EVALUATION OF
OPEN-GRADED FRICTION COURSE MIXTURE

LOUISIANA TRANSPORTATION RESEARCH CENTER
Technical Assistance Report Number 04-1TA

State Project No. 009-02-0018
US 71 Friction Course (CM)
Route US 71
Grant Parish

By

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October 2004

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Introduction

Open-graded friction course (OGFC) is a porous, gap-graded, predominantly single size aggregate bituminous mixture that contains a high percentage of air voids. The high air void content and the open structure of this mix promote the effective drainage of rainwater, which also minimizes hydroplaning during wet weather. This characteristic also reduces splash and spray behind vehicles and improves wet weather skid resistance. Other purported benefits of this type mix are lower pavement noise and reduced roadway glare during wet weather, which improves the night visibility of pavement markings.

OGFCs have been used throughout the United States since 1950 [1, 2]. Some state departments of transportation have reported good performance, but many others have reported poor performance [1, 2]. Louisiana first developed an OGFC in the late 1960s and early 1970s to provide a skid resistant surface [3, 4]. The open texture of the friction course reduced water spray and increased critical hydroplaning speeds. Louisiana's OGFC was developed prior to the initiation of the Federal Highway Safety Program Management Guide, Highway Safety Program 12, and Instructional Memorandum 211-3-73 of 1973 dealing with the establishment of a Skid Accident Reduction Program. Louisiana had already placed several OGFCs prior to the Instruction Memorandum. After receiving the Instructional Memorandum, the Louisiana Department of Transportation and Development (LADOTD) issued an Engineering Directive to use Plant Mix Seal (PMS) (used interchangeably with OGFC and asphaltic concrete friction course (ACFC)) on all roads with an ADT greater than 4,000. In 1980, the ADT limit was revised to require the friction course on all roads with an ADT greater than 3,000.

In late 1980, problems with the OGFCs were encountered. Many of these surfacings had reached their end-of-life, having lasted much longer than the original life expectancy of five years, typically 10 - 12 years. The end-of-life was signaled by severe raveling in the wheel paths due to oxidized asphalt binders and subsequent decrease in serviceability. This, in conjunction with numerous OGFC failures during the construction phase or shortly thereafter, led to a moratorium on its use.

Inspection of the failed construction projects and project records indicated that the problems encountered with the OGFC were related to moisture and temperature. The temperature problems were related to both mix and weather; the moisture problems were generally associated with a particular aggregate type. To address these issues, changes were made to the specifications, including a maximum moisture content for the aggregate, institution of a

construction season from May to September, and an increased minimum ambient air temperature. Based on these changes, the moratorium was lifted.

It should also be noted the design asphalt content of OGFCs was significantly decreased in 1979. This decrease in asphalt content along with the use of asphalt cements composed of base asphalt that oxidized rapidly contributed to all of these construction problems although it was not recognized at the time. Typical deterioration consisted of raveling in the wheel path.

In the next 1 ½ years, 12 OGFCs were placed without incidence. However, because the winters of 1982 and 1983 were extremely severe, the previously placed friction courses were reaching their end-of-life at approximately 8 to 11 years of age. Additionally, because of several oil boycotts and increases in the cost of crude, asphalt cement contents were reduced. In the beginning of 1984, with hundreds of miles of OGFC at end-of-life and raveling, a public and political uproar forced the imposition of a second moratorium which is still in effect today.

In 1984, a final experimental polymer modifying OGFC was placed on LA 48, Poydras-Reggio ten mile construction project. Two experimental sections (4 lane miles each) were constructed using a latex modified asphalt (similar to the current PG 70-22m) and an elastomeric polymer modified asphalt (similar to the current PG 76-22m). These sections were placed with an asphalt content 0.7 percent higher (similar to the 1960/70 binder levels) than the control sections with AC-30 which used the 1979 binder content. It was polymer modified asphalt along with fibers that permit additional asphalt creating greater film thickness and reduced draindown. Within one year the control sections raveled in the cross-overs and turn lanes; within two years the control sections had raveled in the inside and outside wheel paths. The polymer modified section was still performing without raveling when the entire project was rehabilitated circa 1999-2001. This 15-17 year lifespan is consistant with design models used today.

This paper documents Louisiana's first use of this type mix since the suspension of OGFC mixes in 1984.

Project Description

Figure 1 illustrates the project location, which is on US 71 in Grant Parish and begins 4.041 miles (Log Mile 4.041) north of the beginning of the control section (Rapides Parish line, SE of Rock Hill) and commences northward for 0.157 miles to its project ending limits (Log

Mile 4.198). This highway is 24 feet wide (2 12-foot travel lanes) with 2 10-foot improved hot mix shoulders. The contract was bid under State Project No. 009-02-0018 and was awarded to the low bidder, Diamond B. Construction Co., LLC. The work order date for this project was June 7, 2003, and the final inspection date was June 26, 2003. The OGFC was placed on June 15, 2003 and was completed in one day. The OGFC was placed at approximately three-fourths of an inch compacted thickness, and the area covered was minimal at 2181.30 square yards. Approximately 94.0 tons of OGFC was placed during construction. This project site was selected because District 08 wanted to improve the existing surface characteristics at this location, and the placement of the OGFC was applicable in this area.

Figure 1
Project Location

Materials

Asphalt Cement

An elastomeric type of polymer modified asphalt cement was specified for this project, meeting the LADOTD specification for PG76-22m. The PG76-22m asphalt cement was listed on QPL #41 and was supplied by Marlin Asphalt, LTD. The polymer modified asphalt

cement content was 6.6 percent as designed by the contractor, Diamond B. Construction Co., LLC.

Aggregates

The final aggregate blend, Design 2, was composed of 67.2 percent - #78 sandstone, Friction Rating I; 7.4 percent - #11 sandstone, Friction Rating I; and 18.7 percent - #89 siliceous limestone, Friction Rating III (see tables 1 and 2). The sandstone was supplied by Pine Bluff Sand & Gravel Co. (Source Code AB13). The limestone was supplied by Vulcan Material Company (Source Code AA50). The aggregates used complied with the requirements set forth in Subsection 1003.06(b) of the Standard Specifications.

Fibers

A mineral fiber in pellet form was added to the mix at a mix percentage of 0.1 by weight to protect against drain down. The fiber was supplied by Interfibe. The contract specifications required that drain down testing be conducted in accordance with Section 508 of the 2000 Edition of the Louisiana Standard Specifications [5] on the loose mix at a temperature 60°F (15°C) higher than normal mixing temperatures. A maximum drain down of 0.3 percent is required. The approved Job Mix Formula (JMF) indicated that the maximum drain down for the OGFC mixture tested was 0.08 percent using the minimum dosage of fiber specified.

Antistrip

The contractor was required to perform the Boil Test and modified Lottman test to evaluate the mixture's susceptibility to moisture damage. An Ad-Here LA 2 from Arr-Maz Products, Inc. was added at mix percentage of 0.6 by weight. The Lottman test was modified to require five freeze thaw cycles.

Tack Coat

The contractor elected to use the unmodified SS-1 emulsion for tack coat as allowed by Section 504 of the Standard Specifications [5]. The SS-1 emulsion was listed on QPL #41 and supplied by Asphalt Products Unlimited. The tack coat rate to be applied was 0.07 gallons/square yards, as required by the Special Provisions of the contract. The tack coat rate was not measured; however, the tack coat coverage was uniform and covered 100 percent of the existing dense graded asphalt surface, which was approximately 3 years old.

Open-graded Friction Course Mixture Design

The mix design procedures for this project were detailed in the Special Provisions of the contract. The specified OGFC design requirements followed the recommendations as outlined in the 2000 Edition of the Journal of the Association of Asphalt Paving Technologists (AAPT) [6]. The contractor was required to use approved PG76-22m asphalt cement complying with Section 1002 in the Standard Specifications and listed in QPL #41 [5]. It was further specified that the aggregates, coarse and fine, should be 100 percent crushed stone with a Friction Rating of I, thus complying with the requirements set forth in Subsection 1003.06(b) of the Standard Specifications [5]. A Cellulose fiber or mineral filler may also be used to ensure protection against drain down. Also, an anti-strip additive was required to prevent stripping. The OGFC Special Provisions of the contract and the approved JMF are in Appendix B and Appendix C, respectively.

During the mix design process, the contractor evaluated two designs. See tables 1 and 2. The first mixture design, Design 1, incorporated a blend of two sandstone gradations that subsequently failed during the Hamburg rut testing performed by LTRC. The samples obtained from the Design 1 mix disintegrated or fell apart during testing in the Hamburg. In the second mixture design, Design 2, the contractor was allowed to blend less than 25 percent of a #89 siliceous limestone meeting a Friction Rating III. The incorporation of the #89 stone was necessary to introduce some intermediate fine material into the design blend to ensure the stability of the mix during Hamburg rut testing. This particular aggregate was allowed because its availability facilitated the timely completion of the project. It should be noted that Design 2, which Diamond B. Construction Company selected as the JMF and submitted to LADOTD, was subsequently used to construct the OGFC layer.

The Design 1 and Design 2 mixtures were tested for rutting characteristics at LTRC utilizing the Precision Machine and Welding version of the Hamburg Type Wheel Tester. The designs were also tested for drainage characteristics using the Karol-Warner falling head permeability device. The Instrotek CoreLok device was also utilized for Bulk Specific Gravity of mix, G_{mb}, measurements for the compacted specimens.

Table 1 indicates the aggregates and additives used for each trial design of the OGFC mixture. The PG76-22m, fiber, and anti-strip rate remained constant in both mix designs. The only variations between both mix designs were the incorporation of the #89 siliceous limestone and the actual percentages of aggregate blended to achieve a composite blend.

Table 1
Composition of mix design blends

	Percentage		
Material	**Design 1**	**Design 2**	**Source**
#78 Sandstone, FR I	84.0	67.2	Pine Bluff Sand & Gravel
#11 Sandstone, FR I	9.3	7.4	Pine Bluff Sand & Gravel
#89 Limestone, FR III		18.7	Vulcan Materials
PG76-22m	6.6	6.6	Marlin Asphalt
Fibers	0.1	0.1	Interfibe
Ad-Here LA 2	0.6 by Wt. of AC	0.6 by Wt. of AC	Arr-Maz

Table 2 indicates the composite blend and mixture properties for the contractors' Design 1 and Design 2 composite blends. This table also presents the quality assurance (QA) data from the actual plant-produced mix during construction.

The LTRC gradation data indicated in table 2 are based on samples taken from the second truck during production. This data does not match the JMF or the District's QA data. The Design AC and Maximum Theoretical Specific Gravity, G_{mm}, however, correspond with the QA data. It is suspected that because the samples were acquired from the second truck, the hot mix plant had not had sufficient time to stabilize production. One hypothesis is that a purging of the bag house fines resulted in the finer gradation. The District's QA samples were acquired at a later time during production.

Table 2
Composite blends and mixture properties

	Percent Passing				
Sieve Size	**Design 1**	**Design 2**	**QA Data**	**LTRC 2nd Truck**	**Required Gradation**
3/4" (19mm)	100	100	100	100	100
1/2" (12.5mm)	90	92	93	91	85 - 100
3/8" (9.5mm)	58	64	68	66	55 - 75
No. 4 (4.75mm)	14	16	21	26	10 - 25
No. 8 (2.36mm)	9	8	11	18	5 - 10
No. 16 (1.18mm)	7	6	9	16	
No. 30 (.600mm)	6	5	8	15	
No. 50 (.300mm)	5	4	7	14	
No. 100 (.150mm)	3.8	3.4	6	10	
No. 200 (.075mm)	2.8	2.3	3.9	6.1	2 - 4
G_{mb}	1.916	2.173			
G_{mm}	2.374	2.368	2.381	2.389	
VCA	33.0	23.0			18
%Air Voids, AASHTO T166	19.3	8.2			
G_{sb}	2.558	2.604			
G_{se}	2.619	2.612			
P_{ba}	0.9	0.8			
P_{be}	5.9	6			
Permeability, ft/day	276	453			246
Permeability, ft/day LTRC Results	235	278			
Drain Down	0.08	0.08			0.3
Design AC	6.6	6.6	7.0	6.8	

Table 3 shows the rut measurements taken from the Precision Machine and Welding version of the Hamburg Type Wheel Tester (PMW Wheel Tracker). The PMW Wheel Tracker tests mixtures for rutting properties and moisture susceptibility. Samples pass if they attain no more than 6.0 mm of rutting after 20,000 passes of the PMW Wheel Tracker. Also, the PMW Wheel Tracker will stop the measurement process if the samples have attained more than 20.0 mm at 20,000 passes. Two samples each from mixture Design 1 and mixture Design 2 were subjected to these tests. The tests were conducted at 50 ºC. Both sets of samples were tested at 56 passes per minute. Prior to testing, the samples were submerged under water for 90 minutes at the required testing temperature. The rut depths indicated in table 3 are an average of the center 5 of 11 measuring points taken from each sample. The distance between each measuring point is approximately 1.14 inches. As indicated in table 3, Design 1 did not pass the required criteria, nor did it perform as well as Design 2. Design 2 had an average rut measurement of 3.32 mm after 20,000 passes.

Table 3
Rut measurements (mm)

Number of Passes	****Design 1**		**Design 2**	
	Sample #1	**Sample #2**	**Sample #1**	**Sample #2**
14,981	21.98			
4591		23.38		
	****Design 1 failed. Samples fell apart during testing or failed to make the 20,000 pass criteria.**			
20,000			3.50	3.14
			Average = 3.32	

Figures 2 and 3 are the graphical illustrations of the deformation under loading vs. number of passes for mixture designs 1 and 2 as tested in the PMW Wheel Tracker.

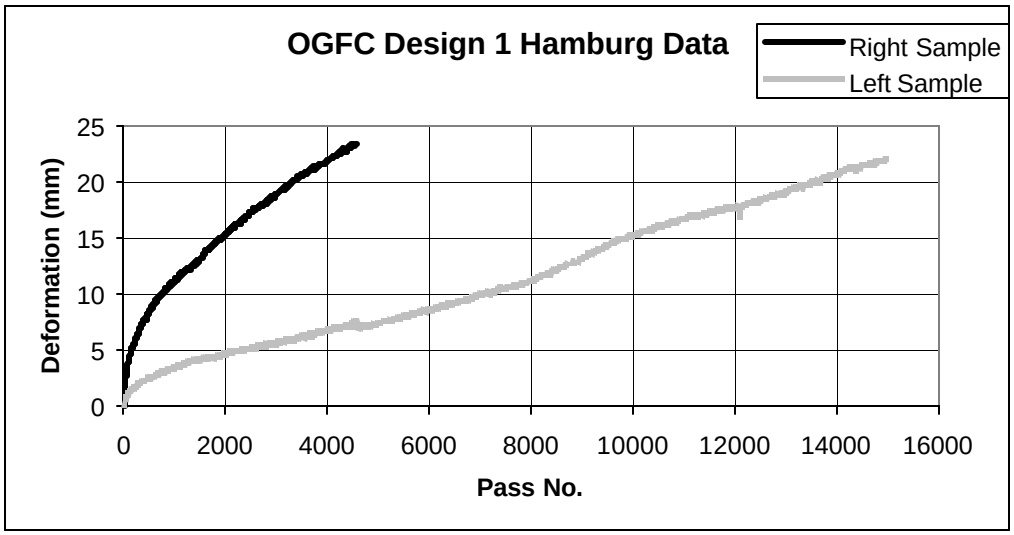


Figure 2
Mixture Design 1, rut measurements (mm) vs. number of passes

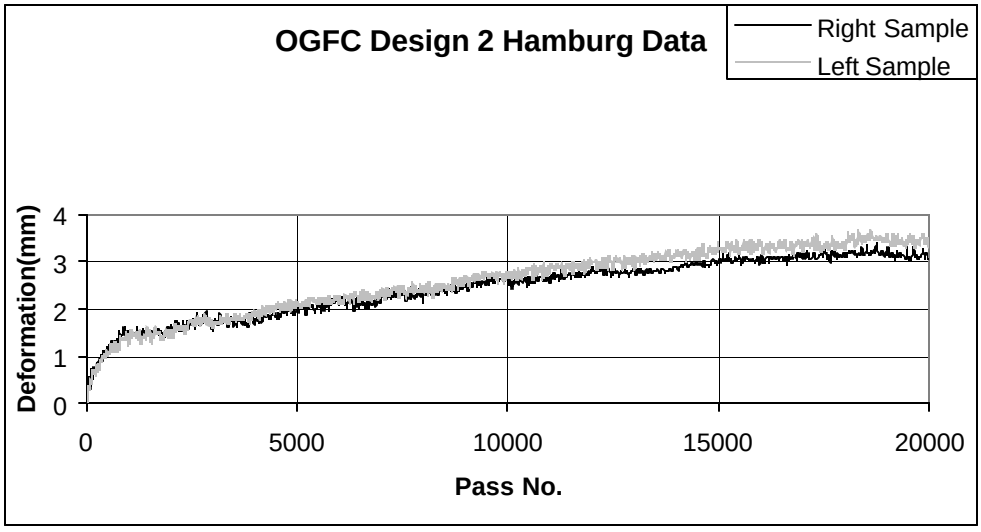


Figure 3
Mixture Design 2, rut measurements (mm) vs. number of passes

Table 4 is a comparison of the percent air voids of the contractor's mix Design 1, mix Design 2, and roadway cores as measured by the CoreLok device versus the contractor's results that were determined by AASHTO T166. It is noted that there is a considerable variance between

results. The percent air voids measured by the CoreLok device is significantly greater than the results determined by AASHTO T166.

Table 4
CoreLok vs. AASHTO T166 air voids

	Percent Air Voids					
	Design 1		Design 2		Roadway Cores	
Contractor's Results	**19.3**		**8.2**			
	Sample 1	**Sample 2**	**Sample 1**	**Sample 2**	**Core #1**	**Core #2**
LTRC (CoreLok)	19.4	27.6	14.3	13.8	16.7	17.6
Average	**23.5**		**14.0**		**17.1**	
LTRC (T166)					11.2	10.6
Average					**10.9**	

Table 5 is a comparison of permeability results between the contractor's mix Design 1, mix Design 2, LTRC-prepared samples based on the contractor's mix design blends, and roadway cores. LTRC prepared two samples for each design and obtained the average coefficient of permeability. The falling head permeability (K-value) of the OGFC mixtures was calculated based on Darcy's Law. Each sample was tested twice and the average was reported. Design 2 resulted in a higher coefficient of permeability because of the decrease in material passing the No. 200 sieve.

Table 5
Coefficient of permeability (feet/day)

	Coefficient of Permeability (feet/day)					
	Design 1		Design 2		Roadway Cores	
	Sample 1	**Sample 2**	**Sample 1**	**Sample 2**	**Sample 1**	**Sample 2**
LTRC Results	212.95	257.15	231.05	324.72	188.9	226.35
Average	**235**		**278**		**208**	
Contractor Results	**276**		**453**			

Profilograph

A smoothness specification was not required on this section of roadway because of the small quantity of material placed. The total length of the project paved was approximately 800 feet.

Cost

This project was estimated at $50,000 for the construction of the OGFC layer on the 0.157-mile stretch of a 2-lane, 12-feet wide roadway, (approximately 2,210 square yards). The low bid by Diamond B. Construction Co., LLC was $54,508.02. This bid included all items for project completion, i.e. striping, signs and barricades, mobilization, etc. The pay item for the OGFC was Item S-001, and it was paid for by the square yard at a unit price of $19.64/sq.yd. The quantity used to date was 2,181.30 square yards, which equates to a cost of $42,841. When this square yard cost value is converted to a price per ton of mix placed at a lift thickness of ¾" (~ 94.0 tons), it equates to approximately $455/ton. Therefore, this project does not have a sufficient quantity to do a proper evaluation of cost comparisons between hot mix and a specialty mix such as the OGFC. Based on a material square yard cost method, we would estimate a budget value of $3.00 to $3.50 per square yard for 10-mile-long projects.

COMMENTS

The high air void content and the open structure of this mix promoted the effective drainage of rainwater as intended. Since roadway drainage is enhanced, splash and spray behind vehicles should be reduced and ponding of water should be minimized, thus minimizing hydroplaning during wet weather. Future performance evaluations of the roadway will be performed.

Recommendations

OGFC's are recommended for immediate use to further enhance safety by improving roadway surface drainage, minimizing hydroplaning, reducing splash/spray and roadway glare, improving wet weather visibility and visibility of traffic markings.

Prior to full implementation use of OGFC's, it is recommended to construct at least one OGFC project in each District to familiarize LADOTD and industry with the OGFC specifications and mix design procedure.

References

1. Kandhal, P., and Mallick, R., "Open Graded Asphalt Friction Course: State of the Practice," National Center for Asphalt Technology Report No. 98-7, May 1998.

2. Mallick, R., Kandal, P., Cooley, Jr., L.A, and Watson, D., "Design, Construction, and Performance of New-Generation Open-Graded Friction Courses," National Center for Asphalt Technology Report No. 2000-01, April 2000.

3. Paul, H. R., "Louisiana Frictional Surfaces," Presentation at the Transportation Research Board, Washington, D.C., January 1989.

4. "Louisiana Standard Specification for Roads and Bridges," State of Louisiana, Department of Transportation and Development, Baton Rouge, 1977 Edition.

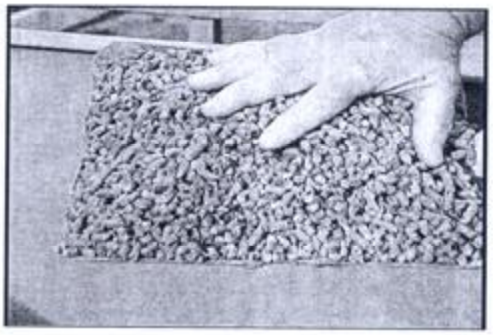
5. "Louisiana Standard Specification for Roads and Bridges," State of Louisiana, Department of Transportation and Development, Baton Rouge, 2000 Edition

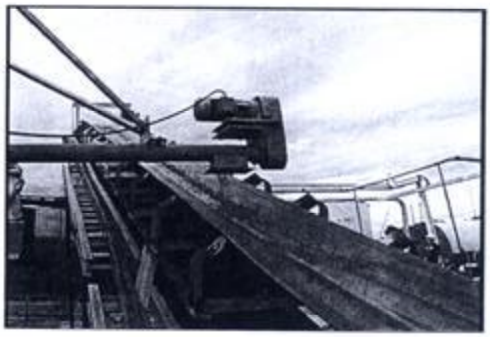
6. Mallick, R., Kandal, P., Cooley, Jr., L.A, and Watson, D., "Design, Construction, and Performance of New-Generation Open-Graded Friction Courses," Asphalt Paving Technology 2000, Journal of the Association of Asphalt Paving Technologists, vol. 69:pp. 391 – 423.

Appendix A

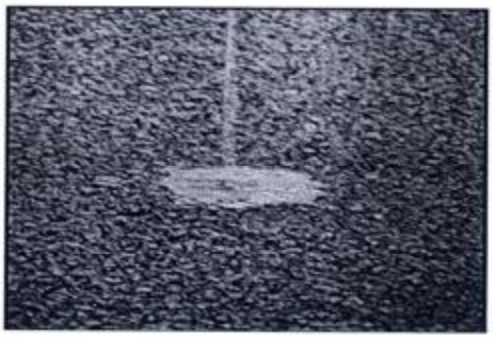
Hotmix Plant and Roadway Pictures

OGFC





OGFC



Appendix B

Contract Specifications

BY LRD DATE 4-24-03

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONTRACT

FOR

STATE PROJECT NO. 009-02-0018

US 71 OPEN GRADED FRICTION COURSE (CM)

ROUTE US 71

GRANT PARISH

DISTRICT 08

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONTRACT

This agreement, is made and executed in **TWO** original copies, between the Louisiana Department of Transportation and Development acting through its Secretary, hereafter designated as the "Department", and **Diamond B Construction Company, LLC**, hereafter designated as the "Contractor."

The Department did advertise for, receive and accept a bid from the Contractor for work on a Department construction project identified as,

State Project No. 009-02-0018, US 71 OPEN GRADED FRICTION COURSE (CM), US 71, GRANT PARISH, consisting generally of OPEN GRADED FRICTION COURSE, PAINTED TRAFFIC STRIPING, REFLECTORIZED RAISED PAVEMENT MARKERS, AND RELATED WORK ON US 71 IN GRANT PARISH.

The Contractor's submission is evidenced by a copy of the "Construction Proposal Signature and Execution Form" incorporated herein as part of the Contract Documents defined hereafter.

In consideration of the agreements herein contained, to be performed by the parties hereto and of the payments hereafter agreed to be made, it is mutually agreed by both parties that:

CONTRACT DOCUMENTS
The contract consists of the "Contract Documents" including but not limited to the following:

a. Agreement (This Instrument)
b. Construction Proposal Signature and Execution Form
c. Louisiana Standard Specifications for Road and Bridges, 2000 Edition (hereafter referred to as "2000 Standard Specifications")
d. Project Construction Proposal (Notice to Contractors, Special Provisions, Supplemental Specifications, Schedule of Items)
e. Plans
f. Plan revisions
g. **ZERO (0)** Addenda made or issued prior to receipt of bids
h. Payment, Performance and Retainage Bonds or Retainage Agreement

For these purposes, all of the provisions contained in the listed Contract Documents are incorporated herein by reference with the same force and effect as though said Contract Documents were herein set out in full. The Contract Documents are kept in the official file at the Department together with the acknowledgment of receipt correspondence signed by the Contractor.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONTRACT

INTENT OF CONTRACT
In accordance with the 2000 Standard Specifications and the Contract Documents, the Contractor agrees to the terms and requirements for the intent of the contract to provide all materials, equipment and labor and perform the work required to complete the project in a thorough and workmanlike manner, to the satisfaction of the appropriate official of the Department.

CONTRACT AMOUNT
The Contractor did submit as advertised with his (her) bid, a dollar value amount for each of the items designated in the construction proposal on the "Schedule of Items" and that the "Schedule of Items," attached hereto and incorporated herein as part of the Contract Documents, submitted by the contractor, establish that the total contract amount for this project is **FIFTY-FOUR THOUSAND, FIVE HUNDRED EIGHT AND 02/100 dollars ($54,508.02)**, as obtained by a summation of the product of the unit bid price submitted by the contractor for each item multiplied by the item quantity as estimated by the Department. The Contractor agrees to accept and the Department agrees to pay for the work at the prices stipulated in this contract in lawful money of the United States in a timely manner as set forth in the 2000 Standard Specifications.

CONTRACT TIME
The entire contract shall be completed in all details and ready for final acceptance within **FIFTEEN (15) WORKING** days. Performance of work on this contract shall begin on the date stipulated in the "Notice to Proceed" and shall be completed within the time specified in the Contract Documents, subject to such extensions as may be authorized.

ALTERATION OF CONTRACT
In accordance with the 2000 Standard Specifications and the Contract Documents, the Contractor agrees to the terms and requirements for alteration of the contract.

STIPULATED DAMAGES
Contractor agrees to the assessment of Stipulated Damages as provided in the Subsection 108.08 of the 2000 Standard Specifications as amended by the Contract Documents.

DAMAGE CLAIMS
Contractor acknowledges that he/she has reviewed and understands Subsection 107.17 of the 2000 Standard Specifications and specifically agrees to be bound by the terms and conditions thereof.

JOINT EFFORT
This Agreement shall be deemed for all purposes prepared by the joint efforts of the parties hereto and shall not be construed against one party or the other as a result of the preparation, drafting, submittal or other event of negotiation, drafting or execution of the Agreement.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONTRACT

This contract shall become effective on the date all parties hereto have signed the same.

Diamond B Construction Company, LLC
CONTRACTOR

72-0847970
(Federal Identification Number)

Jessica Byrd
Witness

Glynn Madere
Witness

By: Paul L. Bossier, Sr.
(Signature of Authorized Agent)

04-29-03
(Date)

BRYAN L BOSSIER SR., PRESI
(Typed or Printed Name and Title)

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

Susan Gauthier
Witness

Ray Dean
Witness

By: Wm Wayne Marchand
Wm. Wayne Marchand, P.E.
District Administrator, District 08

5-8-03
(Date)

CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM

THIS FORM, THE SCHEDULE OF ITEMS, AND THE PROPOSAL GUARANTY MUST BE COMPLETED AS INDICATED AND SUBMITTED TO THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (DOTD) TO CONSTITUTE A VALID BID

STATE PROJECT NO(S). 009-02-0018

FEDERAL AID PROJECT NO(S). N/A

NAME OF PROJECT US 71 FRICTION COURSE (CM)

I (WE) HEREBY CERTIFY THAT I (WE) HAVE CAREFULLY EXAMINED THE PROPOSAL, PLANS AND SPECIFICATIONS, INCLUDING ANY AND ADDENDA, AND THE SITE OF THE ABOVE PROJECT AND AM (ARE) FULLY COGNIZANT OF ALL PROPOSAL DOCUMENTS, THE MASTER COPY WHICH IS ON FILE AT DOTD HEADQUARTERS IN BATON ROUGE, LA., AND ALL WORK, MATERIALS AND LABOR REQUIRED THEREIN, AND AG TO PERFORM ALL WORK, AND SUPPLY ALL NECESSARY MATERIALS AND LABOR REQUIRED FOR SUCCESSFUL AND TIMELY COMPLETION OF ABOVE PROJECT AND TO ACCEPT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS ATTACHED HERI AND MADE A PART HEREOF MULTIPLIED BY THE ACTUAL QUANTITY OF UNIT OF MEASURE PERFORMED FOR EACH ITEM, AS AUDITED BY DO AS FULL AND FINAL PAYMENT FOR ALL WORK, LABOR AND MATERIALS NECESSARY TO COMPLETE THE ABOVE PROJECT, SUBJECT TO INCRE/ ONLY FOR PLAN CHANGES (CHANGE ORDERS) APPROVED BY THE DOTD CHIEF ENGINEER OR HIS DESIGNEE. THIS BID IS SUBMITTED ACCORDANCE WITH THE GENERAL BIDDING REQUIREMENTS IN THE CONSTRUCTION PROPOSAL AND ALL SPECIAL PROVISIONS, PLA SUPPLEMENTAL SPECIFICATIONS, AND THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES (2000 EDITION). I (V UNDERSTAND THAT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS MULTIPLIED BY THE ESTIMAT QUANTITY OF UNIT OF MEASURE FOR EACH ITEM, ALONG WITH ANY OTHER FACTORS SPECIFIED TO BE APPLICABLE SUCH AS CONSTRUCTI TIME AND/OR LANE RENTAL, SHALL BE THE BASIS FOR THE COMPARISON OF BIDS. I (WE) UNDERSTAND THAT THE SCHEDULE OF ITEMS MU CONTAIN UNIT PRICES WRITTEN OUT IN WORDS AND THAT THE SCHEDULE OF ITEMS SUBMITTED AS PART OF THIS BID IS ON THE FOR SUPPLIED BY DOTD IN THE BID PROPOSAL. MY (OUR) PROPOSAL GUARANTY IN THE AMOUNT SPECIFIED FOR THE PROJECT IS ATTACHED HERE AS EVIDENCE OF MY (OUR) GOOD FAITH TO BE FORFEITED IF THIS BID IS ACCEPTED BY DOTD AND I (WE) FAIL TO COMPLY WITH AN REQUIREMENT NECESSARY FOR AWARD AND EXECUTION OF THE CONTRACT, AS WELL AS, SIGN AND DELIVER THE CONTRACT AN PAYMENT/PERFORMANCE/RETAINAGE BOND AS REQUIRED IN THE SPECIFICATIONS.

NONCOLLUSION DECLARATION (APPLICABLE TO FEDERAL-AID PROJECTS)

I (WE) DECLARE UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE UNITED STATES AND THE STATE OF LOUISIANA THAT I (WE) HAVE NOT DIRECTLY OR INDIRECTLY, ENTERED INTO ANY AGREEMENT, PARTICIPATED IN ANY COLLUSION, OR OTHERWISE TAKEN ANY ACTION IN RESTRAINT OF FREE COMPETITIVE BIDDING IN CONNECTION WITH THE CONTRACT FOR THIS PROJECT NOR VIOLATED LA. R.S. 48:254.

BIDDER'S DBE GOAL STATEMENT (APPLICABLE TO DBE GOAL PROJECTS)

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS A DISADVANTAGED BUSINESS ENTERPRISE (DBE) GOAL PROJECT IN ACCORDANCE WITH THE DBE PROVISIONS OF THIS CONTRACT, THE BIDDER ASSURES DOTD THAT HE/SHE WILL MEET OR EXCEED THE DBE CONTRACT GOAL, OR IF THE BIDDER CANNOT MEET THE REQUIRED DBE GOAL, THE BIDDER ASSURES DOTD THAT HE/SHE HAS MADE AND CAN DOCUMENT GOOD FAITH EFFORTS MADE TOWARDS MEETING THE GOAL REQUIREMENT IN ACCORDANCE WITH THE CONTRACT AND DBE PROGRAM MANUAL INCORPORATED HEREIN BY REFERENCE.

THE APPARENT LOW BIDDER SHALL COMPLETE AND SUBMIT TO THE DOTD COMPLIANCE PROGRAMS OFFICE, FORM CS-6AAA AND ATTACHMENT(S) AND, IF NECESSARY, DOCUMENTATION OF GOOD FAITH EFFORTS MADE BY THE BIDDER TOWARD MEETING THE GOAL, WITHIN TEN BUSINESS DAYS AFTER THE OPENING OF BIDS FOR THIS PROJECT. RESPONSIVENESS OF INFORMATION SUPPLIED IN THIS SECTION OF THIS CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM IS GOVERNED BY THE DBE REQUIREMENTS INCLUDED WITHIN THE SPECIFICATIONS AND DBE PROGRAM MANUAL.

CERTIFICATION OF EMPLOYMENT OF LOUISIANA RESIDENTS TRANSPORTATION INFRASTRUCTURE MODEL FOR ECONOMIC DEVELOPMENT (TIME) PROJECTS (APPLICABLE TO TIME PROJECTS)

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS A TRANSPORTATION INFRASTRUCTURE MODEL FOR ECONOMIC DEVELOPMENT (TIME) PROJECT AS DEFINED IN ACT NO. 36 OF THE 1989 FIRST EXTRAORDINARY SESSION OF THE LEGISLATURE WHICH ENACTED PART V OF CHAPTER 7 OF SUBTITLE II OF TITLE 47 OF THE LOUISIANA REVISED STATUTES OF 1950, COMPRISED OF R.S. 47:820.1 THROUGH 820.6.

THE BIDDER CERTIFIES THAT AT LEAST 80 PERCENT OF THE EMPLOYEES EMPLOYED ON THIS TIME PROJECT WILL BE LOUISIANA RESIDENTS IN ACCORDANCE WITH LOUISIANA R.S. 47:820.3.

NON PARTICIPATION IN PAYMENT ADJUSTMENT (ASPHALT CEMENT AND FUELS) STATEMENT

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS BEING SUBJECT TO PAYMENT ADJUSTMENT FOR ASPHALT CEMENT AND/OR FUELS, THE BIDDER HAS THE OPTION OF REQUESTING EXCLUSION FROM SAID PAYMENT ADJUSTMENT PROVISIONS THAT ARE ESTABLISHED BY SPECIAL PROVISION ELSEWHERE HEREIN.

IF THE BIDDER DESIRES TO BE EXCLUDED FROM THESE PAYMENT ADJUSTMENT PROVISIONS,

THE BIDDER IS REQUIRED TO MARK HERE ☐

FAILURE TO MARK THIS BOX PRIOR TO BID OPENING WILL CONSTITUTE FORFEITURE OF THE BIDDER'S OPTION TO REQUEST EXCLUSION.

STATE PROJECT NO(S). 009-02-0018

BIDDER SIGNATURE REQUIREMENTS (APPLICABLE TO ALL PROJECTS)

THIS BID FOR THE CAPTIONED PROJECT IS SUBMITTED BY:

Diamond B Construction Company, LLC
Name of Principal (Individual, Firm, Corporation, or Joint Venture)

If Joint Venture, Name of First Partner

If Joint Venture, Name of Second Partner

12487
(Louisiana Contractor's License Number of Bidder or First Partner to Joint Venture)

(Louisiana Contractor's License Number of Second Partner to Joint Venture)

5796 Bond Ball Drive
(Business Street Address)

(Business Street Address)

Alexandria LA 71302
(Business Mailing Address, if different)

P.O. Box 7177
Alexandria LA 71306

(Business Mailing Address, if different)

(318) 443-5686
(Area Code and Telephone Number of Business)

(Area Code and Telephone Number of Business)

(318) 443-5686 Andy Turner
(Telephone Number and Name of Contact Person)

(318) 443-4643
(Telecopier Number, if any)

(Telephone Number and Name of Contact Person)

(Telecopier Number, if any)

ACTING ON BEHALF OF THE BIDDER, THIS IS TO ATTEST THAT THE UNDERSIGNED DULY AUTHORIZED REPRESENTATIVE OF THE ABOVE CAPTIONED FIRM, CORPORATION OR BUSINESS, BY SUBMISSION OF THIS BID, AGREES AND CERTIFIES THE TRUTH AND ACCURACY OF ALL PROVISIONS OF THIS PROPOSAL, INCLUSIVE OF THE REQUIREMENTS, STATEMENTS, DECLARATIONS AND CERTIFICATIONS ABOVE AND IN THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY. EXECUTION AND SIGNATURE OF THIS FORM AND SUBMISSION OF THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY SHALL CONSTITUTE AN IRREVOCABLE AND LEGALLY BINDING OFFER BY THE BIDDER.

(Signature)

Bryan L. Bossier, Sr.
(Printed Name)

President
(Title)

April 17, 2003
(Date of Signature)

(Signature)

(Printed Name)

(Title)

(Date of Signature)

CONTRACTOR'S TOTAL BASE BID $ 54,508.02

IT IS AGREED THAT THIS TOTAL, DETERMINED BY THE BIDDER, IS FOR PURPOSES OF OPENING AND READING BIDS ONLY, AND THAT THE LOW BID FOR THIS PROJECT WILL BE DETERMINED FROM THE EXTENSION AND TOTAL OF THE BID ITEMS BY DOTD.

CS-14AA
04/01

ISSUED FOR BID
APR 17 2003

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PAYMENT, PERFORMANCE, AND RETAINAGE BONDS

Be it known that Diamond B Construction Company, LLC, as Principal, and Hartford Accident and Indemnity Company, and _____, as Surety(ies), authorized to do business in Louisiana, hereby bind themselves, in solido, to The Louisiana Department of Transportation and Development, and other potential claimants, for all obligations incurred by the Principal under its contract for the construction of **STATE PROJECT NO. 009-02-0018, US 71 OPEN GRADED FRICTION COURSE (CM), US 71, GRANT Parish,** in the full contract amount of **FIFTY-FOUR THOUSAND, FIVE HUNDRED EIGHT AND 02/100 DOLLARS ($ 54,508.02).** The obligations of the Principal and Surety under these payment, performance, and retainage bonds shall continue in full force and effect until all materials, equipment, and labor have been provided, AND all requirements contained in the contract, plans, and specifications have been completed in a timely, thorough, and workmanlike manner. The parties acknowledge that these bonds are given under the provisions and limitations contained in La. R.S. 48:250 et seq.

By this instrument(s), the Principal and Surety(ies) specifically bind themselves, their heirs, successors, and assigns, in solido, under the following bonds:

PAYMENT BOND. To the Louisiana Department of Transportation and Development and all "Claimants," as defined in La. R.S. 48:256.5 in the full contract amount of **FIFTY-FOUR THOUSAND, FIVE HUNDRED EIGHT AND 02/100 DOLLARS ($54,508.02)**, in order to secure the full and timely claims under the project. The parties agree this bond is statutory in nature and governed by La. R.S. 48:256.3.

Claims pursuant to La. R.S. 48:256.5 shall be made to the Undersecretary, DOTD, Headquarters Administration Building, Rm 226, 1201 Capitol Access Road, Baton Rouge, LA 70802.

PERFORMANCE BOND. To the Louisiana Department of Transportation and Development in the full contract amount of **FIFTY-FOUR THOUSAND, FIVE HUNDRED EIGHT AND 02/100 DOLLARS ($54,508.02)**, in order to secure the full and faithful performance and timely completion of the project according to its plans and specifications, inclusive of overpayments to the contractor and stipulated damages as assessed.

RETAINAGE BOND. To the Louisiana Department of Transportation and Development in the full sum of **Ten percent (10%)** of the contract amount, in lieu of the sums required to be withheld from progress payments under the provisions of La. R.S. 48:256.1, inclusive of overpayments to the contractor and stipulated damages as assessed.

CONTRACTOR OPTION: RETAINAGE

I, Principal, elect to exercise my option to have ten percent retainage withheld from all payments in lieu of the above retainage bond.

By: _____
Principal

8/01
Form CS-16A

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PAYMENT, PERFORMANCE, AND RETAINAGE BONDS

In witness whereof we have signed this instrument as dated.

Jessica Byrd
Witness

By Ryan V. Bossier Sr.
Principal

04-29-0
Date

Glynn McAdoo
Witness

BRYAN L. BOSSIER SR., PRESIDENT/CEO
Typed or Printed Name and Title

Hartford Accident and Indemnity Company
Surety

Kristen Fallo
Witness

By J. Dale Gault
Attorney-in-Fact (Seal)

5/01/20
Date

Neil A. Ford
Witness

J. DALE GAULT, LIC. #96317
HIBERNIA INSURANCE CONSTRUCTION
P. O. BOX 66068
BATON ROUGE, LA 70896-6068
Address

Surety

Witness

By
Attorney-in-Fact (Seal)

Date

Witness

Typed or Printed Name

A copy of the contract and subsequent correspondence/communication from LA DOTD or the contracting agency with respect to the contract bonds should be directed to:

(FOR SURETY 1)

Hartford Accident and Indemnity Company
Bonding Agency or Company Name

J. Dale Gault
Local Agent or Representative

J. DALE GAULT, LIC. #96317
HIBERNIA INSURANCE CONSTRUCTION
P. O. BOX 66068
BATON ROUGE, LA 70896-6068
Address

Phone Number

Fax Number

(FOR SURETY 2)

Bonding Agency or Company Name

Local Agent or Representative

Address

Phone Number

Fax Number

8/01
Form CS-16AA

10

POWER OF ATTORNEY

THE HARTFORD
HARTFORD PLAZA
HARTFORD, CONNECTICUT 06115

[X]	Hartford Fire Insurance Company		Twin City Fire Insurance Company
[X]	Hartford Casualty Insurance Company		Hartford Insurance Company of Illinois
[X]	Hartford Accident and Indemnity Company		Hartford Insurance Company of the Midwest
[ ]	Hartford Underwriters Insurance Company		Hartford Insurance Company of the Southeast

KNOW ALL PERSONS BY THESE PRESENTS THAT the *Hartford Fire Insurance Company, Hartford Accident and Inden Company* and *Hartford Underwriters Insurance Company*, corporations duly organized under the laws of the State of Connecticut; *Har Insurance Company of Illinois*, a corporation duly organized under the laws of the State of Illinois; *Hartford Casualty Insurance Comp Twin City Fire Insurance Company* and *Hartford Insurance Company of the Midwest*, corporations duly organized under the laws of State of Indiana; and *Hartford Insurance Company of the Southeast*, a corporation duly organized under the laws of the State of Flo having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute appoint, ***up to the amount of unlimited:***

J. Dale Gault, Charles E. Riddle, Brenda Ann Riddle, Henry Luckett Marye, Jr.
of
Baton Rouge, LA

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety only as delineated above by [X], and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other wr instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceed allowed by law.

In Witness Whereof, and as authorized by a Resolution of the Board of Directors of the Companies on September 12th, 2 the Companies have caused these presents to be signed by its Assistant Vice President and its corporate seals to be hereto affixed, attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies he unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.

Paul A. Bergenholtz, Assistant Secretary

John P. Hyland, Assistant Vice President

STATE OF CONNECTICUT }
COUNTY OF HARTFORD } ss. Hartford

On this 19th day of September, 2000, before me personally came John P. Hyland, to me known, who being by me duly sworn depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Assistant Vice President of the Compar the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the s affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporat and that he signed his name thereto by like authority.

CERTIFICATE

Jean H. Wozniak
Notary Public
My Commission Expires June 30, 2004

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of .

Signed and sealed at the City of Hartford.

Colleen Mastroianni, Assistant Vice President

Obligee's/*Insured's Name*
Diamond B Construction Co., L.L.C.
Obligee's/Insured's Mailing Address
P.O. Box 7618 Alexandria, LA 71306
Bond/Policy Number
43BCSCD1707

IMPORTANT NOTICE TO OBLIGEES/POLICYHOLDERS – TERRORISM RISK INSURANCE ACT OF 2002

You are hereby notified that, under the Terrorism Risk Insurance Act of 2002, effective Novemb 26, 2002, we must make terrorism coverage available in your bond/policy. However, the act coverage provided by your bond/policy for acts of terrorism, as is true for all coverages, is limit by the terms, conditions, exclusions, limits, other provisions of your bond/policy, a endorsements to the bond/policy and generally applicable rules of law.

Any terrorism coverage provided by this bond/policy is partially reinsured by the United States America under a formula established by Federal Law. Under this formula, the United States pay 90% of covered terrorism losses exceeding a statutorily-established deductible paid sureties/insurers until such time as insured losses under the program reach $100 billion. If t occurs, Congress will determine the procedures for, and the source of, any payments for losses excess of $100 billion.

The premium charge that has been established for terrorism coverage under this bond/policy is either shown on this form or elsewhere in the bond/policy. If there is no premium shown for terrorism on this form or elsewhere in the bond/policy, there is no premium for the coverage.

Terrorism premium:	$0

ITEM S-001, OPEN GRADED FRICTION COURSE (03/03): This item consists of furnishing and constructing an Open Graded Friction Course in accordance with plan details, and these specifications.

General: This thin surface asphaltic concrete overlay material is intended to resist permanent deformation, reduce overspray by moving water freely through the layer and improve friction while providing a 10 year maintenance surface. This material shall be placed in thicknesses shown on the plans, otherwise the thickness shall be 3/4 inch (19 mm) minimum and 2.0 inch (50 mm) maximum.

Materials: Materials shall comply with the following:

(a) Asphalt Binder: The asphalt binder shall be PG 76-22m asphalt cement complying with Section 1002 and listed on QPL 41.

(b) Aggregate: Aggregates shall be 100% crushed stone, with a Friction Rating of I complying with the requirements of Subsection 1003.06(b), except that aggregate gradation shall be as follows:

Aggregate Gradation

US Sieve (Metric)	Percent Passing
3/4 inch (19 mm)	100
1/2 inch (12.5 mm)	85-100
3/8 inch (9.5 mm)	55-75
No. 4 (4.75 mm)	10-25
No. 8 (2.36 mm)	5-10
No. 200 (75 µm)	2-4

(c) Fiber: Cellulose fiber or mineral fiber when required shall comply with Section 508 and will be required to assure protection against draindown.

(d) Anti-strip: Anti-strip shall comply with Subsection 1002.02 and be applied according to Section 502.

(e) Tack Coat: The tack coat shall conform to Section 504 and shall be applied at a minimum rate of 0.07 gallons per square yard (0.32 L/sq m).

Equipment: Equipment shall conform to Section 503.

Design Procedure: The contractor shall provide the required mixture using the following design procedures:

1. Select three trial blends of aggregate within the specification bands above.
2. Determine dry-rodded voids in coarse aggregate, plus No. 4 (4.75 mm) sieve, of the coarse aggregate fraction (VCA_{DR})
3. Add between 6 percent to 6.5 percent asphalt to each trial blend and compact to 50 gyrations of a Superpave gyratory compactor.

(Note: At this stage of design, fiber should be added at manufacturer's recommended rate. Fibers are required when draindown is observed, typical rates are 0.2 percent to 0.5 percent.)

4. Determine the voids in the coarse aggregate, VCA, for each compacted mix.
5. VCA must be equal to or less than the VCA_{DR} (this indicates stone on stone contact).
6. Select the trial gradation that produces stone on stone contact and a minimum 22 percent VCA.

7. Using selected design from Step 6, prepare two additional mixtures using 0.5 percent and 1.0 percent additional asphalt content and compact using 50 gyrations of the Superpave gyratory compactor.

8. Conduct draindown test in accordance with Section 508 on the loose mix at a temperature 60°F (15°C) higher than normal mixing temperatures. (A maximum draindown of 0.3 percent is required.)

9. Conduct laboratory permeability test described in ASTM PS 129, 246 feet/day (75 m/day) minimum is desired.

10. Report each step of the procedure. The report must show that the selected design meets draindown, VCA of 18 percent minimum and a minimum of 246 feet/day (75 m/day) permeability.

11. Perform boil test and Lottman test. The Lottman moisture sensitivity test, in accordance with AASHTO T 283, is modified to require 5 freeze/thaw cycles and the retained tensile strength, TSR, shall be 80 percent. A minimum of 90 percent coating is required for the boil test.

12. District Lab Engineer shall review and approve the design, verifying the aggregate gravities.

Plant Validation and Quality Assurance Test: The validation lot is defined as the first four hours of production. Validation requires that the mixtures meet the minimum design criteria excluding Lottman and shall be based on the average of a minimum of two samples. Subsequent validation trials shall be limited to 500 tons (500 Mg) per day.

One set of plant Lottman tests shall be made during validation and reported within one week of production for verification.

A production lot is defined as the material produced in one day.

Two random acceptance samples shall be taken each day and the average shall be reported and shall meet the following:

Gmm, maximum specific gravity ±0.020 from validation target;

VCA, 18 percent minimum; after 50 gyrations of a Superpave gyratory compactor.

Draindown; 0.3 percent;

Boil Test; 90 percent coated

Percent AC, meter; (±0.2 percent from design target)

Permeability; Validation only or when requested by the engineer.

Acceptance pay will be based on the percent deviations from the job mix formula tolerances for the lowest of the pay sieves listed below.

US Sieve (Metric)	100% pay	95% pay	90% pay	50% pay or remove
No. 4 (4.75 mm)	±4%;	±4.1 to 6.0%	±6.1 to 8.0%	>8.0%
No. 8 (2.36 mm)	±3%	±3.1 to 5.0%	±5.1 to 7.0%	>7.0%

Weather Limitations: Weather limits shall comply with Section 502 except that the surface temperature shall be a minimum of 60°F (15°C) and air temperatures must be 60°F (15°C) and rising.

7. Using selected design from Step 6, prepare two additional mixtures using 0.5 percent and 1.0 percent additional asphalt content and compact using 50 gyrations of the Superpave gyratory compactor.

8. Conduct draindown test in accordance with Section 508 on the loose mix at a temperature 60°F (15°C) higher than normal mixing temperatures. (A maximum draindown of 0.3 percent is required.)

9. Conduct laboratory permeability test described in ASTM PS 129, 246 feet/day (75 m/day) minimum is desired.

10. Report each step of the procedure. The report must show that the selected design meets draindown, VCA of 18 percent minimum and a minimum of 246 feet/day (75 m/day) permeability.

11. Perform boil test and Lottman test. The Lottman moisture sensitivity test, in accordance with AASHTO T 283, is modified to require 5 freeze/thaw cycles and the retained tensile strength, TSR, shall be 80 percent. A minimum of 90 percent coating is required for the boil test.

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Boil Test; 90 percent coated

Percent AC, meter; (±0.2 percent from design target)

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No. 8 (2.36 mm)	±3%	±3.1 to 5.0%	±5.1 to 7.0%	>7.0%

Weather Limitations: Weather limits shall comply with Section 502 except that the surface temperature shall be a minimum of 60°F (15°C) and air temperatures must be 60°F (15°C) and rising.

Placement and Compaction: Mixture shall be placed to plan thicknesses and compacted immediately after placement without excessive breakage of aggregate. Two or three passes of a vibratory roller is typical. Newly constructed sections shall be protected until it has cooled enough to develop sufficient strength to hold traffic.

Roadway Inspection and Smoothness Requirements: The inspector will record the average paver screed height settings every hour and will also report the yield hourly by adding the tons reported on the weigh tickets and dividing by the area placed. Smoothness will be measured before construction starts and again after each day of construction. The smoothness measurement after construction shall not exceed the measured smoothness before construction.

Measurement: Open Graded Friction Course will be measured per square yard (sq m). The quantities for payment will be the design quantities specified in the plans, based on horizontal dimensions, and adjustments thereto.

Payment: Payment for Open Graded Friction Course will be made on the accepted quantity at the contract unit price per square yard (sq m) subject to the acceptance payment adjustments contained herein.

Payment will be made under:

Item S-001, Open Graded Friction Course, per square yard (sq m).

F-1

STANDARD PLANS TO BE USED ON THIS PROJECT

STD. PLN.	DATED
HS-01	9-14-94
PM-01	01-21-98

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION
AND DEVELOPMENT

PLAN OF PROPOSED

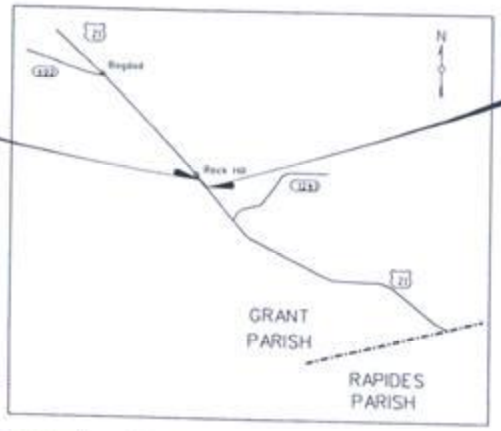
STATE HIGHWAY

S. P. NO.	PARISH	SHEET NUMBER
009-02-0018	Grant	1

STATE PROJECT No. 009-02-0018
US 71 FRICTION COURSE (CM)
GRANT PARISH
US 71

C.S. LOG MILE 4.198
STA. 26+75.00
END. S.P. No. 009-02-0018

C.S. LOG MILE 4.041
STA. 18+45.00
BEG. S.P. No. 009-02-0018



STATE OF LOUISIANA
RODNEY J. CHOATE
REG. No. 23248
REGISTERED
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

9-4-03

9-27-03

TRAFFIC DATA
1998 A.D.T. - 2393

TOTAL PROJ. LENGTH: 0.157 miles

TYPE OF CONSTRUCTION:
Open Graded Friction Course, pavement markings.

The 2000 Louisiana DOTD Standard Specifications for Roads and Bridges, as amended by the project specifications, shall govern on this project.

Date	Revision	Date	Recommended	Date	Approved

APPROVED BY
DISTRICT ADMINISTRATOR

DATE

State Project No.	Parish	Sheet No.
009-02-0018	Grant	2

DESIGN CONCEPT

PROJECT LOCATION AND LIMITS

This project is located on US 71 just south of Rock Hill. It begins at station 18+45, which is located 615' north of mile marker 85. It proceeds northward along US 71 for 0.157 mile. The project ends at station 26+75.

EXISTING ROADWAY

The existing roadway is a 24 ft. wide travelway with paved shoulders. The existing surfacing on the travelway is asphaltic concrete over stabilized base. Shoulders are 10' width asphaltic concrete over a soil cement base.

PROPOSED ROADWAY

Plan intent is to place an open graded friction course on the existing travelway.

MISCELLANEOUS WORK

Additional work will consist of replacing the existing roadway markings (painted) and reflectorized markers.

F-2

State Project No.	Parish	Sheet No.
009-02-0018	Grant	3

GENERAL NOTES

Sheet 1 of 1

1) **GENERAL REQUIREMENTS FOR "CM" PROJECTS:**

The total funding for this contract is fixed, and cost cannot overrun. The Engineer may adjust quantities of work herein to remain on budget.

2) **ITEM 713-01, TEMPORARY SIGNS AND BARRICADES:**

The "Do Not Pass" and "Pass With Care" signs will be erected at the same time as the advance warning signs for the project.

F-3

Surfacing

State Project No.	Parish	Sheet
009-02-0018	Grant	4

Sheet 1 of 1

STA.	STA.	DESCRIPTION	Length (ft.)	ITEM S-001 Open Graded Friction Course Width (ft.)	(Square yards)
18+45	26+75	Travelway	830.0	24.0	2213
					-
					-
					-
					-
					-
					-
					-
					-
					-
					-
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					-
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					-
					-
					-
					-
					-
					-
					-
					-
				Sub Total	2213
				Column Total	2213
				Project Total	2213

F-4

State Project No.	Parish	Sheet No.
009-02-0018	Grant	5

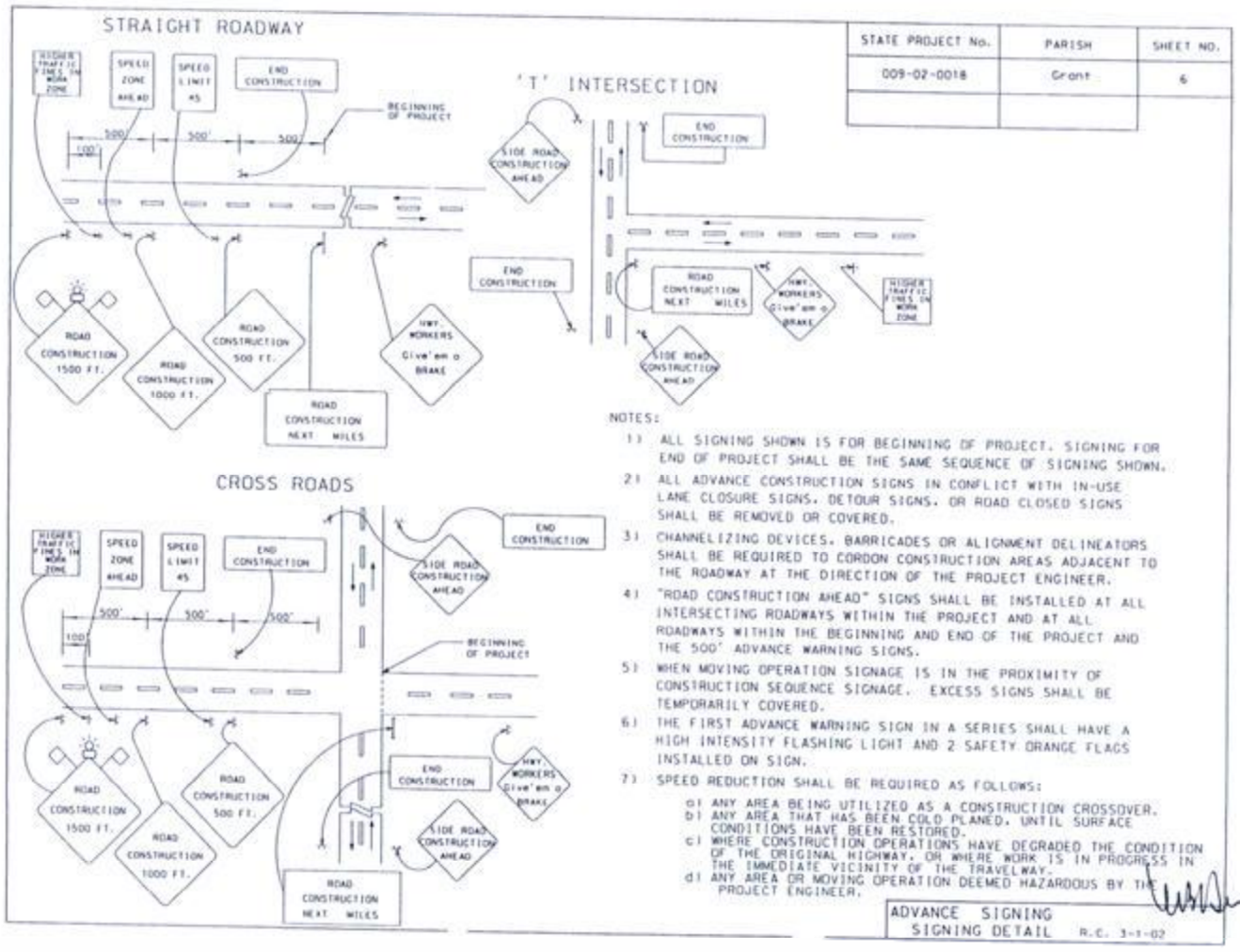
Summary Of ~~Estimated~~ Final Quantities

Sheet 1 of 1

ITEM NO.	ITEM NAME	UNIT	QUANTITY	
713-01	Temporary Signs and Barricades	Lump	Lump	
727-01	Mobilization	Lump	Lump	
731-02	Reflectorized Raised Pavement Markers	Ea.	~~21~~	
737-01-A	Painted Traffic Striping (Solid Line)(4" Width)	Mi.	~~0.519~~	0.432
737-02-A	Painted Traffic Striping (Broken Line)(4" Width)	Mi.	0.104	0.157
S-001	Open Graded Friction Course	Sq. Yd.	~~2215~~	2115

F-5

F-6

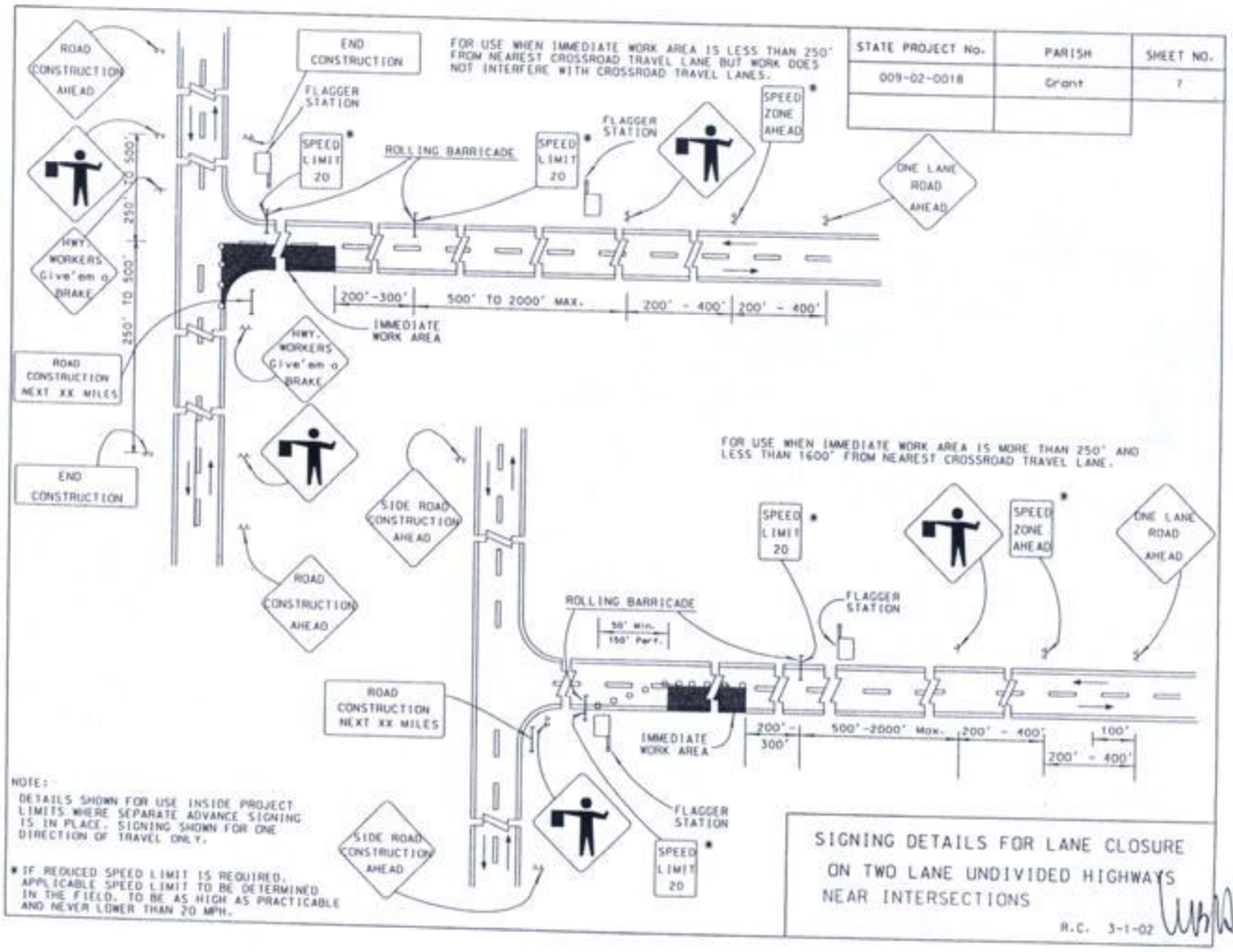


STATE PROJECT No.	PARISH	SHEET NO.
009-02-0018	Grant	6

NOTES:

1) ALL SIGNING SHOWN IS FOR BEGINNING OF PROJECT. SIGNING FOR END OF PROJECT SHALL BE THE SAME SEQUENCE OF SIGNING SHOWN.
2) ALL ADVANCE CONSTRUCTION SIGNS IN CONFLICT WITH IN-USE LANE CLOSURE SIGNS, DETOUR SIGNS, OR ROAD CLOSED SIGNS SHALL BE REMOVED OR COVERED.
3) CHANNELIZING DEVICES, BARRICADES OR ALIGNMENT DELINEATORS SHALL BE REQUIRED TO CORDON CONSTRUCTION AREAS ADJACENT TO THE ROADWAY AT THE DIRECTION OF THE PROJECT ENGINEER.
4) "ROAD CONSTRUCTION AHEAD" SIGNS SHALL BE INSTALLED AT ALL INTERSECTING ROADWAYS WITHIN THE PROJECT AND AT ALL ROADWAYS WITHIN THE BEGINNING AND END OF THE PROJECT AND THE 500' ADVANCE WARNING SIGNS.
5) WHEN MOVING OPERATION SIGNAGE IS IN THE PROXIMITY OF CONSTRUCTION SEQUENCE SIGNAGE, EXCESS SIGNS SHALL BE TEMPORARILY COVERED.
6) THE FIRST ADVANCE WARNING SIGN IN A SERIES SHALL HAVE A HIGH INTENSITY FLASHING LIGHT AND 2 SAFETY ORANGE FLAGS INSTALLED ON SIGN.
7) SPEED REDUCTION SHALL BE REQUIRED AS FOLLOWS:
   a) ANY AREA BEING UTILIZED AS A CONSTRUCTION CROSSOVER.
   b) ANY AREA THAT HAS BEEN COLD PLANED, UNTIL SURFACE CONDITIONS HAVE BEEN RESTORED.
   c) WHERE CONSTRUCTION OPERATIONS HAVE DEGRADED THE CONDITION OF THE ORIGINAL HIGHWAY, OR WHERE WORK IS IN PROGRESS IN THE IMMEDIATE VICINITY OF THE TRAVELWAY.
   d) ANY AREA OR MOVING OPERATION DEEMED HAZARDOUS BY THE PROJECT ENGINEER.

ADVANCE SIGNING
SIGNING DETAIL R.C. 3-1-02

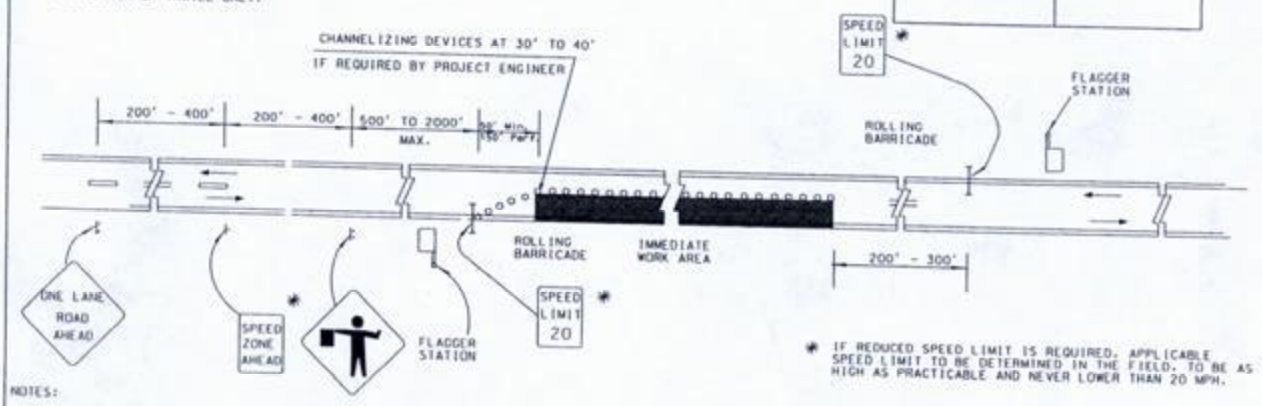

ROAD CONSTRUCTION AHEAD
END CONSTRUCTION
FLAGGER STATION
SPEED LIMIT 20
ROLLING BARRICADE
SPEED LIMIT 20
FLAGGER STATION
SPEED ZONE AHEAD
ONE LANE ROAD AHEAD
HWY. WORKERS Give'em a BRAKE
250' TO 500'
250' TO 500'
200'-300'
500' TO 2000' MAX.
200' - 400'
200' - 400'
IMMEDIATE WORK AREA
HWY. WORKERS Give'em a BRAKE
ROAD CONSTRUCTION NEXT XX MILES
END CONSTRUCTION
SIDE ROAD CONSTRUCTION AHEAD
ROAD CONSTRUCTION AHEAD
FOR USE WHEN IMMEDIATE WORK AREA IS MORE THAN 250' AND LESS THAN 1600' FROM NEAREST CROSSROAD TRAVEL LANE.
SPEED LIMIT 20
SPEED ZONE AHEAD
ONE LANE ROAD AHEAD
ROLLING BARRICADE
50' Min.
150' Pref.
FLAGGER STATION
ROAD CONSTRUCTION NEXT XX MILES
IMMEDIATE WORK AREA
200' - 300'
500'-2000' Max.
200' - 400'
100'
200' - 400'
FLAGGER STATION
SPEED LIMIT 20
SIDE ROAD CONSTRUCTION AHEAD
NOTE:
DETAILS SHOWN FOR USE INSIDE PROJECT LIMITS WHERE SEPARATE ADVANCE SIGNING IS IN PLACE. SIGNING SHOWN FOR ONE DIRECTION OF TRAVEL ONLY.
* IF REDUCED SPEED LIMIT IS REQUIRED, APPLICABLE SPEED LIMIT TO BE DETERMINED IN THE FIELD. TO BE AS HIGH AS PRACTICABLE AND NEVER LOWER THAN 20 MPH.
FOR USE WHEN IMMEDIATE WORK AREA IS LESS THAN 250' FROM NEAREST CROSSROAD TRAVEL LANE BUT WORK DOES NOT INTERFERE WITH CROSSROAD TRAVEL LANES.
STATE PROJECT No.
PARISH
SHEET NO.
009-02-0018
Grant
7
SIGNING DETAILS FOR LANE CLOSURE ON TWO LANE UNDIVIDED HIGHWAYS NEAR INTERSECTIONS
R.C. 3-1-02

F-7

F-8

STATE PROJECT No.	PARISH	SHEET NO.
009-02-0018	Grant	8

NOTE:
DETAILS SHOWN FOR USE INSIDE PROJECT LIMITS WHERE SEPARATE ADVANCE SIGNING IS IN PLACE. SIGNING SHOWN FOR ONE DIRECTION OF TRAVEL ONLY.



* IF REDUCED SPEED LIMIT IS REQUIRED, APPLICABLE SPEED LIMIT TO BE DETERMINED IN THE FIELD, TO BE AS HIGH AS PRACTICABLE AND NEVER LOWER THAN 20 MPH.

NOTES:

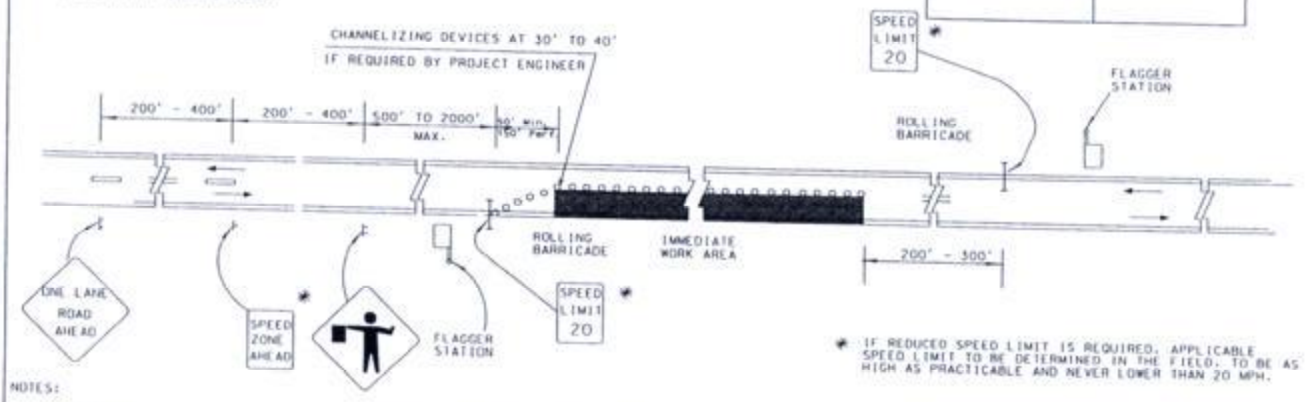
1) FLAGGER STATION SHALL BE LOCATED SUCH THAT AT ALL TIMES FLAGGER WILL BE CLEARLY VISIBLE TO MOTORISTS FROM A DISTANCE OF AT LEAST 500 FT.
2) TWO LANES OF TRAFFIC TO BE OPEN AT THE END OF EACH DAY'S WORKING HOURS.
3) ROLLING BARRICADE TO BE A TYPE III BARRICADE, WITH A MINIMUM WIDTH OF 4 FT. IF USED, THE REDUCED SPEED LIMIT SIGN SHOULD BE MOUNTED ON THE BARRICADE, AT LEAST 36" FROM THE GROUND AND OFFSET TO THE SIDE OF PASSING TRAFFIC. IF PROJECT ENGINEER AUTHORIZES FLAGGING WITHOUT THE ROLLING BARRICADE DEVICE, THE SPEED LIMIT SHALL BE MOUNTED ON A SEPARATE SIGN STAND, 200 FT. TO 400 FT. BEFORE THE FLAGGER STATION.
4) SINGLE LANE SIGNS, FLAGGER SIGN AND REDUCED SPEED SIGN TO BE COVERED OR REMOVED AT NIGHT, AND AT ALL TIMES LANE CLOSURE IS NOT IN EFFECT.
5) DELINEATORS AND SIGNS, SUCH AS "LOW SHOULDERS", "UNEVEN PAVEMENT, OR "BUMP", SHOULD BE INSTALLED THROUGHOUT THE PROJECT AS NEEDED.
6) MINIMUM CONSTRUCTION SIGNING. ANY ADDITIONAL SIGNS SHOWN IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND REQUIRED BY THE PROJECT ENGINEER SHALL BE INSTALLED AT NO ADDITIONAL COST.

SIGNING DETAILS FOR LANE CLOSURE
AT ISOLATED LOCATIONS
DAYTIME OPERATIONS

R.C. 3-1-02

STATE PROJECT No.	PARISH	SHEET NO.
009-02-0018	Grant	8

NOTE:
DETAILS SHOWN FOR USE INSIDE PROJECT LIMITS WHERE SEPARATE ADVANCE SIGNING IS IN PLACE. SIGNING SHOWN FOR ONE DIRECTION OF TRAVEL ONLY.



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6) MINIMUM CONSTRUCTION SIGNING. ANY ADDITIONAL SIGNS SHOWN IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND REQUIRED BY THE PROJECT ENGINEER SHALL BE INSTALLED AT NO ADDITIONAL COST.

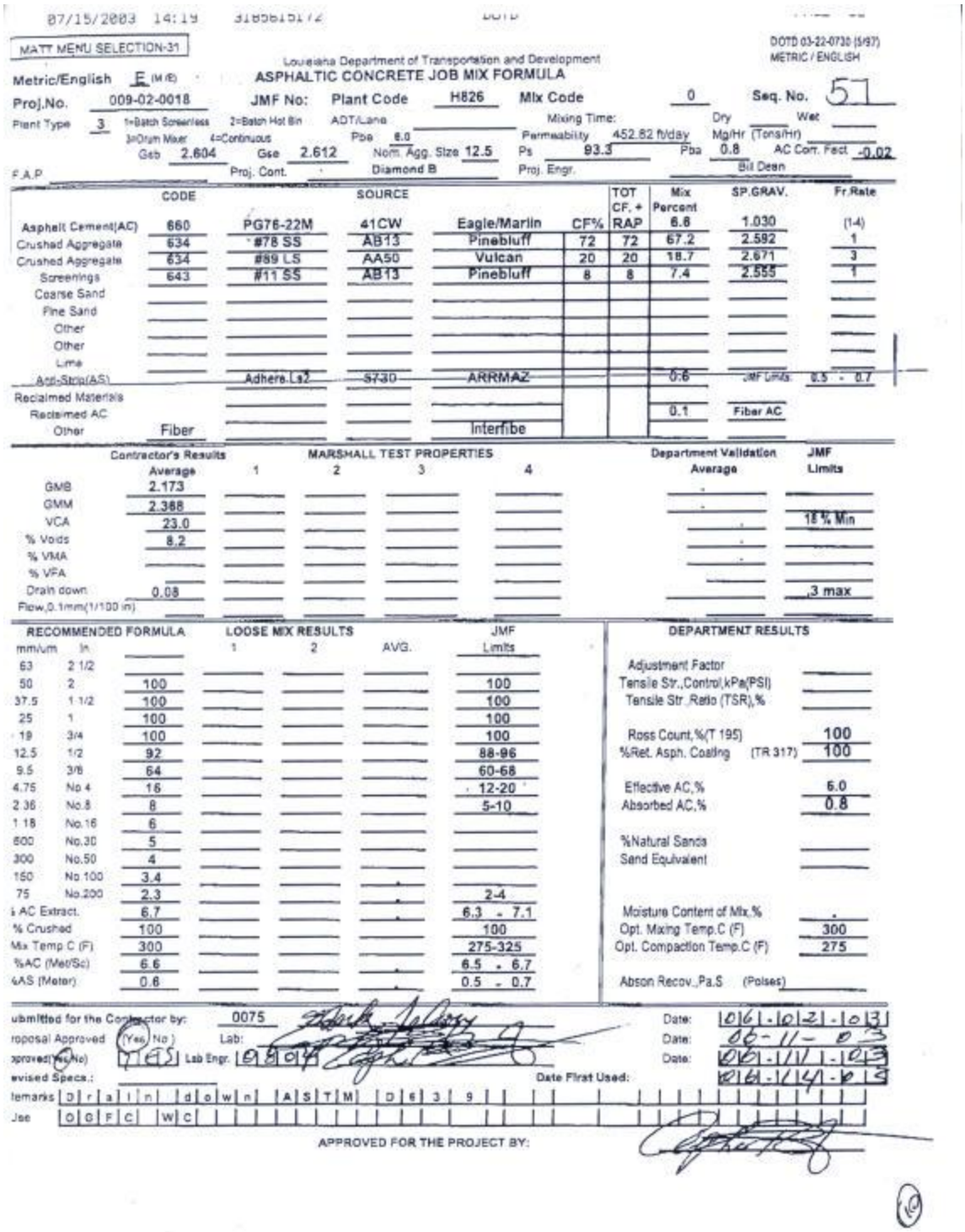
F-8

SIGNING DETAILS FOR LANE CLOSURE
AT ISOLATED LOCATIONS
DAYTIME OPERATIONS

R.C. 3-1-02

Appendix C

Job Mix Formula



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MATT MENU SELECTION-31

DOTD 03-22-0730 (5/97)
METRIC / ENGLISH

Louisiana Department of Transportation and Development
ASPHALTIC CONCRETE JOB MIX FORMULA

Metric/English E (M/E)
Proj.No. 009-02-0018 JMF No: Plant Code H826 Mix Code 0 Seq. No. 51
Plant Type 3 1=Batch Screenless 2=Batch Hot Bin ADT/Lane Mixing Time: Dry Wet
3=Drum Mixer 4=Continuous Pba 6.0 Permeability 452.82 ft/day Mg/Hr (Tons/Hr)
Gsb 2.604 Gse 2.612 Nom. Agg. Size 12.5 Ps 93.3 Pba 0.8 AC Corr. Fact -0.02
F.A.P Proj. Cont. Diamond B Proj. Engr. Bill Dean

	CODE	SOURCE			CF%	TOT CF. + RAP	Mix Percent	SP.GRAV.	Fr.Rate
Asphalt Cement(AC)	660	PG76-22M	41CW	Eagle/Marlin			6.6	1.030	(1-4)
Crushed Aggregate	634	#78 SS	AB13	Pinebluff	72	72	67.2	2.592	1
Crushed Aggregate	634	#89 LS	AA50	Vulcan	20	20	18.7	2.671	3
Screenings	643	#11 SS	AB13	Pinebluff	8	8	7.4	2.555	1
Coarse Sand									
Fine Sand									
Other									
Other									
Lime									
Anti-Strip(AS)		Adhere LS2	S730	ARRMAZ			0.6	JMF Limits	0.5 - 0.7
Reclaimed Materials									
Reclaimed AC							0.1	Fiber AC	
Other	Fiber			Interfibe					

	Contractor's Results Average	1	2	3	4	Department Validation Average	JMF Limits
GMB	2.173						
GMM	2.368						
VCA	23.0						18 % Min
% Voids	8.2						
% VMA							
% VFA							
Drain down	0.08						.3 max
Flow,0.1mm(1/100 in)							

RECOMMENDED FORMULA mm/um	In		LOOSE MIX RESULTS 1	2	AVG.	JMF Limits
63	2 1/2					
50	2	100				100
37.5	1 1/2	100				100
25	1	100				100
19	3/4	100				100
12.5	1/2	92				88-96
9.5	3/8	64				60-68
4.75	No.4	16				12-20
2.36	No.8	8				5-10
1.18	No.16	6				
600	No.30	5				
300	No.50	4				
150	No.100	3.4				
75	No.200	2.3				2-4
% AC Extract.		6.7				6.3 - 7.1
% Crushed		100				100
Mix Temp C (F)		300				275-325
%AC (Met/Sc)		6.6				6.5 - 6.7
%AS (Meter)		0.6				0.5 - 0.7

DEPARTMENT RESULTS

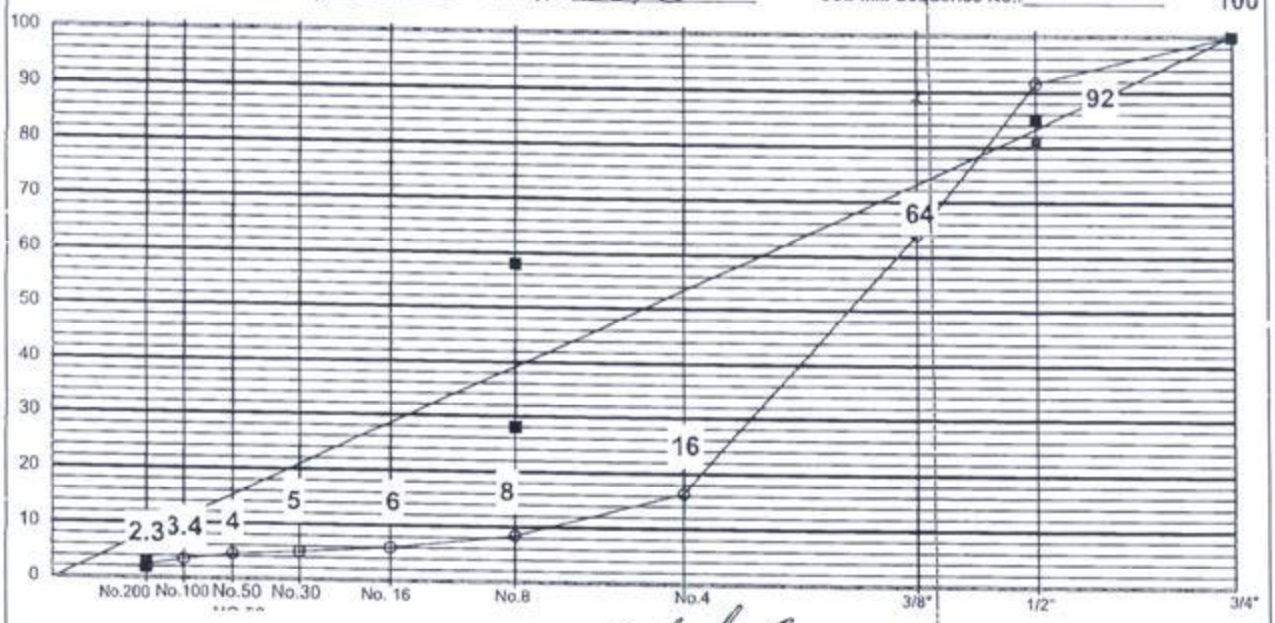
Adjustment Factor	
Tensile Str.,Control,kPa(PSI)	
Tensile Str. Ratio (TSR),%	
Ross Count,%(T 195)	100
%Ret. Asph. Coating (TR 317)	100
Effective AC,%	6.0
Absorbed AC,%	0.8
%Natural Sands	
Sand Equivalent	
Moisture Content of Mix,%	
Opt. Mixing Temp.C (F)	300
Opt. Compaction Temp.C (F)	275
Abson Recov.,Pa.S (Poises)	

Submitted for the Contractor by: 0075 Date: 06-10-21-03
Proposal Approved (Yes) No) Lab: Date: 06-11-03
Approved (Yes) No) YES Lab Engr. Date: 06-11-03
Revised Specs.: Date First Used: 06-11-03
Remarks Drain down ASTM D6390
Use OGFC WC

APPROVED FOR THE PROJECT BY:

Louisiana Department of Transportation and Development
Asphaltic Concrete Gradation - 0.45 Power Curve With Restricted Zones and Control Points
12.5mm(1/2inch) Nominal Maximum Size

Plant Code: HB26 Mix Type: OGFC Job Mix Sequence No.: 100



Certified Asphaltic Concrete Technician

6/2/03
Date

Appendix D

Film Thickness Calculation

OGFC Film Thickness Calculations
Based on
Surface Area

Sieve Size, mm (in)	Percent Passing	**Surface Area Factor (m^2/kg)	Surface Area (m^2/kg)
37.5 (1.5)	100	0.41	0.41000
25 (1)	100		
19 (3/4)	100		
12.5 (1/2)	92		
9.5 (3/8)	64		
4.75 (No. 4)	16	0.41	0.06560
2.36 (No. 8)	8	0.82	0.06560
1.18 (No. 16)	6	1.64	0.09840
0.6 (No. 30)	5	2.87	0.14350
0.3 (No. 50)	4	6.14	0.24560
0.15 (No. 100)	3.4	12.29	0.41786
0.075 (No. 200)	2.3	32.77	0.75371
Total Surface Area			**2.20027**

% VMA = 22.1	G_{se} = 2.612	G_{mb} = 2.173
% VTM = 8.2	P_b = 6.7%	G_{mm} = 2.368
P_{be} = 6.6%	P_{ba} = 0.1%	G_{sb} = 2.604

Volume of Asphalt Binder	13.9 %
Weight of Asphalt Binder	143.17 kg
Weight of Aggregate	2026.072 kg
Weight of Asphalt per kilogram of aggregate	0.070664
Actual Asphalt Film Thickness	**31.2 microns**

Appendix E

LADOTD & Contractor's Project Personnel Comments

LADOTD & Contractor's Project Personnel Comments

Nicholas F. Verret, Jr., LADOTD District 08 Design, Water Res. & Dev. Engineer

"It is obvious that this material is functioning as intended, since you can see water bleeding through it onto the shoulder after a rain……."

Cephas Bowie, Jr., LADOTD District 08 Laboratory Engineer

"The mix design and application at this particular site on US 71 has eliminated the potential for hydroplaning. The mix provided drainage from the travel lanes and has performed well under traffic. This site is in a curve on a hill which allows the water from the travel lanes to either flow to the shoulders or down the travel lane edges during a heavy rain, however, it would be better to lay the OGFC on the travel lanes and shoulders or provide alternate drainage through the shoulders (I realize that our project was a CM job and the monies were limited). This project is performing very well."

Mark Lacroix, Quality Control Manager, Diamond B. Construction Co., LLC

"1) Allow skid 2 and 3 aggregate in the mix. Follow current HM specs which allow 30% skid 1 and 50% skid 2 by weight of total mix. This would allow contractors to utilize commonly inventoried materials while not impacting safety.

2) Eliminate Lottman sensitivity test and evaluate agg/AC compatibility by performing a boil test. The coarse aggregate structure of the mix makes it difficult for the sample to hold together during the thaw cycle. The current spec called for 5 cycles. On the project we did, this was waived.

3) Run plant production at least 150 tons before sampling to allow the plant bag house to purge. The small project that we did showed a finer gradation than was designed as a result of this. Even so the material is functioning as intended."