 TO 1+154 LT. LANE PROJ # 102066-302000 (TEST SECTION)

Engineering Activities: INSPECTING CONTRACTOR ACTIVITIES OF PROCESSING SOIL CEMENT AND FLY ASH & LIME

Contractor

Contractor: TANNER CONST. Prime ✓ Sub ____ DBE ____ Rental ____

Personnel Type	Nbr.	Hours	Personnel Type	Nbr.	Hours
Superintendent	2	12			
Foreman	2	12			
Laborer, Unskilled	5	12			
Survey Party Chief	1	12			
Survey Rodman	2	12			
Survey Laborer	1	12			
Survey Instrument Man	1	12			
Operators	8	12			

CSD-121

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
INSPECTORS DAILY WORK REPORT

DWR Info.

Contract ID: 102066+102065-30 2000

DWR Date: 7-23-09 DWR Nbr. _____ Of _____

DWR Day: Thu. Temperature: High 90°F Low 70°F

Weather Conditions: AM Sunny & Cloudy PM Sunny

DWR Info. Remarks

Precipitation: Previous Night _____ AM _____ PM _____

Soil Conditions AM Fair PM Fair Phase: _____

Contractor Operations: Contractor worked on spreading + mixing soil cement on left lane subbase 41oads from sta 3+769 to 4+551.
On job 102066 test lot of lime + fly ash left lane at sta 1+000 to 1+156 + on sta 31+530 to 31+703 mixed soil cement for test strip (102065)

Engineering Activities: On inspection I observed the mixing of soil cement also lime + fly ash. Tesked for pulverization + moisture check.

Contractor

Contractor: Tanner Soil Cement Prime ✓ Sub ____ DBE ____

Personnel Type	Nbr.	Hours	Personnel Type	Nbr.	Hours
See Laffitte's report for personnel + equipment					

(B)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Project Number 102065 30 2000 Date 7-23-09

Station Number: 31+530 To 31+703. Lanes: ~~( ) Right~~ ~~(X)~~ Left

Test Taken @ Station 31+616 Truck #(1), ~~(X)~~, or ~~(X)~~

Lime Flyash Subgrade Treatment Depth .150

Pulverization

Weight Of Sample 10 Lb.

Weight Passing #4 Sieve 8.0 Lb.

Percentage (%) Passing #4 Sieve 80 %. Soil cement test strip

Moisture Check

Wet Weight of Sample 400 Grams

Dry Weight of Sample 370.0 Grams

Weight Loss 30 Grams

Optimun Moisture 10.9 Percentage of Moisture 8.1 %

Job: 102065

Station Number: 1+000 To 1+156 Lanes: ~~( ) Right~~ ~~(X)~~ Left

Test Taken @ Station 1+078 Truck #2 ~~(X)~~ or ~~(X)~~

Lime Flyash Subgrade Treatment Depth .150

Pulverization

Weight of Sample 10 Lb.

Weight Passing # 4 Sieve 7.6 Lb.

Percentage (%) Passing # 4 Sieve 76 % lime + fly ash test strip

Moisture Check

Wet Weight of Sample 400 Grams

Dry Weight of Sample 361.0 Grams

Weight Loss 39 Grams

Optimun Moisture 11.6 Percentage of Moisture: 10.8 %

Inspected By

5460625

SITEMANAGER

FORM CAD-308M

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
CONTRACT ADMINISTRATION DIVISION
FINAL PLANS SECTION

DAILY REPORT OF RED HILLS FLY ASH

REPORT NUMBER: FLY ASH 1

FLY ASH:BRAND	RED HILLS	PROJECT NUMBER :	102066-302000
WGT. (kg/cu. m)	1936.8	COUNTY :	GREENE
WATER: SOURCE		CONTRACTOR :	TANNER CONST.
RAW SOIL: (CLAY,SLT,SILTY CLAY)	SAND CLAY	LENGTH OF PROJECT (km)	17.398
DEPTH OF TREATMENT (mm)	150	PROCESSED (m)	156.00
RANGE PERMITTED		SQUARE METERS	1404.00
METHOD OF MIXING	ROTARY MIXER	FLY ASH;MT	32.96
TYPE OF ROLLERS	2 SHEEP FT. & RUBBER TIRE	PERCENT COMPLETE	8.01%

CEMENT SPREADING DATA	1	2	3	4	5	TOTAL
DATE	7/23/2009	7/23/2009				
LANE	LT	LT				
FROM STATION	1+000	1+078				
TO STATION	1+078	1+156				
NET LENGTH : (m)	78.00	78.00				156.00
AVG. WIDTH : (m)	9.00	9.00				
SQUARE METERS	702	702				1404
FLY ASH:%8	8.00%	8.00%				
ORDER : (kg)	16315.6	16315.6				32631.2
PLUS 5 % (kg)	17131.4	17131.4				34262.8
SPREAD : (kg)	16411.25	16547.33				32958.58
ALLOWED : (kg)	16411.25	16547.33				32958.58
TEMPERATURE : LOW (°F)						
TEMPERATURE : HIGH (°F)						
TIME: SPREAD BEGUN :						
TIME : INCORP. COMPLETE :						

CEMENT SPREADING DATA	6	7	8	9	10	TOTAL
DATE						
LANE						
FROM STATION						
TO STATION						
NET LENGTH : (m)						0.00
AVG. WIDTH : (m)						
SQUARE METERS						0
CEMENT : % SPECIFIED						
ORDER : (kg)						0
PLUS 5 % (kg)						0
SPREAD : (kg)						0.00
ALLOWED : (kg)						0.00
TEMPERATURE : LOW (°F)						
TEMPERATURE : HIGH (°F)						
TIME: SPREAD BEGUN :						
TIME : INCORP. COMPLETE :						

INSPECTOR

PROJECT ENGINEER

FORM CAD-308M

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
CONTRACT ADMINISTRATION DIVISION
FINAL PLANS SECTION

DAILY REPORT OF FALCO LIME

REPORT NUMBER : LIME 1

LIME:BRAND	FALCO LIME	PROJECT NUMBER :	102066-302000
WGT. (kg/cu. m)	1936.8	COUNTY :	GREENE
WATER: SOURCE		CONTRACTOR :	TANNER CONST.
RAW SOIL : (CLAY,SILT,SILTY CLAY)	SAND CLAY	LENGTH OF PROJECT (km)	17.398
DEPTH OF TREATMENT (mm)	150	PROCESSED (m)	206.00
RANGE PERMITTED		SQUARE METERS	1854.00
METHOD OF MIXING	ROTARY MIXER	LIME : MT	21.68
TYPE OF ROLLERS	2 SHEEP FT. & RUBBER TIRE	PERCENT COMPLETE	10.66%

SECTION PROCESSED

SEGMENT NO.	1	2	3	4	5	TOTAL
DATE	7/23/2009					
LANE	LT					
FROM STATION	1+000					
TO STATION	1+206					
NET LENGTH : (m)	206.00					206.00
AVG. WIDTH : (m)	9					
SQUARE METERS	1854					1854
LIME%	4.00%					
ORDER : (kg)	21681.5					21681.5
PLUS 5 % (kg)	22765.6					22765.6
SPREAD : (kg)	21682.08					21682.08
ALLOWED : (kg)	21682.08					21682.08
TEMPERATURE : LOW (°F)	00.0°	00.0°	00.0°	00.0°	00.0°	
TEMPERATURE : HIGH (°F)	00.0°	00.0°	00.0°	00.0°	00.0°	
TIME: SPREAD BEGUN :						
TIME : INCORP. COMPLETE :						

SEGMENT NO.	6	7	8	9	10	TOTAL
DATE						
LANE						
FROM STATION						
TO STATION						
NET LENGTH : (m)						0.00
AVG. WIDTH : (m)						
SQUARE METERS						0
CEMENT : % SPECIFIED						
ORDER : (kg)						0
PLUS 5 % (kg)						0
SPREAD : (kg)						0.00
ALLOWED : (kg)						0.00
TEMPERATURE : LOW (°F)						
TEMPERATURE : HIGH (°F)						
TIME: SPREAD BEGUN :						
TIME : INCORP. COMPLETE :						

Anthony Griffith
INSPECTOR

PROJECT ENGINEER

EARTHWORK SHEET

RANDOM SAMPLING WORKSHEET FOR ROADWAY DENSITY

DATE 7-23-09 PROJECT: 102

COUNTRY Greene DISTRICT 16-14

Materials ~~Soil Cement~~ Lime and Fly Ash COMPONENT _____

LOT NO: _____ STATION 1+000 TO STATION 1+156

1+156

			RANDOM LENGTH	WIDTH
SUB LOT# 5	station 1+138.9	WIDTH 7	.452	.757
1+124.8 31.2	LENGTH 14.1			
SUB LOT# 4	station 1+102.2	WIDTH 7	.276	.812
1+093.6 31.2	LENGTH 8.6			
SUB LOT# 3	station 1+066.7	WIDTH 2	.138	.229
1+062.4 31.2	LENGTH 4.3			
SUB LOT# 2	station 1+053.7	WIDTH 4	.722	.472
1+031.2 31.2	LENGTH 22.5			
SUB LOT# 1	station 1+010.1	WIDTH 1	.324	.156
1+000 31.2	LENGTH 10.1			

SPD

INSPECTOR Cathy Griffith

TMD-524
Rev. 7-96

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
JACKSON, MS
STRUCTURAL BACKFILL, SUBBASE, BASE & SHOULDERS
(MT - 16)

PROJECT 102066302000 LOT SIZE 31.2 LOT NO. _____
COUNTY _____ CONTRACTOR Tanner TECHNICIAN BDoherty
COMPONENT: Structural Backfill _____ Subbase ✓ unclass
Shoulders _____ Base _____
TREATMENT: None ___ Cement (by Vol.) _____ % Lime (by Wgt.) 4 % Fly Ash (by Wgt.) 8 %
GRANULAR MATERIAL: Class _____ Group _____ BORROW MATERIAL: Class _____
DESIGN THICKNESS (Inches) 150 LIFT: 1st

		1	2	3	4	5	
1. Sublot No.							
2. Date of Test		7-23-09	7-23-09	7-23-09	7-23-09	7-23-09	
3. Time of Test		Pm	Pm	Pm	Pm	Pm	
4. Station Limits of Sublot		1+000 1+031.2	1+031.2 1+062.4	1+062.4 1+093.6	1+093.6 1+124.8	1+124.8 1+156	
5. Station No. At Test Site		1+010.1	1+053.7	1+066.7	1+102.2	1+138.9	
6. Location from Left Edge, Ft.		1	4	2	7	7	
7. Depth of Test, Inches		150	150	150	150	150	
STD DENS	8. Std. Density Curve No.	081614 CWC0032	081614 CWC0032	081614 CWC0032	081614 CWC0032	081614 CWC0032	
STD DENS	9. Optimum Moisture, %	14	14	14	14	14	
STD DENS	10. Std. Density, PCF	1834.9	1839.9	1839.9	1839.9	1839.9	
FLD DENSITY	11. Gage Moisture Bias (+) or (-)	~~+7~~					
FLD DENSITY	12. Dry Density, PCF	1762	1782	1784	1751	1829	Average Density of Lot %
FLD DENSITY	13. Moisture, %	13.53	15.21	13.03 ~~13.03~~	12.95	10.37	
FLD DENSITY	14. Density, % of Std.	96%	97.2	97.2	95.4	99.67	97.09
15. Required Density, % of Standard		96	96	96	96	96	96

REMARKS: Sample ID: 091614AJL0040 ~~0037~~ Pay Item # 907-311-A014

DISTRIBUTION:
Original - Project Engineer
State Materials Engineer
State Construction Engineer
District Materials Engineer

Signed Ben Doherty
Title EAII

Appendix E

Laboratory Data Sheets

Wgt. Dish & air dried soil	221.7
wgt. Dish & oven dried soil	208.7
wgt. Moisture lost	13
dish no.	1
dish wgt.	47.3
wgt. Oven dried soil	161.4
percent hygro. Moisture	8.054523

Fly Ash [ ]

Soil Cement [X]

STA. # 31+545

Wgt. of mold # 1: 2155.2

Mold + Soil: 4045.1

light load 228

PSI 18

Wgt. Dish & air dried soil	184.9
wgt. Dish & oven dried soil	172.0
wgt. Moisture lost	17.9
dish no.	2
dish wgt.	46.5
wgt. Oven dried soil	125.5
percent hygro. Moisture	14.26295

Fly Ash	
Soil Cement	✓

STA. # 31 +560

Wgt of mold #2: 2173.8

Mold + Soil: 4034.5

dark

load

10345

PSI

823

Wgt. Dish & air dried soil	245.0
wgt. Dish & oven dried soil	230.7
wgt. Moisture lost	14.3
dish no.	3
dish wgt.	47.7
wgt. Oven dried soil	183
percent hygro. Moisture	7.814208

Fly Ash	
Soil Cement	✓

STA. #	31+575

Wgt. of Mold #3: 2174.7

Mold+Soil: 4070.1

dark load 4113

PSI ~~360~~ 327

Wgt. Dish & air dried soil	246.4
wgt. Dish & oven dried soil	232.2
wgt. Moisture lost	14.2
dish no.	4
dish wgt.	47.3
wgt. Oven dried soil	184.9
percent hygro. Moisture	7.679827

Fly Ash	
Soil Cement	✓

STA. #	31+590

Wgt. of Mold#4: 2181.3

Mold+Soil: 4171.7

dark load 820S

PSI 653

Wgt. Dish & air dried soil	253.2
wgt. Dish & oven dried soil	235.8
wgt. Moisture lost	17.4
dish no.	5
dish wgt.	48.4
wgt. Oven dried soil	187.4
percent hygro. Moisture	9.284952

Fly Ash ☐

Soil Cement ☑

STA. # 31+605

Wgt. of Mold #5: 2158.2

Mold+Soil: 4054.8

Kiehda light load	psi
1939.5	154.

Wgt. Dish & air dried soil	204.3
wgt. Dish & oven dried soil	192.0
wgt. Moisture lost	12.3
dish no.	6
dish wgt.	47.7
wgt. Oven dried soil	144.3
percent hygro. Moisture	8.523909

Fly Ash	
Soil Cement	✓

STA. # 31+620

Wgt. of Mold #6: 2036.7

Mold + Soil: 3871.0

load	PSI
7866	62.6

Wgt. Dish & air dried soil	188.2
wgt. Dish & oven dried soil	177.3
wgt. Moisture lost	11
dish no.	7
dish wgt.	46.8
wgt. Oven dried soil	130.4
percent hygro. Moisture	8.435583

Fly Ash	
Soil Cement	✓

STA. #	31+635

Wgt. of Mold #7: 2186.3

Mold + Soil: 4202.4

dark load	PSI
7237	576

Wgt. Dish & air dried soil	227.7
wgt. Dish & oven dried soil	213.7
wgt. Moisture lost	14
dish no.	8
dish wgt.	47.8
wgt. Oven dried soil	165.9
percent hygro. Moisture	8.438819

Fly Ash [ ]

Soil Cement [✓]

STA. # 31+650

Wgt. of Mold #8: 2000.2

Mold + Soil: 3921.5

load	PSI
7615	600

Wgt. Dish & air dried soil	236.9
wgt. Dish & oven dried soil	225.1
wgt. Moisture lost	11.8
dish no.	9
dish wgt.	47.3
wgt. Oven dried soil	177.8
percent hygro. Moisture	6.63667

Fly Ash ☐

Soil Cement ☑

STA. # 31+665

Wgt. of Mold #9: 2003.4

Mold+Soil: 3851.6

load	PSI
4065	323

Wgt. Dish & air dried soil	248.1
wgt. Dish & oven dried soil	228.4
wgt. Moisture lost	19.7
dish no.	10
dish wgt.	47.0
wgt. Oven dried soil	181.4
percent hygro. Moisture	10.85998

Fly Ash ☐

Soil Cement ☑

STA. # 31+680

load	PSI
4134	321

Wgt. of Mold #10 : 2000.3

Mold + Soil: 3925.9

Wgt. Dish & air dried soil	222.6
wgt. Dish & oven dried soil	201.8
wgt. Moisture lost	20.8
dish no.	11
dish wgt.	48.6
wgt. Oven dried soil	153.2
percent hygro. Moisture	13.57702

Fly Ash	✓
Soil Cement	

STA. # 1+15

Load	PSI
3807	303

Wgt. of Mold #11: 2001.6

Mold + Soil: 3792.3

3792.3

Wgt. Dish & air dried soil	211.0
wgt. Dish & oven dried soil	189.6
wgt. Moisture lost	21.4
dish no.	12
dish wgt.	47.1
wgt. Oven dried soil	142.5
percent hygro. Moisture	15.01754

Fly Ash ☑

Soil Cement ☐

STA. # 1+30

Load 6522

PSI 519

Wgt. of Mold #12: 2000.3

Mold + Soil: 3950.7

Wgt. Dish & air dried soil	210.5
wgt. Dish & oven dried soil	190.7
wgt. Moisture lost	19.8
dish no.	13
dish wgt.	48.4
wgt. Oven dried soil	142.3
percent hygro. Moisture	13.91427

Fly Ash	✓
Soil Cement	

STA. # 1+~~5~~45

Wgt. of Mold #13: 2006.2

Mold + Soil : 3962.9

Load PSI

5770 459

Wgt. Dish & air dried soil	244.8
wgt. Dish & oven dried soil	218.4
wgt. Moisture lost	26.4
dish no.	14
dish wgt.	47.3
wgt. Oven dried soil	171.1
percent hygro. Moisture	15.42957

Fly Ash	✓
Soil Cement	

STA. #	1 + 60

Wgt. of Mold #14 : 1998.8
Mold + Soil: 3960.0

Load	PSI
5745	457

Wgt. Dish & air dried soil	232.7
wgt. Dish & oven dried soil	212.4
wgt. Moisture lost	20.3
dish no.	15
dish wgt.	46.9
wgt. Oven dried soil	165.5
percent hygro. Moisture	12.26586

Fly Ash ☑

Soil Cement ☐

STA. # 1+75

Wgt. of Mold #15: 2037.4

Mold+Soil: 3955.8

Load	PSI
6685	532

Wgt. Dish & air dried soil	218.2
wgt. Dish & oven dried soil	195.7
wgt. Moisture lost	22.5
dish no.	16
dish wgt.	45.3
wgt. Oven dried soil	150.4
percent hygro. Moisture	14.96011

Fly Ash	✓
Soil Cement	

STA. # 1+~~90~~ 1+90

Wgt. of Mold #16: 2001.3

Mold+Soil: 3943.5

Load	PSF
6848	545

Wgt. Dish & air dried soil	2360.6
wgt. Dish & oven dried soil	2126
wgt. Moisture lost	24
dish no.	18
dish wgt.	46.5
wgt. Oven dried soil	166.1
percent hygro. Moisture	14.44913

Fly Ash ☑

Soil Cement ☐

STA. # 1+120

Wgt. of Mold #18: 2004.8

Mold+Soil: 3892.6

Load	PSI
9640	767

Wgt. Dish & air dried soil	241.6
wgt. Dish & oven dried soil	219.1
wgt. Moisture lost	22.5
dish no.	17
dish wgt.	47.5
wgt. Oven dried soil	171.6
percent hygro. Moisture	13.11189

Fly Ash	✓
Soil Cement	

STA. #	1+105

Wgt. of Mold #17: 2002.2
Mold + Soil: 3825.2

Load	PSI
6128	488

Wgt. Dish & air dried soil	212.0
wgt. Dish & oven dried soil	189.3
wgt. Moisture lost	22.7
dish no.	19
dish wgt.	49.15
wgt. Oven dried soil	140.15
percent hygro. Moisture	16.19693

Fly Ash	✓
Soil Cement	

STA. # 1+135

Wgt. of Mold #19: 2002.6

Mold + Soil: 3917.0

Load 8371

PSI 666

Wgt. Dish & air dried soil	235.0
wgt. Dish & oven dried soil	212.4
wgt. Moisture lost	22.6
dish no.	20
dish wgt.	47.3
wgt. Oven dried soil	165.1
percent hygro. Moisture	13.68867

Fly Ash	✓
Soil Cement	

STA. #	1+150

Wgt. of Mold #20 = 2003.3

Mold + Soil = 3905.6

Load PSI
8278 659

Appendix F

Approval Letter

Melinda L. McGrath
Deputy Executive Director/
Chief Engineer

Brenda Znachko
Deputy Executive Director/
Administration

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Larry L. "Butch" Brown
Executive Director

Steven K. Edwards
Director
Office of Intermodal Planning

Willie Huff
Director
Office of Enforcement

P. O. Box 1850 / Jackson, Mississippi 39215-1850 / Telephone (601) 359-7001 / FAX (601) 359-7110 / GoMDOT.com

April 9, 2010

Mr. Ben Franklin
Director of Technical Services
Headwaters Resources
180 Honey Hill Loop
Searcy, Arkansas 72143

RE: Approval of Red Hills Fly Ash as an Alternate for Soil Stabilization

Dear Mr. Franklin:

We are pleased to inform you that the Red Hills Fly Ash from Mississippi Power Company in Ackerman, Mississippi has been approved as an ***alternate for Class C and Class F Fly Ash for soil stabilization*** in accordance with Section 2.2.3, Fly Ash of the Materials Division Inspection, Testing, and Certification Manual. All distributions of applicable documents required must be made in accordance with the referenced procedures and signed by an authorized employee of Headwaters Resources.

Headwaters Resources Red Hills in Ackerman, Mississippi will be placed on our approved product list shortly. You may view our Approved Products List at www.goMDOT.com under the Business Section, Division Resources, and Materials. Please note that all related the test reports must state that the results meet MDOT specifications. In addition, shipments of fly ash must be made in accordance with Section 2.2.3.4.2 of our materials manual (attached).

We appreciate your making quality fly ash available for the Department's use and look forward to working with you. If you have any questions with regards to this matter, please contact me at (601) 359-1666.

Sincerely,

James A. Williams, III, P.E.
State Materials Engineer

CC: Central File (Battey)
District Engineers
District Materials Engineers
Lab File