# Shelby County

# Tennessee

**Mark H. Luttrell, Jr., Mayor**

# SEALED BID

# Shelby County Government

# Purchasing Department

**160 N. Main, Suite 550**
**Memphis, TN 38103**

***Issued: June 20, 2013***
***Due: July 15, 2013 at 2:30 P.M. (Central Standard Time)***

## SEALED BID # I-000222

## FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT

STP-M-7900(29)
PIN 043071.00
Completion Date: 1,095 Days

Shelby County Government is soliciting Sealed Bids for the provision of Construction Services to provide road improvements and construction of a bridge in Shelby County, Tennessee. The Sealed Bid is located on the County's website at www.shelbycountytn.gov and click the link "Department" at the top, then "P" for the Purchasing Department, then click on the link "Bids."

**A voluntary pre-bid conference will be held at 9:00 A.M., June 25, 2013 at the following location, Shelby County Roads and Engineering Department, Conference Room, at 6449 Haley Road, Memphis, Tennessee 38134.**

The bid, as submitted, should include all estimated cost related to the services requested in this Sealed Bid. If selected, your proposal will be the basis for negotiating a contract with Shelby County Government. Respondents requesting additional information or clarification are to contact, Nelson Fowler at nelson.fowler@shelbycountytn.gov.

Bids must be received in the office of the Administrator of Purchasing **no later than 2:30 P.M. on July 15, 2013. Bids will be publicly opened at that time and all interested bidders are invited to attend.: Bids should be addressed**

**Nelson Fowler, Manager A**
**Shelby County Government**
**160 N. Main, Rm. 550**
**Memphis, TN 38103**

The package containing an original **(clearly identified as original)** and four (4) copies of your proposal must be sealed and marked with the bidders name and "**CONFIDENTIAL, "FITE ROAD PROJECT**", **SEALED BID # I-000222** noted on the outside.

**THE LABEL, WHICH IS ATTACHED TO THE BID NOTIFICATION LETTER SHALL BE COMPLETELY FILLED OUT AND ATTACHED TO THE BID SUBMISSION ENVELOPE. YOU MUST DISPLAY YOUR CURRENT E.O.C. ELIGIBILITY NUMBER ON THE OUTSIDE OF YOUR ENVELOPE. UNLESS THE LABEL IS COMPLETELY FILLED OUT AND YOUR CURRENT CERTIFICATION NUMBER OR ELIGIBILITY NUMBER IS NOTED THEREON, YOUR BID WILL BE RETURNED TO YOU UNOPENED. SHOULD YOUR LABEL BE LOST OR MISPLACED, PLEASE NOTE THE APPROPRIATE INFORMATION IN THE LOWER LEFT-HAND CORNER OF YOUR ENVELOPE.**

**Sincerely,**

**Nelson Fowler, Manager A**
**Purchasing Department, Shelby County Government**

## TABLE OF CONTENTS

Instruction to Bidders

Supplemental Specifications to The Standard Specifications..... Revision Date
Supplemental Specification to Section 100.....10/19/12
Supplemental Specification to Section 200.....08/06/12
Supplemental Specification to Section 300.....01/05/10
Supplemental Specification to Section 400.....01/07/13
Supplemental Specification to Section 500.....12/13/10
Supplemental Specification to Section 600.....06/25/12
Supplemental Specification to Section 700.....12/13/10
Supplemental Specification to Section 800.....05/05/10
Supplemental Specification to Section 900.....01/07/13

***The above Supplemental Specifications, revised as noted, are incorporated by reference for bidding purposes and will be printed with the Contract after awards. These Supplemental Specifications may be obtained from the Department at Suite 700, James K. Polk Bldg., Nashville, Tennessee or viewed on the Department's website at http://www.tdot.state.tn.us/construction.***

Special Provisions Regarding .....Special Provision No..... Date

Unbalanced Bids.....SP102B 03/01/06
Employing and Contracting with Illegal Immigrants ..... SP102I 02/05/07
Section 105 – Control of Work, Critical Path Method (CPM) Schedule .....SP105E 10/19/12
Buy America Requirements .....SP106A 06/20/11
Water Quality & Storm Water Permits .....SP107FP 02/13/12
Contractor Employee Safety And Health Program……SP107SHP 02/06/10
Specialty Items.....SP108A 03/01/06
Embankment (Compacted in Place) .....SP205A 02/01/02
Reinforced Soil Slopes.....SP205RSS 09/01/09
Asphalt Pavement Safety Edge ..... SP407SE 04/04/11
Retaining Walls ..... SP624 08/06/12
Traffic Signals ..... SP730M 03/01/06
Seeding With Wood Cellulose Fiber Mulch .....SP801A 03/15/06
Equal Employment Opportunity ..... SP1230 03/01/06
Standard Federal Equal Employment Opportunity ..... SP1231 03/01/06
Construction Contract Specifications (Executive Order 11246)
Notice of Requirement for Affirmative Action to Ensure Equal ..... SP1232 10/19/12
Employment Opportunity (Executive Order 11246)
Training Program Requirements..... SP1240 05/11/09
Disadvantaged Business Enterprise Participation ..... SP1246 11/10/08
DBE Contract Goals..... SP1247 09/17/11
Required Contract Provisions Federal – Aid Construction Contracts ..... SP1273 05/01/12
Tennessee Department of Transportation Minimum Wage Scales For ..... SP1320 01/09/13
Federal-Aid Construction and State Funded Construction

Federal Wage Rates……...01/09/2013
State Wage Rates.....01/02/2013

**Special Provision For Protection of Railway Interest** ..... **322**
**Special Provision Regarding Environmental Concerns** ..... **332**
**Special Provision Regarding Seeding** ..... **333**

**SECTION A** **REQUEST FOR PROPOSAL**

**I.** **INTRODUCTION** ..... **336**
**II.** **MINIMUM BIDDER REQUIREMENTS** ..... **336**
**III.** **CORRESPONDENCE** ..... **337**
**IV.** **PROPOSAL SUBMISSION DEADLINE** ..... **337**
**V.** **PROPOSAL TIMELINE** ..... **338**
**VI.** **PROPOSAL CONDITIONS** ..... **338**
**A) CONTINGENCIES**
**B) MODIFICATIONS**
**C) PROPOSAL SUBMISSION**
**D) INCURRED COSTS**
**E) FINAL AUTHORITY**
**F) PROPOSAL VALIDITY**
**G) DISCLOSURE OF PROPOSED CONTENTS**
**H) LIVING WAGE**
**I) NON-DISCRIMINATION AND TITLE VI**
**J) LOSB**
**K) DRUG-FREE WORKPLACE AFFIDAVIT**
**L) GRATUITY DISCLOSURE FORM**
**M) FORMS TO BE SUBMITTED**
**VII.** **GENERAL REQUIREMENTS** ..... **357**
**VIII.** **AWARD OF CONTRACT** ..... **357**
**IX.** **NOTICE TO BIDDERS** ..... **358**

**SECTION B** **PROPOSAL AND CONTRACT REQUIREMENTS**

**I.** **PROPOSAL** ..... **360**
**II.** **BID FORM** ..... **364**
**III.** **PROPOSAL RESPONSE SHEET** ..... **373**
**IV.** **CONTRACT** ..... **374**
**V.** **CONTRACT BOND** ..... **388**

**SECTION C** **SHELBY COUNTY SPECIAL PROVISIONS**

**SECTION D** **APPENDIX**
**I.** **PHASE II ENVIRONMENTAL SITE ASSESSMENT**
**II.** **FITE ROAD EXTENSION – PSI SOILS REPORT DATED 2/16/2004**
**III.** **SUBSURFACE EXPLORATION REPORT**
**FITE ROAD RETAINING WALL #1 (2/11/2012)**
**IV.** **SUBSURFACE EXPLORATION REPORT**
**FITE ROAD RETAINING WALL #2 (2/10/2012)**

## ATTENTION

It shall be the bidders' responsibility to confirm that the Contract Proposal contains all the documents indicated on the Table of Contents.

Should any omissions occur, the appropriate documents may be obtained from Shelby County upon request.

## COUNTY OF SHELBY

## INSTRUCTIONS TO BIDDERS

## BIDS TO BE RECEIVED

## JULY 15, 2013

Sealed bids for the construction of the following projects will be received by the **COUNTY** of **SHELBY, 160 N. MAIN STREET, SUITE 550** until **2:30 PM, JULY 15, 2013** and opened publicly at 160 N. MAIN STREET, SUITE 550 **, 2:30 PM, JULY 15, 2013**. The reading of the bids will begin at **2:30 PM**.

The proposed construction shall be performed in accordance with the most current version of the Standard Specifications for Road and Bridge Construction of the Tennessee Department of Transportation , and the Standard Roadway and Structures Drawings of the Tennessee Department of Transportation which are incorporated herein by reference and made a part hereof. In addition, only the Special Provisions contained within the applicable Contract Proposal will be considered binding. Any reference to any Special Provision not contained within the applicable Contract Proposal shall be disregarded. All questions related to the Contract Proposal, Plans, Specifications or Special Provisions shall be directed to the **NELSON FOWLER, MANAGER A SHELBY COUNTY GOVERNMEN, 160 N. MAIN STREET, RM 550 MEMPHIS, TN 38103** (901-222-2250). Information received from other offices of the **COUNTY** strictly advisory.

## IMPORTANT NOTICE TO BIDDERS:

Prospective bidders should read the following instructions carefully before submitting their bids. Special attention is called to the regulations of the **COUNTY** that total bids, rather than unit prices, will be read. Proposals shall be rejected as being irregular if they fail to contain a unit price for each item listed. Extensions of the various items must be sub-totaled, carried forward, and shown as a grand total following the last proposal item. All entries must be in ink.

After a bidder has deposited a proposal with the **COUNTY**, he can withdraw it only on written request in accordance with Subsection 102.07 of the Tennessee Department of Transportation Standard Specifications.

Totals read at the opening of the bids are not guaranteed to be correct and no final award of the contract will be made until bids and extensions have been checked and re-checked.

On all projects which are financed in whole or in part by funds received through Federal agencies and/or the Tennessee Department of Transportation, the awarding of contracts by the **COUNTY** will be subject to approval by the Tennessee Department of Transportation. The **COUNTY** reserves the right to reject any bid proposal which is not acceptable to the parties as listed, although such bid proposal would otherwise qualify as the lowest and best bid under the Tennessee Department of Transportation Standard Specifications.

The **COUNTY** reserves the right to reject any or all Proposals, to waive technicalities or to advertise for new Proposals, if in the judgment of the awarding authority, the best interest of the **COUNTY** will be promoted thereby.

The **COUNTY** reserves the right to cancel the award of any Contract, at any time prior to execution of said Contract by all parties without any liability against the **COUNTY.**

The awarding of the contract or rejection of all proposals will be made within 30 days after the formal opening of the proposals. Upon award, a detailed letter of instructions will be forwarded along with appropriate documents to the low bidder.

The **COUNTY** hereby notifies all bidders, that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the basis of age, race, color, religion, national origin, sex or disability in consideration for an award.

The **COUNTY** is an equal opportunity affirmative action employer, drug-free, with policies of nondiscrimination on the basis of race, sex, religion, color, national or ethnic origin, age, disability, or military service.

## PREQUALIFICATION OF BIDDERS:

Each prospective bidder and subcontractor will be required to file a document entitled "Prequalification Questionnaire." The foregoing shall be filed on a form provided by the Tennessee Department of Transportation. The form must be filled out completely, and the truth and accuracy of the information provided must be certified by a sworn affidavit signed by an officer, partner, owner or other authorized representative of the applicant who has authority to sign contracts or other legal documents on behalf of the applicant. A prospective bidder must be prequalified by and in good standing with the Tennessee Department of Transportation prior to the issuance of a proposal form. A prospective subcontractor must be prequalified by and in good standing with the Tennessee Department of Transportation prior to being approved as a subcontractor. Each prospective bidder or subcontractor shall notify the Tennessee Department of Transportation if there is any subsequent change in the name, organization or contact information provided.

Prospective bidders' "Prequalification Questionnaire" shall be filed with the Tennessee Department of Transportation at least fourteen (14) days prior to the date of opening bids on any letting in which the applicant intends to submit a bid to the **COUNTY,** or at least fourteen (14) days prior to the date on which the applicant requests approval as a subcontractor under a contract awarded by the **COUNTY**. Bidders intending to submit proposals consistently shall complete and submit the prequalification application annually; however, this document may be changed during such period upon submission of additional favorable reports or upon receipt by the Tennessee Department of Transportation of substantiated evidence of unsatisfactory performance. The Tennessee Department of Transportation reserves the right to request additional information and documentation to clarify and/or verify any information submitted in an applicant's prequalification application.

**The prequalification form can be found at the web address**
**http://www.tdot.state.tn.us/construction**

A proposal to be used for non-bidding purposes may be issued to any interested party regardless of prequalification.

## PROPOSAL BOND

Each proposal must be accompanied by a bidder's bond, or Cashier's Check, or Certified Check made payable to the **COUNTY** in an amount equaling not less than five percent (5%) of the amount bid. In the case of optional items in the proposals, the amount of the bidder's bond or check must be in an amount equaling not less than five percent (5%) of the total amount of the bid based on the high option.

If the bidder's bond is offered as guaranty, the bond must be on the form furnished by the **COUNTY** and made by a surety company, qualified and authorized to transact business in the State of Tennessee and must be acceptable to the **COUNTY**.

If a check is offered as guaranty, the check of the successful bidder will be cashable at the discretion of the **COUNTY**, pending the satisfactory execution and acceptance of the contract and the contract bond.

## ISSUANCE OF BIDDING DOCUMENTS

Shelby County Government is soliciting Sealed Bids for the provision of Construction Services to provide road improvements and construction of a bridge in Shelby County, Tennessee. The Sealed Bid is located on the County's website at www.shelbycountytn.gov and click the link "Department" at the top, then "P" for the Purchasing Department, then click on the link "Bids." It is the responsibility of the Contractor to download Plans and Bid Book from the Shelby County website as directed above.

The Tennessee Department of Transportation is on a cash basis for sales of Standard Specifications and Standard Drawings. Requests for documents must be accompanied by cash, check, money order, or they may be mailed to the buyer C.O.D. Tennessee Department of Transportation Standard Drawing Books will be furnished by the Tennessee Department of Transportation at **$100.00** per book plus **9.25%** sales tax, for in-state delivery. Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, dated March 1, 2006, will be furnished by the Tennessee Department of Transportation at **$12.00** per book plus **9.25%** sales tax, for in-state delivery. There will be a minimum charge of $2.00 on any purchase. All documents will be furnished without refund and transmitted at your risk.

When two or more contractors wish to bid together in a joint venture, each contractor will be required to make a written request for such a proposal to the **COUNTY**. This request shall be signed by an authorized signatory of each firm.

Requests for joint venture proposals may be made in person or by telephone. However, the proposal for said joint venture will not be issued until the request in writing, as set forth above, is received by the **COUNTY**.

## REJECTION OF PROPOSALS

Proposals will be rejected as irregular if prior to the formal opening of the Proposal all of the following documents have not been signed: (1) the bidder shall sign by written signature the Proposal form, (2) the bidder shall sign by written signature the Proposal Certification form, (3) the bidder shall sign by written signature the Proposal Bond form or the Proposal Guarantee, whichever is applicable, (4) the Agent or Attorney-in-Fact representing a Surety Company shall sign by written signature the Proposal Bond, if applicable. In addition, Proposals will be rejected if any of the above signatures are a reproduced copy, such as, but not limited to a photostatic copy or a facsimile transmission. An original, dated and valid Power of Attorney for the Attorney-in-Fact must accompany the Proposal and the Contract. The accompanying Power of Attorney must be dated, and the date must be the exact same date as the date on the Proposal Bond. The Proposal and the Proposal Bond, including the attached Power of Attorney, shall be valid and binding for 60 days subsequent to the date of opening bids.

Proposals shall be completed on the forms as issued. Please review a part of Subsection 102.02 of the Tennessee Department of Transportation Standard Specifications stating: "All of the documents that are bound therein are part of the Proposal and shall not be detached." Proposals shall not be taken apart. Proposals taken apart may be subject to rejection. Also, please review a part of Subsection 102.09 of the Tennessee Department of Transportation Standard Specifications stating: "Proposals will be rejected as being irregular if they are not prepared on the prescribed forms; if they show any omissions, alterations of form, additions, or conditions not called for, unauthorized alternate bids, or irregularities of any kind; or if they fail to contain a unit price for each item listed." Proposals shall be completed on the forms as issued. Photostatic or facsimile copies of Proposal sheets may not be attached to the Proposal. Proposals containing forms not issued by the **COUNTY** may be subject to rejection.

## ADDENDA

Addenda to the Proposal will be acknowledged by all bidders. Failure to acknowledge receipt of Addendum Letters is grounds for rejection.

## RETAINAGE

Effective for all contracts, the **COUNTY** will not hold retainage. In addition, the Contractor will not be able to hold retainage from the subcontractor.

## SUBCONTRACTS

Your special attention is called to Section 105 - Control of Work, and Section 108 - Prosecution and Progress of the Tennessee Department of Transportation Standard Specifications, concerning duties of the contractor and subletting of contracts.

## CHANGED CONDITIONS

Your special attention is called to Section 104.02 of the Tennessee Department of Transportation Standard Specifications, concerning changed conditions on this contract.

_____

**[COUNTY Officer]**

The following information applies to Federal-Aid construction projects:

## NOTICE TO ALL BIDDERS

**To report bid rigging activities call:**

**1-800-424-9071**

**The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m. eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.**

**The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.**

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 05-05-10) March 1, 2006
(Rev. 11-01-10)
(Rev. 12-13-10)
(Rev. 10-31-11)
(Rev. 06-25-12)
(Rev. 08-06-12)
(Rev. 10-19-12)

**Supplemental Specifications - Section 100**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 101.13,** Second paragraph, first sentence, **Delete** "Revisions and Additions."

**Subsection 101, Add** the following definition

> **"Amendment.** A revision to the electronic bid file which may include adjusting a quantity, adding, deleting, or revising a pay item(s).

**Subsection 101.47,** Second sentence, **Replace** "**Revisions and Additions**" with "**Supplemental Specifications**"

**Subsection 101.57, Delete** the entire paragraph and replace with the following

"A company authorized to guarantee a bidder's proposal and a contractor's performance and payment obligations under a contract and which is authorized to do business in the State of Tennessee."

**Subsection 102.01, Replace the entire subsection with the following:**

**102.01-Prequalification Questionnaire and Competency of Bidders**. Each prospective bidder and subcontractor will be required to file a document entitled "Prequalification Questionnaire." The foregoing shall be filed on a form provided by the Department. The form must be filled out completely, and the truth and accuracy of the information provided must be certified by a sworn affidavit signed by an officer, partner, owner or other authorized representative of the applicant who has authority to sign contracts or other legal documents on behalf of the applicant. A prospective bidder must be prequalified by and in good standing with the Department prior to the issuance of a proposal form; however this standing does not prohibit any person from requesting or obtaining a void proposal form for any purpose other than submitting a proposal to the Department. A prospective subcontractor must be prequalified by and in good standing with the Department prior to being approved as a subcontractor. Each prospective bidder or subcontractor shall notify the Department if there is any subsequent change in the name, organization or contact information provided.

Prospective bidders' "Prequalification Questionnaire" shall be filed with the Department at least fourteen (14) days prior to the date of opening bids on any letting in which the applicant intends to submit a bid to the Department, or at least fourteen (14) days prior to the date on which the applicant requests approval as a subcontractor under a contract awarded by the Department. Bidders intending to submit proposals consistently shall complete and submit the prequalification application annually; however, this document may be changed during such period upon submission of additional favorable reports or upon receipt by the Department of substantiated evidence of unsatisfactory performance. The Department reserves the right to request additional information and documentation to clarify and/or verify any information submitted in an applicant's prequalification application.

Prospective subcontractors will be required to pre-qualify prior to approval of the subcontracts by the Department and must also submit a prequalification application annually.

The Department reserves the right to refuse to issue a proposal form when a bidder is in default or delinquent for any of the following reasons:

a) When a "Prequalification Questionnaire" has not been filed with and examined by the Department or when the bidder, in the opinion of the Commissioner, is not qualified.

b) Default of existing contract (s).

c) When a bidder has an existing incomplete contract (s) with the Department which is behind schedule to the extent that it may hinder or prevent prompt completion of any additional contract (s).

d) When a bidder has been suspended, debarred, or otherwise excluded under the Department's rules governing contractor debarment and suspension, Chapter 1680-5-1, or under applicable Federal rules governing the suspension and debarment of contractors.

**Subsection 102.02 Contents of Proposal Forms, Revise** entire subsection to the following:

**102.02-Contents of Proposal Forms.** Upon request, the Department will furnish the Bidder an electronic proposal form which will contain an "Instructions to Bidders" form, Supplemental Specifications, Special Provisions, and proposal guaranty form. The proposal form will state the location and description of the contemplated construction. The proposal form will state the time in which the Work must be completed, the amount of the Proposal Guaranty, and the date, time and place for the opening of Proposals. The Plans and Specifications are as much a part of the Proposal form as if they were bound therein. All of the documents that are bound therein are part of the Proposal.

The prospective bidder will be required to pay the Department the sum stated in the Instructions to Bidders for each electronic proposal form. Plans will be available for the sum stated in the notice to Contractors.

**Subsection 102.03 Interpretation of Quantities in Bid Schedule, Revise** entire subsection to the following:

**102.03-Interpretation of Quantities in Bid Schedule.** The quantities appearing on the electronic bidding file are approximate only and are prepared for the comparison of bids and award of Contract. The Department does not guarantee or assume any responsibility that quantities indicated on the Plans or given in the electronic bidding file will hold in the construction of the project and the Contractor shall not plead deception or misunderstanding because of variation from these quantities or of variation from the location, character or any

other conditions pertaining thereto. Payment to the Contractor will be made only for the actual quantities of work performed and accepted, and materials furnished in accordance with the Contract. The schedule of quantities of work to be done and materials to be furnished may be increased, decreased, or omitted as hereinafter provided under **Subsection 104.02.**

**Subsection 102.05 Preparations of Proposals, Revise** entire subsection to the following:

**102.05-Preparation of Proposals.** A document entitled "Instructions to Bidders" is bound into the electronic proposal form. The proposal form shall be electronically signed in exact accordance with these instructions using the electronic bidding file furnished by the Department. The proposal guaranty form shall be handled similarly. The completed electronic bidding file, inclusive of the proposal form as described in **Subsection 102.02** and the bid prices described below, shall then be submitted to the Department in exact accordance with the applicable part of these instructions.

The electronic bidding file contains the contract bid items and associated estimated quantities. The following stipulations shall apply to electronic bidding:

(a) It is the bidder's responsibility to compare the bid quantities indicated on the plans to those contained on the electronic bidding file to ensure they are the same. Any discrepancies are to be called to the Department's attention immediately.

(b) Any revisions to the Contract Proposal regarding bid items or quantities will be accompanied by an amendment to the electronic bidding file with the revision date indicated. The amended electronic bidding file is to be utilized in the formulation of the bid.

Some proposals may contain numerous alternates. The Contractor will be required to bid on only 1 alternate for each construction item unless otherwise specified. The proper procedure for entering alternate bids is to enter prices for the intended alternate item(s) of construction and leave the undesired alternate item(s) of construction blank. The electronic bidding program allows only for 1 alternate to be bid. If prices are entered for more than 1 alternate, the electronic bidding program will not tabulate the total. Instructions for electronic bidding are available from the Headquarters Construction office and the method of entering alternates is explained therein.

The electronic bidding program will perform all extensions of the estimated quantities and unit or lump sum prices, calculate the total bid and allow the printing of a complete set of bid item sheets with appropriate subtotals and grand total bid price.

**Subsection 102.06 Delivery of Proposals, Revise** entire subsection to the following**:**

**102.06-Delivery of Proposals.** Each Proposal must be submitted via the Internet using the electronic bidding program.

No proposal will be considered or accepted which has not been received by the Department previous to the hour of the date and at the place set forth for the opening thereof in the Advertisement or Instruction to Bidders.

**Subsection 102.07 Withdrawal of Proposal, Revise** entire subsection to the following:

**102.07-Withdrawal of Proposal.** Any Bidder may withdraw his Proposal through the electronic bidding program prior to the hour of bid opening as indicated in the Advertisement for Bids and in the Instruction to Bidders

**Subsection 102.08 Public Opening of Proposals, Revise** entire subsection to the following:

**102.08-Public Opening of Proposals.** Proposals will be opened and either read publicly or bid totals will be furnished and posted on the date, time, and place indicated in the Advertisement for Bids and Instruction to Bidders. Bidders, authorized Agents, and interested parties are invited to be present.

**Subsection 102.09 Rejection of Proposals, Revise** entire subsection to the following:

**102.09-Rejection of Proposals.** Proposals will not be rejected if they condition their consideration upon the elimination of other proposals submitted by the same bidder, provided that any selection of awards will be made by the Department. A Bidder may tie the acceptance or rejection of 2 or more of his proposals on the condition that either all of his proposals are accepted or that they are all rejected, in which case his bids must be the lowest responsible bid on each project before they will be considered.

Proposals may be rejected by the Commissioner if any of the unit prices contained therein are obviously unbalanced, either excessive or below the reasonable cost analysis value.

Proposals will be rejected as being irregular if they are not prepared on the prescribed forms; if they show any omissions, alterations of form, additions, or conditions not called for, unauthorized alternate bids, or irregularities of any kind; or if they fail to contain a unit price for each item listed. In the case of authorized alternate items, a unit price on only 1 of the alternates will be required, unless otherwise specified in the Contract.

Proposals will be rejected as irregular if they are not electronically signed by an authorized representative of the bidder. The electronic signature on the electronic bidding file serves as signatures for the Proposal form, Proposal Certification form and the Proposal Bond form, if applicable. If the bidder elects to submit the Proposal Guarantee, the Proposal Guarantee Form must be signed by written signature and in the possession of the Department prior to the formal opening of the Proposal. The Agent or Attorney-in-Fact representing a Surety Company shall electronically sign the electronic Proposal Bond, if applicable. An original, dated and valid Power of Attorney for the Attorney-in-Fact must accompany the Proposal and the Contract. The accompanying Power of Attorney must be dated, and the date must be the exact same date as the date on the Proposal Guaranty Bond. The Proposal and the Proposal Guarantee Bond, including the attached Power of Attorney shall be valid and binding for 60 days subsequent to the date of opening bids. As an alternative, Surety Companies may submit an original, unnumbered Power of Attorney suitable for photocopying to the Department. Surety Companies choosing this alternative will be required to furnish the Department with a letter on the company letterhead and signed by an officer of the company authorized to appoint Attorneys-in-fact. A draft copy of this letter is available from the Department upon request.

Proposals will be rejected as irregular when submitted by a Bidder who has not qualified as required by the Commissioner under the authority given him by Tennessee Code Annotated.

All prime Contractors, except mowing and litter removal Contractors, must be licensed with the Tennessee Department of Commerce and Insurance (TDCI), Board for Licensing Contractors (BLC). The Contractor must be licensed in the general classification (e.g. Heavy Construction (HC), Highway, Railroad, Airport Construction (HRA), Specialty (S), Municipal and Utility Construction (MU), or Electrical Contracting (CE)) for the type of work in the project which they will perform. A Proposal submitted by a Bidder will be considered for Award for twenty-one (21) days after the Proposals are opened. If the Bidder does not have a license with the TDCI, on or before twenty-one (21) days after Proposals are opened, the Bidder will be

considered non-responsive and their Proposal will be rejected as irregular. The next lowest responsible Bidder would then be considered for Award. If the next lowest responsible Bidder does not have a license on or before the twenty-one (21) days after the Proposals are opened, they also would be considered non-responsive, and the subsequent Bidder will then be considered.

Bidders that are domestic or foreign Corporations, Limited Liability Companies, Limited Partnerships, or Limited Liability Partnerships, must be in good standing with the Secretary of State (i.e. have a valid Certificate of Existence/Authorization). If a Bidder is not in good standing with the Secretary of State (i.e. have a valid Certificate of Existence/Authorization) on or before twenty-one (21) days after Proposals are opened then the Bidder will be considered non-responsive and their Proposal will be rejected.

Reasonable grounds for believing that any Bidder is interested in more than 1 Proposal on the same project or that there has been collusion among the Bidders will cause a rejection of all Proposals in which the Bidders involved are interested.

A Proposal will be rejected, at the discretion of the Commissioner, if a Bidder or any member of the firm, partnership, or corporation represented in his Proposal is related either by blood or marriage within the fourth degree, computing by the civil law, to any member of the Department, or if any member of the Department will have any financial interest in the Contract.

The right is reserved to reject a Proposal from a Bidder who has not paid or satisfactorily settled all legal debts due on former contracts in force at the time of the letting.

All Proposals will be rejected that do not contain the Proposal Guaranty of the character and amount indicated in the proposal form.

Until the execution and approval of the Contract by the Department, the right is reserved to reject any and all Proposals and to waive technical errors.

**Subsection 103.01 Consideration of Proposals, Revise** entire subsection to the following:

**103.01-Consideration of Proposals.** The Internet bid shall be recognized as the only official bid.

After the Proposals are opened and read, they will be compared based on the summation of the products of the unit bid prices and the approximate quantities. The results of such comparisons will be made available to the public.

The right is reserved to reject any or all Proposals, to waive technicalities or to advertise for new Proposals, if in the judgment of the awarding authority, the best interest of the Department will be promoted thereby.

**Subsection 103.04, Award of Contract, add** the following as the second paragraph:

TDOT will only award a contract to a contractor that is licensed with the State of Tennessee, except if the contract is for mowing or mowing and litter removal, Contractors for mowing or mowing and liter removal type contracts must be registered with the Secretary of State, if applicable, before a project will be awarded.

**Section 104-SCOPE OF WORK, Add** the following to the Table of Contents **"104.02-Alterations in Plans or in Character of Construction."**

**Subsection 104.02,** Significant Changes in the Character of Work, (4), **Revise** subsection to the following:

4. An adjustment of the contract terms in accordance with number 2 above will be made only if the Engineer orders, in writing, an alteration in the work or in the quantities that significantly change the character of work. The term "significant change" shall be construed to apply only to the following circumstances:

   (a) When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction or

   (b) When a major item of work is increased or decreased by more than 25 percent of the original contract quantity (adjustments shall apply only to that portion in excess of 125 percent of original contract quantity, or in case of a decrease, to the actual quantity performed).

The above provides for adjustments resulting from formal change orders by the Engineer, in writing. Either party may initiate an adjustment and both must be in agreement before the work is performed.

**Subsection 104.03 Remove and replace** entire subsection to the following:

**104.03-Extra Work.** When unforeseen work results for any reason and is not handled as prescribed elsewhere herein, the Engineer and the Contractor will attempt to agree on equitable prices. When such prices are agreed upon, a Change Order will be executed, and a Construction Change will be issued by the Engineer. When equitable prices are not agreed upon mutually, the Engineer may issue a written order that the Extra Work be completed on a force account basis and paid for as provided in **Subsection 109.04**.

When the Change Order process is initiated, the Contractor shall be required to submit to the Project Supervisor detailed breakdowns for Materials, Labor, Equipment, Profit and Overhead. Profit and Overhead shall not exceed 15% of the subtotal of Materials, Labor and Equipment. When the Change Order is initiated for subcontractor items, the Prime Contractor's administrative cost shall not exceed 5% of the subcontractor's total (materials, labor, equipment, profit & overhead).

The requirement for detailed cost breakdowns may be waived when a Bid Item History exists for the proposed item(s), and the contractor's requested price is within 10% of the Regional, 3 year historic cost for that item. In any case, the Department reserves the right to request detailed information from the Contractor for any Change Order request.

**Subsection 104.04 Maintenance of Traffic, Delete** "with 30,000 or greater Average Daily Traffic or any interstate routes," from the third paragraph. **Change** " three (3)" to "seven (7)" in the third paragraph. **Delete** "(these restrictions apply to state routes with 30,000 or greater Average Daily Traffic or any interstate route):" from the fifth paragraph. **Add** "without the written consent of the Engineer." to the end of the fifth paragraph. **Delete** "In addition, any state routes less than 30,000 ADT shall have no lane closures, or any lane restrictions of any type will be allowed on Good Friday, Labor Day, Memorial Day, July 4$^{th}$ , and the working day immediately preceding and including the holidays of Thanksgiving, and Christmas Day without the written consent of the Engineer." from the sixth paragraph.

**Subsection 104.06** First sentence, **Replace** the word "sectiot", **should read** "section"

**Subsection104.11. Revise** entire subsection to the following:

**104.11-Final Cleanup.** Before final acceptance of the Work, the entire rights-of-way, all material pits, all waste areas, all areas and access roads used by the Contractor, all streams in or over which he has worked, and all ground occupied by the Contractor, in connection with the Work, shall be cleaned of all forms, falsework, temporary structures, temporary erosion control measures, excess materials, equipment, rubbish, and waste, and all parts of the work shall be left in a neat and presentable condition. The entire right-of-way, all material pits, all waste areas, all areas and access roads used by the Contractor shall be final stabilized per the TN NPDES Construction General Permit criteria or per the agreed upon Reclamation Plan. Final cleanup shall include the mowing of the rights-of-way as required. If the project was graded under a previous Contract, final cleanup will be performed within the construction limits of work being performed and other areas disturbed or otherwise requiring cleanup due to the Contractor's operations. No rubbish, waste or debris shall be deposited on or in sight of the rights-of-way. All damage to private and public property shall be replaced, repaired, or settled for.

**Subsection 104.12** Add the following to Section 104 of the Standard Specifications.

**104.12- Value Engineering Change Proposal (VECP).**The Contractor may request a modification to the plans, the specifications or other contract requirements based on a Value Engineering Change Proposal (VECP) submitted to the Department specifying a cost reduction change. This will not apply to a proposal unless it is identified as a VECP at the time of its submittal.

Value Engineering Change Proposals (VECP) are those which would require a change in the contract and would result in an immediate net savings to the Department without impairing essential functions and characteristics of the project, including but not limited to the service life, reliability, economy of operation, maintenance and safety features. VECP's that propose a total savings of less than $25,000 (twenty-five thousand dollars) will normally not be considered unless there are other non-monetary savings to be realized.

The Contractor may submit for review a "VECP Concept" provided that it contains enough information to clearly define the work involved and the benefits to be realized. The "VECP Concept" shall state all applicable design criteria that will be used in the VECP design. Written notification by the Department that the review has been completed and that the "VECP Concept" appears to be favorable merely indicates that the engineering and plan development may continue for submittal of the VECP proposal and is not authorization for any construction work to begin. Should the final design not reflect the expected benefits, the Department may reject the "VECP Concept" and the VECP without recourse by the Contractor.

The following information, as a minimum, shall be submitted with each proposal to the Engineer, allowing adequate time for Department analysis and processing without interference with project schedules:

(a) A description of the difference between the existing contract requirements and the proposed change, and the comparative advantages and disadvantages of each.

(b) An itemized list of the contract changes required if the VECP is accepted, and any recommendation as to how to make each such change.

(c) A separate detailed cost estimate for (1) the affected portions of the existing contract requirements and (2) the VECP.

(d) A prediction of any effects the proposed change will have on other Department costs, such as costs of maintenance and operation.

(e) A statement of the time by which a supplemental agreement must be issued in order to obtain the proposed cost reduction for the project, noting any effect on the contract completion time or delivery schedule.

(f) The date(s) of any known previous or concurrent submissions of the same proposal and any previous actions by the Department.

(g) The contract items of work affected by the proposed change, including any quantity changes.

Proposed construction changes in pavement design, right of way, relocation of bridges, etc. or changes in the environmental impact statement will not normally be considered as an acceptable VECP. The Department may determine at any point during the evaluation process that the VECP is not cost effective and summarily reject the VECP.

While a VECP is being considered by the Department, the contractor shall continue to perform the work in accordance with the requirements of the contract. The Department has no obligation but to review the VECP and shall not be liable for failure to accept or act upon any VECP or for any delays to the work due to the submitted proposal. The Department shall be the sole judge of the acceptance or rejection of a VECP, either wholly or in part. If an agreement has not been reached by the date that the contractor's VECP specifies that a decision should be made, or such other date as the contractor may have specified in writing, the VECP shall be deemed rejected.

The Contractor shall have no claim against the Department for additional costs or delays resulting from the rejection of a VECP, including but not limited to, “VECP Concept” acceptance, engineering and development costs, loss of anticipated profits, and increased material or labor costs.

The Department will not accept a VECP that is similar to a change in the plans or specifications under consideration by the Department for the project at the time the proposal is submitted; nor will the Department accept a proposal based upon, or similar to, standard specifications, general use special provisions or standard drawings adopted by the Department after the advertisement for the contract. The Department reserves the right to make such changes without compensation to the Contractor under the provisions of Subsections 104.02 and 104.03 of the standard specifications.

The Department will determine the estimated net savings from the adoption of all or any part of the VECP. In determining the estimated net savings, the Department may disregard the contract bid prices if, in the judgment of the Department, such prices do not represent a fair measure of the value of the work to be performed or to be deleted.

In the event the Department accepts the VECP the contractor thereby grants to the Department all rights to adoption of the proposal for general use on other contracts without obligation or compensation of any kind.

Acceptance of a VECP will be by supplemental agreement incorporating the changes necessary to permit the VECP, or any part of it, to be put into effect. The supplemental agreement shall also set forth the estimated net savings to the Department and further provide that the contractor be paid 50 percent of the actual net savings.

The cost to the contractor to develop and implement the VECP and any design (including redesign by a Tennessee licensed engineer, preparation of new reproducible plans, etc. and any other information requested by the Department to facilitate its review) shall be incidental to the contractor and shall in no way affect the VECP payment herein before specified. The cost to the Department to review the VECP shall be incidental to the Department and shall not affect the VECP payment.

The actual net savings will be determined when the work in the VECP and Supplemental Agreement is completed. If upon completion of the work proposed in the VECP it is determined that the supplemental agreement did not adequately address a change in quantities for other pay items that were either increased or decreased substantially as a result of the change proposal, those additional costs or savings shall be included in the actual net savings determination. A single payment will be made to the contractor representing fifty percent (50%) of the actual net savings once all items are considered.

If the completed VECP results in an increase in cost such that there is no net savings, those costs above the original contract costs as proposed in the VECP and supplemental agreement will be reimbursed at a rate of fifty percent (50%).

The preparation of the VECP, its acceptance and performance of the work shall not extend the contract completion time unless the supplemental agreement provides an extension.

**Subsection 105.02 Add** the following as the first paragraph:

All contractors and subcontractors directly engaged in the erection or removal of falsework, temporary structures, structural steel, precast prestressed or mild steel reinforced concrete bridge beams or girders over active highway traffic lanes, on any route, railroad or any stream deemed navigable to commercial or pleasure water craft, shall be required to submit an erection plan prepared and stamped by a Tennessee registered engineer. Falsework (steel stay-in-place forms, overhang jacks, etc.) for bridge deck construction shall be installed in accordance with the manufacturer's recommendation and will not require a submittal. See also Subsection 602.41, 602.42, and 604.06.

**Subsection 105.06, Revise** the entire subsection to the following:

**105.06-Planning of the Operations-Preconstruction Conference.** After execution of the Contract by both parties thereto and prior to beginning work, the Contractor shall furnish the Engineer a complete and practicable plan of operations which shall provide for orderly and continuous performance of the Work. The plan of operations shall be in such form and in such detail as to show properly the sequence of operations, the location of operations and the period of time required for completion of the portion of the Work under each item or group of like items in the schedule. The plan of operations shall show the controlling item of work during each phase and a revised schedule shall be submitted when changed conditions warrant. An anticipated schedule may be submitted by the Contractor that will show the anticipated monthly progress for the duration of the Contract. If the Contractor does not submit an anticipated schedule, then a straight-line curve will be used to determine progress. The plan of operation shall indicate the manpower and equipment to be available to handle the several phases of the Work. If the Contractor so elects, the Work may be scheduled by the Critical Path Method (CPM); and if called for in the Proposal, utilization of the Critical Path Method (CPM) shall be mandatory. When required, the CPM should be updated at least every 30 days as directed by the Engineer.

Subsequent to submission of the plan of operation, the Contractor shall attend a preconstruction conference called by the Engineer. He shall have available at such meeting all data necessary to substantiate his plan of operation and the scheduling thereof.

In addition to this basic plan of operations, the Contractor shall keep the Engineer notified of his planned or contemplated operation details sufficiently in advance of starting each phase so that inspection may be arranged by the Engineer. Such notice shall include the nature and location of the work planned or contemplated, the date and time of starting, and any hours outside of the conventional working day and working week during which the prosecution of such work is contemplated. The performance of any work without such notice to the Engineer and in the absence of inspection or the written waiver thereof, in itself, shall constitute sufficient grounds for rejection of such portion of the work.

**Subsection 105.09 Construction Stakes, Revise** the 12th paragraph to the following:

All staking shall be performed by qualified engineering or surveying personnel who are trained, experienced and skilled in construction layout and staking of the type required under the contract and who are acceptable to the Engineer. The personnel shall perform this staking under the direct supervision of a Tennessee licensed Professional Engineer or a Tennessee Registered Land Surveyor experienced in the direction of such work and acceptable to the Engineer.

**Subsection 105.10. Revise** entire Subsection to the following:

**105.10-Authority and Duties of Inspectors.** Inspectors employed by or contracted with the Department will be authorized to inspect all work done and all materials furnished. Such inspection may extend to any part or to all of the Work and to the preparation, fabrication, or manufacture of materials to be used including offsite waste and/or borrow areas. The Inspectors will have the authority to reject defective material and to suspend any construction that is being improperly done, subject to final decision by the Engineer. Inspectors will not be authorized to revoke, alter, enlarge, or relax the provisions of the Specifications, nor will they be authorized to approve or accept any portion of the completed project, or to issue instructions contrary to the Plans and Specifications. At the request of the Contractor, instructions from an Inspector may be had in writing on important items.

**Subsection 105.11. Revise** entire subsection to the following:

**105.11-Inspection of Work.** All materials and each part or detail of the Work shall be subject to inspection by the Engineer, or his representative including waste and /or borrow areas. He shall be given free access to all parts of the Work at all times and shall be furnished all information, facilities, and assistance by the Contractor as may be required to make complete and detailed inspection. Any work done or materials used without supervision or inspection by an authorized Department representative may be ordered removed and replaced at the Contractor's expense unless the Department representative failed to inspect after having been given reasonable notice in writing that such portion of the Work was to be performed.

At any time before acceptance of the Work, the Contractor shall remove or uncover such portion thereof as may be directed. If examination discloses that the Work is acceptable under the terms of the Contract, the Contractor shall return it to the original condition, and the cost of exposing the Work for examination and of returning it to the original condition shall be paid for

as Extra Work. If the Work exposed and examined does not prove acceptable, the cost of uncovering, or removing, of replacing all of the material involved, in full accordance with the Specifications and Plans, and of restoring the Work, shall all be at the expense of the Contractor. When any unit of government or political subdivision or any railroad corporation is to pay a portion of the cost of the Work covered by the Contract, its respective representatives shall have the right to inspect the Work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation a party to the Contract, and shall in no way interfere with the rights of either party hereunder.

Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer made under the provisions of this Subsection, the Engineer will have authority to cause unacceptable work to be remedied or removed and to deduct the costs from any monies due the Contractor. In the event that monies due or to become due the Contractor are not sufficient to defray the costs of such repairs or replacements, then the Department will hold the Contractor's Surety liable for the costs incurred. Any Construction performed by the Department under these provisions will not waive any provisions of the Contract nor relieve the Contractor in any way the responsibility for the construction performed by him.

**Subsection 105.13. Revise** entire Subsection to the following:

**105.13-Completion of Specific Sections of a Project.** The Department may accept a section or sections of a project before the entire project is completed. Such section(s) shall be of reasonable length, as determined by the Engineer, and shall be completed in full accordance with the Plans, Specifications and all other applicable provisions of the Contract. When such sectiot (s) is fully completed, the Engineer, after final inspection, will accept the section(s) and the Contractor will be relieved of any further work in connection therewith or any cost of maintenance thereof.

The Department may require a specific section or sections of a project to be completed prior to the completion of the entire project. Such section(s) shall be completed in full accordance with the Plans, Specifications and all other applicable provisions of the Contract. All provisions of the above paragraph regarding final inspection, acceptance, further work and maintenance shall apply.

After any offsite waste and/or borrow area (s) are no longer needed, the contractor shall ensure that the disturbed area is stabilized per the TN NPDES Construction General Permit criteria or per the agreed upon Reclamation Plan. After the area has reached final stabilization, the contractor shall request a meeting with the Engineer to perform a final inspection. Once the area is deemed acceptable, the contractor is responsible for terminating any Contractor obtained permits.

The acceptance of a section or sections of a project shall in no way void or alter any of the terms of the Contract.

**Subsection 105.15. Revise** entire Subsection to the following:

**105.15-Acceptance.** Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. If all construction provided for and contemplated by the Contract is found to be completed to his satisfaction, then that inspection shall constitute the final inspection and the Engineer will make the final acceptance and notify the Contractor in writing of his acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same, and the Contractor shall immediately comply with and execute such instructions. Upon correction of the Work, another inspection will be made which shall constitute the final inspection, provided the Work has been satisfactorily completed. In such event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

If exclusive offsite waste and/or borrow area(s) were used as part of the project, the Contractor must provide the Engineer proof of permit termination for all waste and/or borrow area(s) before the Engineer can start the process for final acceptance of the project. If the Contractor wishes to continue use of the waste and/or borrow area(s), the contractor shall provide the Engineer with a letter indicating the intended use and updated documentation.

**Subsection 105.18 Method of Measurement, Remove and Replace** Payment Schedule Table with the following:

PAYMENT SCHEDULE

| Estimate Number or Percent of Total Contract Amount of Previous Estimate | Total Percent of Construction Stakes, Lines, and Grades Lump Sum Bid Item |
|---|---|
| Estimate # 1 | 20% |
| Estimate # 2 | 40% |
| 10% | 50% |
| 20% | 60% |
| 40% | 70% |
| 60% | 80% |
| 80% | 100% |

**Subsection 106.04,** Fourth paragraph, **Insert** the word "notarized" in the first sentence, as follows

"A notarized Certificate of Compliance…"

**Section 107-Legal Relations And Responsibility,** Left out "**107.02-Load Restrictions on Projects Under Construction."**

**Subsection 107.02 Load Restrictions, Revise** entire Subsection to the following:

**107.02-Load Restrictions.**

(a). Delivery of Materials. The gross weight of trucks delivering material to construction projects shall be governed by State Law as set forth in Tennessee Code and Federal Law. All delivery trucks shall conspicuously display the tare weight, the allowable gross weight for State Highways, and the allowable gross weight for the Interstate System on the side of each truck. The Bridge Formula shall be used to determine allowable Interstate System gross weights as defined in the Federal Highways Administration's publication, *Bridge Formula Weights.*

The operation of equipment of such weight, or so loaded, as to cause damage to structures, the roadway, or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damages done by equipment used in construction of the project.

In such cases where it is necessary to haul material over a structure, other than structures with posted load limitations, the Contractor shall be required to limit the gross loads to the weights listed below. The loads posted for structures with weight limitations shall not be exceeded unless adequate shoring is provided and written permission is granted by the Department's Division of Structures.

Maximum axle load .....32,000 lbs.
.....(14,515 kg.)
Maximum load per axle on tandem axles ....24,000 lbs
.....(10,886 kg.)
Maximum total load.....90,000 lbs.
.....(40,824 kg.)

The contractor will be further required to place approved temporary guides on the bridge floor, as directed by the Engineer, in order to position the wheel loads as nearly as possible directly over the bridge girders. He shall keep the bridge floor clean so as to reduce impact forces. The maximum speed permitted will be 15 miles(25 kilometers) per hour.

Upon completion of hauling over the bridge, the Contractor will be required to clean the bridge floor, curbs and rail in a manner acceptable to the Engineer.

(b). Construction Loads. Construction loads include all material, component, equipment, and personnel loads applied to the structure other than those which are a consequence of permanent elements of the structure in their final state of construction. All construction loads not essential to the active construction work shall be prohibited from placement on the structure. Construction loads on bridges applied anytime subsequent to the placement of girders shall not exceed 50 pounds per square foot based on a uniform distribution of load. Loads characterized as non-uniform in nature shall be reconciled either by analysis equating load to an effective uniform load or employment of timbers or other means approved by Engineer to distribute construction loads. Length of load distribution may be taken as the bridge beam spacing (or slab span between walls for concrete culverts) occurring at the location of load application. The Contractor will be responsible for submitting to the Engineer all analysis and supplementary support details required to effect proper construction load distribution. Contractor is advised that if concrete is mounded ahead of the screed machine during placement of the deck, that any portion extending above the screed elevation is considered a construction load in applying the provisions of this section. Construction loads shall be placed as optimally as reasonable to minimize loads on the structure. When the area occupied by construction loads in any structure span exceeds 25% of the area of that span the Contractor shall be required to submit a diagram detailing the location, character, sequence and weight of all

construction loads applied to the structure to TDOT Division of Structures for approval. This submittal shall be executed a minimum of 30 days in advance of the planned operation. These provisions supplement those of Subsection 604.28.

**Subsection 107.06 Federal Aid Provisions (b). Revise** Subsection b to the following:

All waste and borrow areas outside the project right-of-way must be in compliance with Section 106 of the National Historic Preservation Act. The Contractor must furnish the TDOT Engineer and the Environmental Division with an Archaeological Clearance certified by the State Historic Preservation Office on all non-commercial material sources requiring excavation and/or fill.

Regardless of prior certification, if prehistoric remains or human burial sites are encountered at any time during construction, such operations shall be suspended and the Engineer and the State Historic Preservation Office shall be notified immediately.

All waste and borrow areas from outside the project right-of-way must comply with Section 7 of the Endangered Species Act. The contractor must furnish the TDOT Engineer and the Environmental Division with Threatened and Endangered Species Clearance from the Tennessee Wildlife Resource Agency and the U.S. Fish and Wildlife Service on all waste and borrow sites located outside project right-of-way.

The Archaeological Clearance certification, and the Threatened and Endangered Species Clearance from the Tennessee Wildlife Resource Agency and the U.S. Fish and Wildlife Service, must be furnished to the TDOT Engineer and the Environmental Division Permits Section, 30 days prior to work being started on all waste/borrow sites outside of the project right-of-way.

**Subsection 107.20 No Waiver of Legal Rights,** Delete and replace with the following:

**107.20-No Waiver of Legal Rights.** The Department shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after the completion of the Work or by final acceptance of the Work according to **Subsection 105.15** from showing the true amount and character of the Work performed and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor from showing that the Work or materials do not in fact conform to the Contract. The Department shall not be precluded or estopped, notwithstanding any such measurement, estimate, certificate and payment, or acceptance in accordance therewith, from recovering from the Contractor or his Sureties, or both, such overpayment or damages as it may sustain or damages due to the Contractor's failure to comply with the terms of the Contract. The Department shall retain and apply monies owed to the Contractor under any Department Contract, or claim and recover by process of law such sums, in order to correct any error or make good any defects in the Work or materials.

Neither the acceptance by the Department, or any representative of the Department, nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the Department, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or of any right to damages. A waiver by the Department of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

**Subsection 108.06- Determination of Time for Completion, Replace** entire subsection with the following:

**108.06-Determination of Time for Completion.** The Contractor shall complete the Work in full accordance with **Subsections 104.01** and **105.03** within the number of working days or calendar days or by the completion date stipulated in the Proposal. If a number of working days govern in connection with a specific Contract, the Engineer will apprise the Contractor, monthly, of the number of accumulated working days charged against him. Protest by the Contractor, in such connection, shall be filed within five working days of receipt of the information. The Engineer will review such protest and the supporting information and will render decision either affirming or correcting the accumulated number of working days previously reported.

When the contract time is on a calendar day basis, it shall consist of the number of calendar days stated in the Contract counting from the effective date of the Engineer's order to commence work, including all Sundays, holidays and non-work days. All calendar days elapsing between the effective dates of any orders of the Engineer to suspend work and to resume work for suspensions not the fault of the Contractor shall be excluded.

When the Contract completion date is a fixed calendar date, all work on the project shall be completed on or before that date.

If satisfactory fulfillment of the Contract requires performance of work in greater quantities than those set forth in the proposal, the contract time allowed for performance may be proportionally increased for major items only, as defined in section 101.64, if the Engineer determines that the increase in quantities for the major items has affected the completion of the project. If the contract requires a mandatory Critical Path Method (CPM), or contains an incentive clause, or a bonus clause for early completion, the Engineer shall not proportionately increase the working time. The Engineer will determine if the added work or increased quantities impact the submitted critical path workflow and will adjust the working time accordingly, but the incentive clause date or the bonus clause date will not be adjusted unless otherwise allowed in the Contract.

If the Contractor finds it impossible for reasons beyond his control to complete the Work within the contract time as specified or as extended in accordance with the provisions of this Subsection, he may, at any time prior to the expiration of the contract time specified or as extended, make a written request to the Engineer for an extension of time setting forth therein the reasons which he believes will justify the granting of his request. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the Engineer finds that the Work was delayed because of conditions beyond the control and without the fault of the Contractor, he may extend the time for completion by a properly executed Supplemental Agreement in such amount as the conditions justify. The extended time for completion shall then be in full force and effect the same as though it were the original time for completion except incentive clause date or the bonus clause date will not be adjusted unless otherwise allowed in the Contract.

Final acceptance will be made by the Engineer as prescribed in Subsection 105.15 and in accordance with the following:

State Funded Projects:

Upon presumptive completion of the project and due notice from the Contractor, the Engineer will make an inspection. If all items of work are completed to his satisfaction, the Engineer will accept the project and stop time charges as of the date of the inspection. However, if the inspection reveals that some items of work remain to be completed, the Engineer will direct the Contractor to complete these items and continue charging time until

all work has been satisfactorily completed, regardless of the number of inspections required prior to project acceptance.

Federal-Aid Projects:

The procedure for Federal-aid projects will be the same as noted above for wholly State funded projects except that time charges will be suspended during the time interval between presumptive acceptance by the Engineer and the date of inspection by the Federal Highway Administration (FHWA). Should the FHWA Engineer find any work unsatisfactory, time charges will be resumed the day after the inspection during which such determination is made until correction of such work.

In the event further inspections by FHWA are required, the procedure described herein will be repeated until final acceptance of the project.

**Subsection 108.07-Failure to Complete Work on Time, Remove** entire subsection and **replaced** with the following:

**108.07-Failure to Complete the Work on Time.** For each calendar day over and above the stipulated completion date on which any portion of the Work remains incomplete, a sum of money shall be deducted from monies due the Contractor, not as a penalty but as liquidated damages. The amounts to be deducted shall be as set forth below.

| Original Contract Amount | | | Daily Charge |
|---|---|---|---|
| $0 | - | $500,000 | $170.00 |
| >500,000 | - | 1,000,000 | $420.00 |
| >1,000,000 | - | 2,000,000 | $740.00 |
| >2,000,000 | - | 10,000,000 | $1,000.00 |
| >10,000,000 | - | 20,000,000 | $1,600.00 |
| >20,000,000 | | | $1,800.00 |

Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Department of any of its rights under the Contract.

**Subsection 108.08(a) Default,** Replace the first sentence with the following:

The Department reserves the right to terminate, by a written Contract Termination Notice, any Contract, of which these Specifications are a part, if the Contractor:

**Subsection 108.08(b) Without Fault,** Replace the first sentence to the following:

The Department may, by a written Contract Termination Notice, with the approval of the Federal Highway Administration where applicable, terminate any Contract or a portion thereof after determining that for reasons beyond the control of the Contractor, the work contracted for cannot be completed. Such reasons for termination may include, but need not necessarily be limited to one of the following:

**Subsection 108.08(c) New,** Insert (c) Convenience with the following paragraphs.

(c) Convenience

The Department may, by a written Contract Termination Notice, with the approval of the Federal Highway Administration where applicable, terminate any contract, or any portion thereof for the Department's convenience, when the Engineer determines that, a termination is in the best interest of the Department.

A termination of the contract for convenience may be directed at any time after the Department has made a determination to award a contract. Such reasons for termination may include, but are not limited to:

1. Insufficient funds by the Department due to extenuating circumstances;

2. Orders from duly constituted authorities relating to energy conservation;
3. Restraining orders or injunctions obtained by third party citizen action resulting from federal or state environmental protection laws or where acts or omissions or persons or agencies whether or not the Contractor primarily caused the issuance of such order or injunction;
4. Occurrence of an environmental situation of a significant nature that would require extensive and time-consuming delays in the work for the purposes of identification, evaluation, and possibly mitigation;
5. Occurrence of a previously undiscovered error in the bid documents;
6. Any other circumstances determined by the Department to be in the best interest of the Department and/or public.

In addition to the general reservation of the right to terminate for convenience under this section, the bidding documents may provide for a termination of the contract for convenience under this section upon the occurrence or non-occurrence of a specified event after bid opening.

Under any of the above circumstances for termination, the Engineer will deliver to the Contractor and the Surety a written Contract Termination Notice for reasons that will be set forth therein. The Notice shall specify the extent to which performance of work is terminated under the Contract and the effective date of termination. Unless otherwise directed by the Engineer, upon receipt of a Contract Termination Notice, the Contractor, or his Surety, shall immediately:

1. Stop work as directed in the Notice.
2. Place no further orders or subcontracts for materials, services or facilities except as approved by the Engineer to complete work not terminated.
3. Terminate all orders and subcontracts for the terminated work.
4. Deliver to the Engineer completed or partially completed plans, drawings, information and other property required to be furnished under the contract.
5. Take any action that the Engineer directs to protect and preserve contract-related property that is in the possession of the contractor in which the Department has or may acquire an interest.
6. Provide all other information included in this section and/or as requested by the Engineer.
7. Complete all work not terminated.

If the Contract or any portion thereof is terminated before completion of all items of work in the contract; payment will be made for the actual number of units of items of work completed at the contract unit prices and as mutually agreed for items or work partially completed. No claim for loss of overhead or anticipated profits, including anticipated earnings on usage of owned equipment, and impact, delay, or other direct or indirect costs resulting from this termination, will be compensated as part of any settlement. Items that are eliminated in their entirety by the termination, will be paid according to **subsection 109.05**.

Completed or partially completed work will be paid for at the contract unit prices of the actual number of units or items of contract work completed prior to the effective date of the termination, or on a force account basis, as determined by the Engineer.

Reimbursement for organization of the Work (when not otherwise included in the contract) and moving equipment to and from the job will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the contract unit prices, the intent being that an equitable settlement will be made with the Contractor. The Department may consider reimbursing the Contractor for actual work done and actual costs incurred by the Contractor before notification. It may include only such cost items as mobilization, subcontractor costs not otherwise paid for, actual idle equipment costs only for any time the work is stopped in advance of the termination date, and guaranteed payments for private land usage as part of the original contract (when not otherwise included in the contract). Any claim request for additional costs, not covered in this section or elsewhere in the contract, shall be submitted within 60 calendar days of the effective termination date.

Acceptable materials, obtained by the Contractor for the Work, that have been inspected, tested, and accepted by the Engineer, and that are not incorporated in the Work, may, at the option of the Engineer, be purchased from the Contractor. The Contractor shall submit the proof of actual cost, as shown by receipted bills and actual cost records. The Engineer, as shown by actual cost records, may designate all actual costs for delivery at such points of delivery to be added to this cost. If the Engineer and the Contractor do not agree to purchase such materials, the Department may reimburse the Contractor for any reasonable restocking fees and handling costs incurred by the Contractor in returning said materials to the vendor. In the event that only portions of the contract work are eliminated, the Department may stop delivery and payment for materials made unnecessary.

Termination of a Contract or a portion thereof shall not relieve the Contractor of his responsibilities for the completed Work, nor shall it relieve his Surety of its obligation for and concerning any just claims arising out of the Work performed.

**Subsection 109.02 Add the following to the end of Subsection 109.02:**

The prime contractor must pay each subcontractor for work performed under its subcontract no later than 30 days from the date the prime contractor receives payment for the work from the Department. The prime contractor must pay each material supplier for materials supplied to the project no later than 30 days from the date the prime contractor receives payment for the material from the Department. In addition, all subcontractors, at all tiers, must make payment no later than 30 days to each subcontractor and material supplier for work and/or material provided for the project once they receive payment from the prime contractor or subcontractor. The prime contractor shall provide monthly payment certification to the Department entitled “Prompt Payment Certification Form”. An officer of the prime contractor shall sign the “Prompt Payment Certification Form”. The Department will withhold estimate payments if information is not submitted. The Department will withhold estimate payments for subcontracted items if subcontractors, at any tier, or materials suppliers are not paid. Also, all required certifications must be in the field office and accepted before such work is deemed satisfactorily completed. Any delay or postponement of payment from the above referenced time frame will result in accrual of interest as provided under TCA, Section 12-4-707(b).

The prime contractor, or subcontractors, at any tier, shall not withhold any retainage from progress payments made to their subcontractors.

The contractor shall also document on the “Prompt Payment Certification Form” the actual amount paid to any certified Disadvantaged Business Enterprise (DBE) or certified Small Business Enterprise (SBE) during the estimate period certification is being made.

**Subsection 109.04-Methods of Payment for Extra Work, (a) Labor, Add** “for profit and overhead” to the end of the second sentence.

**Subsection 109.04-Methods of Payment for Extra Work, (c) Materials, Add** “for profit and overhead” to the end of the sentence.

**Subsection 109.04-Methods of Payment for Extra Work, (d) Equipment, Revise** to the following:

(d) Equipment

Equipment used for Force Account work shall be of the size, type and number necessary to perform the required work in an economic and expeditious manner.

The Contractor shall submit for approval a list of all contractor owned equipment or equipment rented from another contractor (i.e. an entity not in the commercial rental business), including the manufacturer, make, model, year of manufacture, type of fuel, and other necessary information to determine proper hourly payment rate. The hourly rate shall not exceed the Monthly rate less the regional adjustment and age adjustment, as published in "*The Rental Rate Blue Book for Construction Equipment*" published by Equipment Watch, Prism Business Media, divided by 176. The contractor shall also submit for approval the hourly operating cost for all equipment. The hourly operating cost shall include all costs and labor for routine maintenance and servicing, including but not limited to fuel, lubrication, filters, blades, belts, pumps, lines, hoses, teeth, tires, tracks, etc.. The hourly operating costs shall not exceed the rates published in "The Rental Rate Blue Book for Construction Equipment". The rental rates will be paid for the actual time that the equipment is in operation. The weekly, daily or hourly premium equipment rates shown in the Blue Book shall not be used.

Contractor owned equipment or equipment rented from another contractor that has been approved for force account work that remains idle or on standby will be paid at a rate of 50% of the hourly rate calculated above. Idle equipment shall not be paid for more than 8 hours in a day or 40 hours in a week or on days of inclement weather when no other work is taking place. Equipment that is inoperable will not be paid idle time. The Department will determine if it will be more cost effective to pay idle time on approved equipment or for multiple mobilizations.

For equipment being used to complete force account work for part of the day and idle for a part of a day, the total hours that can be charged will be 8 hours, unless the equipment is in operation for more than 8 hours. Idle time will not be paid for any equipment which operates more than 8 hours in a day

Equipment that is rented or leased from a commercial rental company will be paid for at actual invoice price, provided the prices are fair and reasonable but not to exceed the monthly rate published in "The Rental Rate Blue Book for Construction Equipment". The Department will pay a mark up of 15% for all rented/leased equipment for profit and overhead. The contractor shall also submit for approval the hourly operating cost for all rented/leased equipment if the rent/lease agreement does

not include these expenses. The mark up will not apply to hourly operating costs. Rented or leased equipment will not be subject to payment for idle time. The Department will determine if it will be more cost effective to leave the equipment on site idle paying invoice price or pay for multiple mobilizations.

**Subsection 109.04-Methods of Payment for Extra Work, (e) Transporting Equipment, Revise** to the following:

(e) Transporting Equipment

When it is necessary to bring approved equipment to the project site, the contractor will be reimbursed for these costs and the costs to return it to its original location. The cost to return shall not be more than the cost to deliver. If a piece of equipment is delivered to the project site and used for other contract pay items then return costs will not be reimbursed.

If the equipment is transported by the contractor, then payment will be by hourly rate as calculated in 109.04 (d) for other equipment. If the equipment is transported by common carrier, then payment will be the actual invoiced amount with no markup.

**Subsection 109.04-Methods of Payment for Extra Work, (f) Subcontracting and Professional Services, Revise** to the following:

(f) Subcontracting and Professional Services.

The contractor will be paid an administrative fee of 5% for all approved force account work completed by subcontractors and for approved special services associated with the force account work. Invoices shall be submitted for all subcontracted and professional services rendered.

**Subsection 109.04-Methods of Payment for Extra Work, (g) Miscellaneous, Revise** to the following:

(g) Miscellaneous.

No additional allowance will be made for general superintendence (Superintendent), time keepers, the use of small tools, or other costs for which no special allowance is herein provided.

**Subsection 109.04-Methods of Payment for Extra Work, (h) Compensation, Revise** to the following:

(h) Compensation.

The Contractor's representative and the Engineer shall compare records of the cost of work done as ordered on a force account basis at the end of each day's work.

**Subsection 109.04-Methods of Payment for Extra Work, (I) Statements, Revise** to the following:

(i) Statements.

No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with duplicate certified itemized statements of the cost of such force account work detailed as follows:

1. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman.
2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
3. Quantities of materials, prices, and extensions.
4. Transportation of materials.
5. Cost of property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions and social security tax.

Statements shall be accompanied and supported by receipted invoices for all materials used, including transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from his stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

**Subsection 109.06, Remove and Replace** the entire subsection with the following:

When requested in writing by the Contractor and approved by the Engineer, partial payment of non-perishable materials that will be permanently incorporated into the project may be made. These materials must be stockpiled in an approved manner on or near the project site or in special cases at an off-site location because of fabrication. These off-site locations should be limited to special cases where the material cannot be readily stockpiled at the project site such as steel structure components, prefabricated bridge components, etc. Material stored at an off-site location shall be clearly marked with the project information. A map noting the location shall be provided to the Project Supervisor. The material stockpiled on the project site shall be stored in an approved manner so that the quality of the material is not compromised. No payment will be made prior to inspection and documentation by a TDOT representative. Material, whether stored on-site or off-site, shall be readily identifiable in order to reference the quantity and assigned project.

Materials that may be included in partial payments: aggregates (stored on project, not at quarry), reinforcing steel, bridge piling, structural steel (fabricated units or steel delivered to fabricator if designated for particular project), precast concrete structures, traffic signal equipment, electrical equipment, fencing materials, sign materials, guardrail, and others as approved by the Project Supervisor.

Materials that may not be included in partial payments: Living or perishable plant materials, seed, fuel, used materials, form lumber, falsework, temporary erosion items, and other temporary items that will not become part of the completed work.

The payment for stockpile materials is initiated by the Contractor with a request to the Project Supervisor. The request shall be made in writing and shall contain the following information:

1. Request for stockpile payment that includes the following information:
   a. Contract and Project Numbers
   b. Item Number and Description as stated in the Contract Proposal

   c. Quantity and Unit of measure
   d. Conversion factor, if applicable
2. Written statement of assurance that material will be used on the specific project
3. Written consent of Prime Contractor's surety
4. Copy of certified paid invoice (in order to certify, a representative of the supplier must mark the invoice as paid in full, sign and date)
5. If the certified paid invoice is unavailable, a stockpile payment may be conditionally approved with receipt of the Surety's consent and a copy of the unpaid invoice. However, the contractor must submit the certified paid invoice within 30 days following the date of the progress payment for which the stockpiled material was paid. If the certified paid invoice is not submitted, the stockpile payment will be deducted from the following progress payment. In addition, any further requests for stockpile payment of that item must be accompanied by a certified paid invoice, or stockpile payment will not be paid.
6. Material certifications/Test reports for the material.

Partial payment will only be considered for an invoice or accumulation of invoices totaling $5,000.00 for each eligible pay item. Individual invoices shall not total less than $2,500.00. Invoices may include tax and freight. Partial payment shall not exceed 100% of the invoice amount or 75% of the contract unit price, whichever is less.

Stockpile payments shall not exceed the contract amount, unless the contract amount is increased by an approved change order. Payments will not be made for items that will be incorporated permanently into the project within 30 days from request of stockpile payment.

The Contractor shall assume full responsibility for the stockpiled materials from the elements and against loss or damage by any cause. In the event any of these stockpiled materials become lost, stolen, impaired or damaged after partial payment has been made, the monetary value of the lost, stolen, impaired or damaged material as may have been paid for in a current estimate will be deducted from the next estimate, and no further payment will be made until such material has been satisfactorily replaced in accordance with specification requirements.

The department will not withhold retainage from the Contractor. No monthly estimate or partial payment will be made when the total value of the work done since the last previous monthly estimate amounts to less than $1000.00.

After the first partial payment, the Department reserves the right to withhold any subsequent partial payments until it has been completely satisfied by the Contractor that his labor, material, and equipment costs and any claims for other reasons are paid on a current basis. Should any defective construction or material be discovered, or should a reasonable doubt arise as to the satisfactory quality of any part of the construction completed prior to final acceptance and payment, there will be deducted from the first estimate rendered after the discovery of such defective or questioned construction, and if necessary, from subsequent estimates, an amount sufficient to insure the replacement of such work by the Contractor or by others as may prove necessary.

**Subsection 109.08** New, insert the following:

**109.08-Payment of Costs Owed to the Department.**

The Contractor, without prejudice to the terms of the Department Contract, shall be liable to the Department for any or all of the following: fraud or such gross mistakes as may amount to fraud, the Department's rights under any warranty or guarantee, or any latent defects in the work.

The Department reserves the right to set off against any amount otherwise due the Contractor or his Sureties, or both, under this Contract or under any other contract or arrangement, including payment obligations under **Section 109.04** of these Specifications, that the Contractor or his Sureties, or both, has with the Department, the following:

1. any costs that the Department has incurred due to noncompliance with this contract by the Contractor or his Sureties, or both, and
2. any other amounts that are due and payable from the Contractor or his Sureties, or both, to the Department

**S T A T E** **O F** **T E N N E S S E E**

Rev. 10-20-07
Rev. 03-23-09
Rev. 05-5-2010
Rev. 08-06-2012

March 1, 2006

## Supplemental Specifications - Section 200

## of the

## Standard Specifications for Road and Bridge Construction

**Subsection 201.03-Clearing and Grubbing. Replace** the entire subsection with the following:

**201.03-Clearing and Grubbing.** The Engineer or Contractor when required will establish rights-of-way lines and construction lines, and the Engineer will designate all trees, shrubs, plants, and other objects to remain. The rights-of-way necessary for construction, as directed by the Engineer, shall be cleared of all dead trees, stumps, brush, projecting roots, hedge, weeds, pole stubs, logs, and other objectionable material. All trees, stumps, roots, pole stubs, brush, hedge, and other protruding obstructions within the area bounded by lines 5 ft. (1.5 m) outside the construction lines shall be completely grubbed except sound undisturbed stumps and roots which will be a minimum of 5 ft. (1.5 m) below subgrade or slope of embankment may be allowed to remain in place provided undercutting or other corrective measures, or topsoil stripping is not stipulated in the Plans or directed by the Engineer and providing stumps do not extend more than 6 in. (15 cm) above the ground surface. This work shall be done in advance of excavation and embankment operations.

Before construction activities begin, two types of areas must be marked within the project site. First, the limits of disturbance (clearing limits) must be clearly marked using staking or another acceptable visible marking method. Second, any environmentally sensitive areas such as streams, wetlands, buffers and ARAP boundaries that are included in the project boundaries must be marked with highly visible markers. Highly visible markers must be readily visible to project personnel including equipment operators.

Clearing and grubbing operations shall be avoided in areas designated to remain undisturbed as specified in the project's Stormwater Pollution Prevention Plan and any other applicable environmental permits. For clearing and grubbing activities associated with borrow pits or waste areas furnished by the Contractor, the borrow pits or waste areas must be approved in advance by the Project Supervisor, the Environmental Coordinator, and the Environmental Division and operated and maintained in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

When embankments are to be constructed in swampy areas, and undercutting or other corrective measures are not stipulated in the Plans or directed by the Engineer for these areas, undisturbed trees and stumps may be cut off at not more than 6 in. (15 cm) above the ground surface or low water level and the stump and root mass remain in place, if approved by the Engineer.

Unless marked for removal by the Engineer, living trees more than 5 ft. (1.5 m) outside the construction lines of the road are to be undisturbed, and are to be protected by the Contractor during construction of the project. Cut or scarred surfaces of trees or shrubs shall be treated with a paint prepared especially for tree surgery.

Clearing of hedge, weeds, pole stubs, logs, and other objectionable material inside the rights-of-way but outside the construction lines shall be completed to the ground surface.

Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed. Branches of trees extending over the roadbed shall be trimmed to give a clear height of 20 ft. (6 m) above the roadbed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

Trees more than 5 ft. (1.5 m) outside the construction lines and marked for removal by the Engineer shall be cut off within 6 in. (15 cm) of the ground surface. All stumps more than 5 ft. (1.5 m) outside the construction lines shall be trimmed to within 6 in. (15 cm) of the ground surface.

Wood debris that is chipped on site shall be properly disposed of so that does not become part of embankment. Within the areas where embankments are to be constructed, all depressions resulting from grubbing operations shall be backfilled with suitable excavation material and compacted in accordance with the provisions of Section 205 to natural ground elevation before embankment construction is started.

Depressions in excavation areas which are below finished subgrade elevation resulting from grubbing operations shall be backfilled with suitable material and compacted to finished subgrade in accordance with the provisions of Section 205 during the excavation operations.

Backfilling shall be completed a satisfactory distance ahead of embankment construction operations.

All slopes of cuts, embankments, ditches, channels, waterways and all structures both old and new, shall be cleared of all brush, hedges, weeds, heavy vegetation, and other objectionable material; and shall be maintained in a neat and satisfactory condition until the project is accepted.

Areas approved as borrow pits by the Engineer shall be cleared and grubbed of all trees, stumps, brush and heavy vegetation. Areas designated for obtaining construction material other than borrow material shall be cleared and grubbed of trees, stumps, brush and vegetation, and in addition shall be stripped of overburden laying above the material to be obtained. This work shall be completed well in advance of the removal of borrow or construction materials. Any offsite borrow areas must also be in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual

Areas within the limits of all drainage structures shall be cleared of all objectionable material to within 3 in. (75 mm) of the ground surface. Such areas shall extend the full length of the structures, as measured along the center-line of the highway, and to the rights-of-way lines along lines parallel to the centerline of the inlet and outlet channel or drainage of the structure. These areas shall also include the entire area of all easements obtained for drainage purposes.

**Subsection 201.04- Disposal of Debris. Replace** second paragraph with the following:

When permitted by the Engineer, perishable materials and debris may be removed from the rights-of-way and disposed of at locations off the project, outside the limits of view from the project during all seasons as long as the work is in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual. The cost involved shall be

included in the bid cost for the project. In addition the material shall be disposed of in accordance with all applicable laws and ordinances regarding solid wastes as per Tennessee Department of Environment and Conservation requirements.

**Subsection 201.05-Method of Measurement. Add** the following to the end of the first paragraph.

"When the bid schedule contains an item for Clearing and Grubbing on a lump sum basis, no measurement of area will be made."

**Subsection 201.06-Basis of Payments. Revise** entire subsection to the following:

"Payment for Clearing and Grubbing shall be made at the contract unit price per lump sum and shall be full compensation for completing the Clearing and Grubbing as outlined on the Plans and in these Specifications."

Payment for Clearing and Grubbing (Borrow Pits) at the contract unit price per acre (hectare) shall be full compensation for completing the Clearing and Grubbing of Department furnished borrow pits as outlined in the Plans and in these Specifications. These borrow areas will be furnished in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

**Subsection 202.03-General. Replace** the last sentence of the first paragraph with the following:

Material disposed of on private property shall be disposed of in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

**Subsection 202.04- Removal of Bridges, Culverts, and Other Drainage Structures. Replace** the entire subsection with the following:

**202.04-Removal of Bridges, Culverts, and Other Drainage Structures.** Bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. All bridge, culvert and drainage structure removal from streams must comply with any terms and conditions specified in applicable environmental permits, including the TN Construction General Permit. The Contractor will use highly visible markers to clearly mark permit boundaries and disturbed area limits.

Unless otherwise specified or directed, such portions of the substructures of bridges located in a stream shall be removed to 1 ft. (30 cm) below the adjacent ground level or natural stream bottom or the lowest scour elevation shown on the contract plans if shown to uncover the existing portion of the substructure. An exception to the above rule may occur if such portions of the substructure of a bridge are located in a stream or wetland, and then it shall be subject to the requirements set out in the permit form of the applicable State and Federal agencies approving the location and plans and authorizing the construction of the bridge. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

Steel bridges, precast or precast prestressed bridges and wood bridges designated to become the property of the Department shall be carefully dismantled without unnecessary damage. All such material shall be stored as specified in **Subsection 202.03.**

The removal of bridge decks shall be governed by the following:

1. Where bridge decks are to be wholly removed, but the girders are to remain in service;

   A. If the contractor elects to employ concrete saws to aid in the removal of the concrete deck, sawing transverse, the depth of the cut may not exceed the following :

      - Decks supported by steel beams or girders, 3-in. (75mm.)
      - Decks supported by prestressed concrete beams, 3-in. (75mm.)
      - Decks of cast-in-place hollow box or t-beam bridges, 1-in. (25mm.)

   B. The remainder of the slab depth under the cuts must be completed using pneumatically or electrically operated chipping hammers, not exceeding 60 lbs. (27.2 kgs.) in weight.

   C. Longitudinal saw cuts may be full depth, but no closer than –

      - Decks supported by steel beams or girders, within 1-in. (25 mm) of the widest top flanges.
      - Decks supported by prestressed beams, within 1 in. (25 mm) of the top flange.
      - Decks of hollow boxes or t-beam bridges, within 1-in. (25 mm) of the web, unless otherwise noted on the contract plans.

2. Where only the slab overhangs are to be removed, and if the contractor elects to employ concrete saws to aid in the removal of overhangs, only the top 1-in. (25 mm) of the slab may be saw cut. Pneumatically or electrically operated chipping hammers, not exceeding 60 lbs. (27.2 kgs.) in weight may be used to remove the remainder of the concrete. Care shall be taken not to damage transverse slab reinforcing bars.

3 Where bridge decks are to be removed as part of complete bridge demolition and the contractor elects to employ concrete saws in the removal of the deck, the depth of the cuts may not exceed the following:

   A. Decks supported by steel beams or girders, the plans depth of slab minus 1-in. (25 mm).
   B. Decks of hollow box or t-beam bridges; if not otherwise shown on the contract plans, the contractor shall submit a plan to the engineer for approval.

The use of hoe rams, pneumatic shears, pavement breakers, or other heavy equipment to remove slabs, where girders or adjacent slab portions are to remain, is strictly prohibited.

Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work, or adequate precautions shall be taken to prevent such damage.

**Subsection 203.01 Description. Add** the following as the last paragraph to this Subsection:

The Contractor must address both natural and created steep slope areas as required in the TN Construction General Permit. Steep slope requirements for erosion prevention and sediment controls and stabilization shall be in accordance with the TN Construction General Permit and any other applicable environmental permits.

**Subsection 203.02-Classification. Replace** the entire subsection with the following:

(a) Road and Drainage Excavation (Unclassified).

All excavation performed under this Section, including portland cement concrete located above subgrade elevation, other than Borrow Excavation, Channel Excavation, and Undercutting, will be considered unclassified excavation regardless of the nature of the material excavated.

(b) Borrow Excavation.

Borrow Excavation shall consist of material required for the construction of embankments or other portions of the work and shall be obtained from approved sources outside the right-of way limits in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual, unless otherwise designated in the Plans. However, any material, other than Borrow Excavation (Unclassified), as may be found in the excavation that meets the specifications of the designated borrow material may be used in the project in accordance with the conditions prescribed in **Subsection 104.10**. However, if the flattening of certain cut slopes on projects graded under previous contracts is desirable and approved in writing by the Engineer, the Contractor will be permitted to use this material for borrow provided the material is satisfactory and in accordance with plans approved by the Engineer, and provided he complies with the requirements of **Subsection 203.04** regarding borrow areas. Borrow material shall not be obtained from wetland areas, unless otherwise noted on the Plans and approved by applicable environmental permits

Borrow shall be classified as Borrow Excavation (Solid Rock), Borrow Excavation (Graded Solid Rock), Borrow Excavation (Unclassified), or Borrow Excavation (Select Material). Borrow Excavation (Solid Rock) shall consist of the removal and satisfactory placement of non-degradable rock which cannot be economically excavated by the proper use of a power shovel or without the use of explosives. Borrow Excavation (Unclassified) shall consist of the removal and satisfactory placement of all approved material encompassed under the classification of Borrow Excavation (Solid Rock) and all other approved material.

Borrow Excavation (Graded Solid Rock) shall consist of the removal and satisfactory placement of sound, non-degradable rock with a maximum size of 3 ft. (1 m). At least 50 percent of the rock shall be uniformly distributed between 1 ft. (30 cm) and 3 ft. (1 m) in diameter and no greater than 10 percent shall be less than 2 in. (50 mm) in diameter. The material shall be roughly equi-dimensional in shape. Thin, slabby material will not be accepted. The Contractor shall be required to process the material with an acceptable mechanical screening process that produces the required gradation. When the material is subjected to five alternations of the sodium sulfate soundness test (AASHTO T 104), the weighted percentage of loss shall be not more than 12. The material shall be approved by the Engineer before use.

Borrow Material other than solid rock shall be AASHTO M 145, classification A-6 or better if reasonably available. If classification A-6 is not reasonably available, the borrow shall be no worse than the predominant soil type in the roadway excavation based on AASHTO classification.

Borrow Excavation (Select Material) for special construction purposes shall meet the requirements set forth in the Contract.

Material obtained from an approved borrow source off the right-of-way as provided in this Subsection shall not be utilized to produce processed aggregate as described in Section 903. In no case shall material excavated from an offsite borrow source be utilized in base or other paving courses above the elevation of the subgrade.

Unless otherwise designated in the Contract, the Contractor shall make his own arrangements for obtaining borrow material in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

(c) Channel Excavation (Unclassified).

This item shall consist of the removal and satisfactory disposal of all material, regardless of its nature and the manner in which it may be removed, that is excavated for channel changes in widening, deepening, and straightening existing channels or constructing new ones, which have a width at the bottom of more than 14 ft. (4 m) as indicated on the Plans. All other similar excavation with a bottom width 14 ft. (4 m) or less, as shown on the Plans, shall be paid for as Road and Drainage Excavation (Unclassified). ). Any channel excavation that includes an existing stream or a proposed stream relocation must be constructed as specified in the applicable environmental permits.

(d) Undercutting.

This item shall consist of removing and disposing of unsatisfactory materials below grade in cut sections, from areas upon which embankments are to be placed, and may also include material excavated below the Foundation elevation for pipe, box culverts and box bridges as described in **Subsection 204.12**. Undercutting does not include the stripping, stockpiling and placing of topsoil, described in **Subsection 203.06**, nor does it include step-benching in the preparation of embankment areas on hillsides. Disposal of undercutting material off rights-of-way shall be conducted in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

**Subsection 203.04 General. Replace** the entire subsection with the following:

**203.04-General.** Prior to beginning excavation, grading, and embankment operations in any area, all necessary Clearing and Grubbing, Removal of Structures and Obstructions and placement of Erosion Control Devices in that area shall have been performed in accordance with **Section 201, Section 202** and **Section 209**, respectively, of these Specifications.

Excavation materials shall be removed in such a manner that the slopes may be neatly trimmed to the lines given. The Engineer may change the slopes shown on the original cross sections, depress raised medians or islands, raise depressed medians or islands or daylight cuts to increase or decrease the quantity of Road and Drainage Excavation (Unclassified) provided the material can be excavated without blasting and these changes are set in the slope stakes prior to commencement of excavation of the affected slopes, medians or islands. Any additional material

thus obtained shall be paid for at the contract unit price bid for Road and Drainage Excavation (Unclassified).

Excavation required to correct slides, regardless of its location relative to the theoretical slope line, or excavation required to prevent potential slides including blasting, and the dressing, reshaping or flattening of the affected slopes as directed by the Engineer, shall be paid for under the Item for Road and Drainage Excavation (Additional Material) in accordance with **Subsection 203.10**. If it becomes necessary to flatten a slope to correct a slide or prevent a potential slide after the cut has been started but not completed, payment under Road and Drainage Excavation (Additional Material) will be limited to material removed between the original staked slope line and the newly established slope line above the elevation to which the cut has been made. All other material will be paid for at the contract unit price of Road and Drainage Excavation (Unclassified). Seeding, sod and other incidental items required to repair the slide area will be paid for at the contract unit price bid for the respective items.

If more material is required to complete the embankments after all cuts have been brought to grade and all Road and Drainage Excavation (Unclassified) has been removed from within the balance, additional materials shall be obtained from within the rights-of-way by flattening, widening or daylighting cut slopes, and by depressing raised medians or islands at locations designated and as directed by the Engineer provided:

(a) The cost of this material is more economical than borrow excavation.

(b) The material is available within the adjusted balance where the shortage exists or the material may be hauled outside the limits of adjusted balance if the cost of the material is more economical than borrow when the additional cost of overhaul is considered.

(c) The material can be excavated without blasting.

(d) There is a minimum of 20 ft. (6 m) between the top of the existing slope and the top of the new slope and minimum of 5 ft. (1.5 m) between the top of the new slope and Rights-of-Way Line or Control Access fence. The 20 ft. (6 m) minimum will not apply when the existing slope is 4:1 or flatter or to overlapping or near overlapping slopes in medians or between parallel roads or ramps. The 20 ft. (6 m) minimum may be reduced at the written request of the Contractor.

This additional material is to be paid for under the item for Road and Drainage Excavation (Additional Material) in accordance with **Subsection 203.10**.

When additional material is paid for under the item for Road and Drainage Excavation(Additional Material) and additional clearing and grubbing is required, the additional clearing and grubbing will be measured and paid for by the acre (hectare), provided the item for Adjusted Clearing and Grubbing is in the Contract, or as negotiated. No additional payment will be made for extra handling of stockpiled topsoil made necessary by the use of the item for Road and Drainage Excavation (Additional Material).

The roadbed through rock cuts shall be constructed to the grading line shown on the Plans, with an allowable working tolerance of plus 1 to minus 3 in. (plus 25 to minus 75 mm). The portions of the roadway that are less than 3 in. (75 mm) below grade shall be brought to grade with spalls or other suitable granular material that is available from the excavation within the

balance. If such excavation is not available, the Engineer may direct the Contractor to use approved base material for capping. Payment for furnishing and placing said base material will be made at the contract unit price bid per ton (metric ton) for the applicable Item in **Subsection 303.14**. When base material is not a bid item in the Contract, the material shall be furnished under the provisions of **Subsection 104.03**. If the roadbed is excavated in excess of 3 in. (75 mm ) below the grading line shown on the Plans, the Contractor will be required to furnish and place at his own expense sufficient amounts of spalls or base material to bring the roadbed to a line 3 in. (75 mm) below the grading line.

Where sodding is indicated on the Plans to be placed on rock cuts, the rock shall be removed to 1 ft. (30 cm) below the grading line and backfilled to grade with earthen material prior to placing the sod. Measurement and payment of this work will be made under Items for Roadway and Drainage Excavation (Unclassified) and Sodding (New Sod).

All suitable materials removed from the excavation areas shall be used in the construction of embankments, intersecting road approaches, and in such other places as directed. Embankment construction shall be performed in accordance with the provisions of **Section 205** of these Specifications.

When boulder formations occur, the roadbed in the excavation area shall be scarified and all boulders removed to a depth of 12 in. (30 cm) below grade. The cavities thus formed shall be backfilled with suitable material and compacted.

All rock cuts shall be presplit at the outside limits of the cut areas. Presplitting shall consist of forming a plane of split rock prior to any primary blasting. The plane shall be formed for the entire depth of the cut or to a predetermined bench level. Presplitting shall be accomplished by drilling holes of appropriate size to the desired depth along the outside limits of the cut area, loading such holes with appropriate charges of explosives, stemming with minus 3/8 in. (9.5 mm) clean stone chips to the collar of the holes and detonating simultaneously. The initial horizontal spacing of holes and vertical spacing of charges and blasting cord for simultaneous detonation shall be as recommended by a reliable powder company. Adjustments of horizontal hole spacing and vertical spacing of charges shall be made as necessary to obtain a relatively smooth shear plane. Sand, gravel, clay, or dirt will not be permitted for stemming. In drilling holes for presplitting, the drills shall be plumbed for vertical slopes or set on the required slope when other than vertical slopes are specified, and all holes shall be drilled in the same plane. Presplitting will not be required on slopes flatter than 1 to 1. After presplitting is done, the drilling of primary blast holes shall be kept at least 3 ft. (1 m) or more from the presplit face. Presplitting of rock cuts under bridge sites shall be in accordance with the provisions of this Subsection and hole spacing shall be as specified under **Subsection 204.08**. Blasting records shall be made available on request by the Engineer. Blasting shall not be permitted within 300 ft. (100 m) of any Structure or concrete until at least 72 hours have elapsed after placement of the concrete. The Contractor will be responsible and replace and/or repair any and all damages at no expense to the Department.

All loose rock on cut slopes shall be removed immediately. Excavation material shall not be wasted, deposited or disposed of outside the construction lines unless directed by the Engineer. All excavation material wasted, deposited or disposed of outside the construction lines must be in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual. Obliteration of old roadways shall include all grading operations necessary to incorporate the old roadway into the new roadway and surroundings in order to provide a pleasing appearance from the new roadway.

Removal of concrete pavement, base, parking strip, sidewalk, curb and gutter, etc. will be paid for under the classifications as prescribed in **Subsections 202.06 and 203.02(a).** Roadway obliteration will be paid for as Road and Drainage Excavation (Unclassified).

When the Contractor's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. The Engineer will contact archaeological authorities to determine the disposition thereof.

The Engineer shall designate as unsuitable those soils that cannot be properly compacted in embankments. All unsuitable soil shall be disposed of as directed at no additional cost.

When the location of unstable soil is shown on the Plans, its removal and replacement shall be as shown.

The Contractor shall notify the Engineer sufficiently in advance of opening any borrow area so that, after stripping, cross section elevations and measurements of the ground surface may be taken, and so that the borrow material can be tested before being used. The borrow area shall be approved in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual. At least 14 days' time shall be allowed for testing borrow materials or other material from roadside pits that is proposed for construction purposes.

Unless otherwise permitted, borrow material shall not be placed until after the roadway excavation has been placed in the embankments. If the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste will be deducted from the borrow volume as measured in the borrow area. The Contractor shall not excavate beyond the dimensions and elevations established.

When the Contractor elects to remove highway fencing to obtain borrow materials, the fencing shall be replaced with new fence at the Contractor's expense. The Contractor shall be responsible for the confinement of livestock when a portion of the fence is removed.

Borrow pits shall be approved in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual and excavated in such a manner that they will be self-draining where possible and practicable, and shall be of a shape that can be easily cross sectioned.

When the Contractor's excavation operations are completed the area shall have a neat appearance. All borrow areas, except those portions which are under water in the case of pits which are not self-draining, shall be covered with topsoil and stabilized in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

Furnishing and placing of topsoil and seeding (with mulch) shall be performed in accordance with the provisions of **Subsection 203.06** and **Section 801**, respectively.

Furnishing and placing topsoil and stabilization of borrow areas, as specified above, shall be included in the bid cost for the project as specified in the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

The Contractor's attention is called to **Sections 53-801 through 53-809** of the **Tennessee Code, Annotated**, the provisions of which apply to borrow pits 1 acre (4047 $m^2$) or more in size that are not self-draining. Full information regarding the requirements to be complied with and the necessary permits which the property owner must secure for the construction of a pond, lake, borrow pits, etc., one acre or larger which is not constructed to drain, will be supplied upon application to the Tennessee Department of Environment and Conservation.

All existing roads within the right-of-way and not in the graded area that are to be abandoned shall be scarified, obliterated, top-soiled, and seeded. Scarifying and obliterating the pavement

will not be measured and paid for directly, but the cost will be included in the cost of other items. Topsoil will be measured and paid as outlined in **Section 203.09** and **203.10.** Seeding, in accordance with **Section 801** of these Specifications, will be measured and paid for under the item for Seeding.

When additional material is paid for under the item for Road and Drainage Excavation(Additional Material) and additional clearing and grubbing is required, the additional clearing and grubbing will be measured and paid for by the acre (hectare), provided the item for Adjusted Clearing and Grubbing is in the Contract, or as negotiated. No additional payment will be made for extra handling of stockpiled topsoil made necessary by the use of the item for Road and Drainage Excavation (Additional Material).

**Subsection 203.05-Undercutting. Add** the following as the last sentence of the first paragraph:

If undercutting material is to be disposed of off rights-of-way, disposal shall be conducted in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual, and the site to be used for disposal must be approved in advance by the Project Supervisor, Environmental Coordinator, and the Environmental Division.

**Subsection 203.06-Stripping, Stockpiling and Placing Topsoil. Revise** the first paragraph to the following:

**203.06-Stripping, Stockpiling and Placing Topsoil.** The Engineer will designate areas between slope stake points in both cut and fill from which the existing topsoil shall be stripped and stockpiled. The quantity of topsoil to be stripped shall be sufficient to provide, over all areas to be seeded, a depth of 2 to 3 in. (50 to 75 mm) of the material. If the quantity of topsoil available in such areas is insufficient, the Contractor shall make up the deficiency with topsoil from an approved borrow area in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual. The quantity of topsoil from such a source shall be measured by cross sectioning the area before and after removal.

**Subsection 203.07-Disposal of Excess or Unsuitable Material. Revise** the entire subsection to the following:

**203.07-Disposal of Excess or Unsuitable Material.** Excess excavation material shall be used to raise, widen or flatten the slopes of embankments; to fade embankments into cuts; or be placed in such other locations and for such purposes as the Engineer may direct.

Specific instructions will be given by the Engineer regarding the disposal of surplus material. Excess or unsuitable material placed within the rights-of-way limits shall be placed and compacted in accordance with **Subsection 205.04**. Foundation preparation for and drainage through these waste areas shall be equivalent to that provided for the adjacent roadway embankment.

If no suitable place can be found to dispose of excess or unsuitable material within the limits of the rights-of-way, the Engineer may direct the Contractor to provide a suitable site off the rights-of-way at no additional cost in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

Furnishing and placing topsoil and seeding waste areas inside the Rights-of-Way shall be measured and paid for at the contract unit prices bid for the respective items. Furnishing and

placing topsoil and seeding on waste areas outside the Rights-of-Way in accordance with the above provisions will not be paid for directly, and the costs thereof shall be included in the unit price bid for other items of construction.

When waste material is placed off the rights-of-way which, in the judgment of the Engineer, are so removed from the rights-of-way as to not constitute a potential threat to the stability of the project, the contractor should follow the requirements outlined in the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual to ensure the waste area is properly designed, regulated, and implemented.

**Subsection 203.09-Method of Measurement. Delete** the next to the last paragraph which begins with, "Overhaul of Road and Drainage Excavation".

**Subsection 203.10-Basis of Payment. Delete** the last paragraph.

**Subsection 204.02-Classification** (g) Bedding Material for Support for Pipe Culverts. **Add** the following sentence to (g):

"Payment for Type "A" or Type "B" backfill including bedding material will be included in the unit price of the pipe unless otherwise specified in the plans."

**Subsection 204.06 Add** the following before section (a)

> "The contractor shall submit for approval a proposed mix design in accordance with **Subsection 604.03."**

**Subsection 204.06** (a), second paragraph, **Delete** the first sentence and replace with the following:

"The above Specification Limits may be adjusted by the Engineer to obtain the consistency required for satisfactory flow."

**Subsection 204.08-Excavation (a) and (c). Replace** Subsection (a) and (c) with the following:

(a) Bridges, Box Culverts and Other Major Structures.

Before excavation is started the Engineer or Contractor when required, will set stakes locating and outlining the structure and cross section for excavation computations. The Contractor will also use highly visible markers to mark disturbed area and undisturbed area limits. Highly visible markers must be readily visible to project personnel including equipment operators. No excavation shall be started prior to that time.

All structure excavation shall be cut to the lines and elevations indicated on the Plans, or as directed by the Engineer. Working variations outside the neat lines will be permitted; however, only that excavation outlined under **Subsection 204.12** will be measured for payment.

No excavated materials shall be deposited or disposed of outside the construction lines unless directed and approved by the Engineer in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

When solid rock is encountered in roadway cut sections and channel sections under bridges, presplitting operations shall be performed in accordance with the provisions of **Subsection 203.04**. Hole spacing along bridge abutment sites shall not exceed 12 in. (30 cm). Where overshooting of rock, beyond the cut sections shown on the bridge plans

cause modification of bridge abutments or span lengths, such modifications shall be made at the contractor's expense.

Inclined surfaces of rock used as foundation shall be excavated either level or in steps. When necessary, as determined by the Engineer, to obtain good bond, the surface of rock foundation shall be roughened, or suitable anchors installed. Over-excavations that require re-design, or increased bridge length and/or quantities, or supplemental retaining walls or other earth retaining structures shall be paid at the expense of the Contractor.

Existing concrete foundations, boulders, or ledge streaks of rock projecting into the bottom of the excavation shall be removed to a depth of 6 in. (15 cm) below foundation elevation, and the space backfilled with approved material and thoroughly compacted.

Excavation below bridge foundation elevations as given shall be done only upon direction of the Engineer. All materials moved without such authority shall be replaced by the Contractor without compensation by constructing a sub-footing of the same materials as the footing of the structure unit and 6 in. (15 cm) wider on every side.

(c) Utilization of Excavated Materials.

All suitable excavated material shall be utilized as backfill or embankment. Excess or unsuitable material shall be disposed of in such a manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the structure. No excavated material shall be deposited at any time in such a manner as to endanger a partly finished structure.

The Contractor shall handle and deposit excavated materials in such a manner as to furnish proper protection to materials which will be incorporated in the structure.

In streams, the disposal of material will be subject to the laws of the U.S. Government and requirements set out in the TN Construction General Permit and any other applicable environmental permits.

**Subsection 204.09-Protection of Excavation. Replace** the entire subsection with the following:

**204.09-Protection of Excavation.** The Contractor will be held responsible for protecting his excavation and shall take every precaution to maintain the excavation intact.

Cofferdams or cribs, used in the preparation and protection of the foundation, in general, shall be carried well below the bottom of the footings, shall be substantially braced in all directions; and shall be of such construction as will permit them to be pumped and maintained free of water until the construction therein has been completed. All dewatering of work areas of must comply with the requirements of the TN Construction General Permit and shall not cause a water quality violation. Unless otherwise specifically indicated on the Plans, the interior dimensions of the cofferdam will be such as to give sufficient clearance to provide for the construction and inspection of forms; and to provide for the handling and pumping of leakage outside of the footing area. Cofferdams or cribs which tilt or move out of position during the process of sinking shall be righted or enlarged in order to provide the necessary clearance.

Cofferdams or cribs shall be so constructed as to protect the foundation and the construction therein against damage from a rise in the stream.

Timber, or bracing of a cofferdam or crib may extend into or through the substructure only with the written permission of the Engineer, obtained before the construction of the cofferdam or

crib has been started. In addition, the cofferdams for structure widening shall not be braced off of the existing structure.

The Contractor shall submit drawings, prepared by and stamped by a Professional Engineer licensed in Tennessee, showing details of his proposed cofferdam, or crib construction to the Engineer, prior to starting any work. The type and clearance of cofferdams, or cribs, insofar as they affect the finished structure or part thereof, will be subject to the approval of the Engineer but the design and successful construction shall be the responsibility of the Contractor. Work in a stream shall not begin until applicable permits from state and federal agencies have been obtained. Coffer dam construction shall be in accordance with the requirements of the permit(s).

Cofferdams or cribs, with all falsework, sheeting, bracing, etc. shall be removed by the Contractor after the completion of the sub-structure therein, unless otherwise directed. The removal shall be affected in such a manner as not to disturb nor mar the completed work.

If the foundation excavation has become disturbed or distorted, it shall be cleaned out and restored to satisfactory condition at the Contractor's expense.

**Subsection 204.10-Foundation Preparation. Replace** the entire subsection with the following:

**204.10-Foundation Preparation.**

(a) Bridges, Box Culverts, and Other Major Structures.

The preparation of foundations for bridges, box culverts and other major structures, in addition to the stipulations set out in **Subsections 204.08** and **204.09**, shall be in accordance with the following:

When the foundation has been completed to foundation elevation as given, the Engineer shall be notified and the construction therein withheld pending his inspection and approval of the foundation.

When directed by the Engineer, unless piles are indicated, the Contractor shall test each foundation in the presence of the Engineer, by sinking not less than 3 holes, or more than 6 holes to a depth of between 6 and 10 ft. (1.8 and 3 m) in order to verify the apparent conditions of the foundations.

Should these test holes disclose unsatisfactory foundation conditions, the excavation shall be carried lower, as directed by the Engineer, and new tests made, until a satisfactory foundation is secured. The costs incurred in sinking test holes will not be paid for directly but shall be included in the price bid for other items of construction unless specified otherwise on the Contract drawings.

When rock is encountered in the excavation for the foundation, it shall be cleared off and the Engineer notified. Test holes shall then be drilled in the rock as shown on the Plans or directed by the Engineer to determine the lines of demarcation, the classification and the stability of the rock. The excavation shall then be continued to the elevation designated by the Engineer and test holes, if required by the Engineer, shall again be drilled and excavation continued until a foundation approved by the Engineer is secured.

Rock used as foundation shall be stripped and cleaned of all overlying materials. All loose, disintegrated, or light slabby portions of the rock shall be removed.

In rock foundations, when the rock is shattered below the foundation elevation, the shattered material shall be removed and the space so created rebuilt with the same type of

construction as the proposed overlying construction. The additional quantities thus made necessary shall not be included in the pay quantities for this item.

When the Plans indicate that piles shall be driven, or if after the foundation excavation has been completed it becomes necessary to reinforce the foundation by driving piles therein, any bulge of the foundation material, caused by the driving of the piles, shall be removed at the Contractor's expense, to the elevation indicated or directed and the foundation trued to an even surface over its entire area.

Unsatisfactory material in the foundation shall be removed and replaced with satisfactory material designated by the Engineer. This material shall be placed in layers not exceeding 6 in. (15 cm) in loose depth and compacted to 100 % of maximum density up to the foundation elevation.

Any pumping that may be permitted from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of any portion of concrete material being carried away. Any pumping required during the placing of concrete, or for a period of at least 24 hours thereafter, shall be done from a suitable sump located outside the concrete forms. All dewatering of work areas must comply with the requirements of the TN Construction General Permit and shall not cause a water quality violation.

When conditions are encountered which render it impracticable to dewater the foundation before placing the footing, the Engineer may permit the construction of a concrete foundation seal of such dimensions as he may consider necessary and of such thickness as to resist any possible uplift. Before pouring the seal, the foundation shall be cleaned of all objectionable material by the use of sand pumps, spud bars or other means which will accomplish the purpose satisfactorily. The seals shall then be constructed in accordance with the provisions of **Subsection 604.19.** Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure. The foundation shall then be dewatered and the seal thoroughly cleaned of all laitance and generally prepared for further construction.

Measurement and payment for concrete foundation seal will be as provided for under **Subsections 604.31** and **604.32** except as provided for in 204.13.

(b) Pipe Culverts.

Bedding for pipe culverts shall conform to the requirements given below for Class A, B, or C bedding, whichever is shown on the Plans or in the special provisions. If the class of bedding is not shown, Class C bedding shall be placed.

Class A bedding for pipe culverts shall consist of a continuous concrete cradle constructed in conformity with the details shown on the Plans and the applicable requirements of **Section 604** (Concrete Structures).

Class B bedding shall be constructed by bedding the culvert pipe in a trench cut in natural ground or compacted embankment to a depth as shown on the Plans. The pipe shall be bedded on a 6 in. (15 cm) thickness of Class B Material and sufficient additional Class B material accurately shaped by a template to fit the lower part of the pipe exterior for at least 10% of its overall height. Class B material shall then be rammed and tamped in layers not over 6 in. (15 cm) in loose thickness around the pipe to a minimum depth of that shown on the Plans. The remaining depth of trench shall then be backfilled and compacted as outlined in **Subsection 204.11(b)**. When bell and spigot pipe is to be placed, recesses shall be dug in the bedding material of sufficient width and depth to

accommodate the bell without its resting on the bottom of the recess. The width of the recess shall not exceed the width of the bell by more than 2 in. (50 mm).

When plastic pipe is to be placed, the bedding and backfill shall be granular compactable Type "A" or Type "B" Aggregate, Grading D or E material meeting the requirements of **Subsection 903.05**. Open graded aggregates will not be allowed. A minimum of 6 inches of bedding compacted to a minimum 90% Standard Proctor Density shall be provided prior to placement of the pipe unless otherwise specified.

Class C bedding shall be constructed by bedding the culvert pipe in a shallow trench cut in natural ground or compacted embankment to a depth of not less than 10% of the outside vertical pipe diameter, and shall be shaped to fit the lower pipe exterior for the specified embedment. When bell and spigot pipe is to be placed, recesses shall be dug in the earth foundation of sufficient width and depth to accommodate the bell without its resting on the bottom of the recess. The width of the recess shall not exceed the width of the bell by more than 2 in. (50 mm).

When flowable fill is required by the plans, class B bedding shall be constructed by bedding the culvert pipe in a trench cut in natural ground or compacted embankment to a depth as shown on the Plans. The pipe shall be bedded on a 6 in.(15 cm) thickness of Class B Material and sufficient additional Class B material accurately shaped by a template to fit the lower part of the pipe exterior for at least 10 % of its overall height. Flowable fill shall then be placed around the pipe as specified in **Subsection 204.11(c).**

**Subsection 204.11 Backfilling,** (b) Pipe culverts. **Add** The following as the third paragraph:

"When plastic pipe is to be placed, structural backfill must be worked into the haunch area and compacted by hand after placement of the pipe. Special compaction means may be necessary in the haunch area. Structural backfill may then be placed in layers not to exceed an 6 inch loose lift thickness and brought up evenly and simultaneously on both sides of the pipe to an elevation not less than one foot above the pipe. A minimum compaction level of 90% Standard Proctor Density per *AASHTO T99* shall be achieved by the use of a vibratory plate. Hydrohammer type compactors shall not be used over the pipe. All compaction equipment used shall be approved by the Engineer."

**204.12-Method of Measurement. Add** the following as the last paragraph:

"Payment for Type "A" or Type "B" backfill including bedding material will be included in the unit price of the pipe."

**204.13-Basis of Payment,** (h) Concrete for Class A Bedding. **Remove** paragraph and **replace** with the following:

"Payment for Type "A" bedding material will be included in the unit price of the pipe unless otherwise provided in the plans. If specified by the plans, concrete for Class A Bedding will be paid for at the contract unit price per cubic yard (m3) for Bedding Material (Pipe) Class A, complete in place."

**204.13-Basis of Payment,** (i) Material for Class B Bedding. **Remove** paragraph and **replace** with the following:

"Payment for Type "B" bedding material will be included in the unit price of the pipe unless otherwise provided in the plans." If specified by the plans, material for Class B Bedding will be

paid for at the contract unit price per cubic yard (cubic meter) for Bedding Material (Pipe) Class B, complete in place.

**204.13-Basis of Payment,** (l) Backfill Material (Flowable Fill). **Add** the following as the last paragraph:

"Payment for "Flowable Fill" as backfill material for pipe shall be included in the unit price of the pipe unless otherwise provided in the plans."

**Subsection 205.01 Description. Revise** the entire subsection to the following:

**205.01-Description.** This work shall consist of constructing roadway embankments, including preparation of the area upon which they are to be placed; the construction of dikes within or outside the rights-of-way; the placing and compacting of approved material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the roadway area all in accordance with these Specifications and in reasonably close conformity with the lines, grades, and typical cross sections shown on the Plans or established by the Engineer. Only approved materials shall be used in the construction of embankments and backfills. These materials shall consist of Road and Drainage Excavation, Channel Excavation, and Borrow Excavation material described in **Section 203**, or excess material as described in **Section 204**.

The Contractor must identify both natural and created steep slope areas as defined in the TN Construction General Permit. These slopes must be marked in the SWPPP. Maintenance and stabilization of steep slopes must comply with the TN Construction General Permit and any other applicable environmental permits.

**Subsection 205.04** Insert the following, between the fifth and sixth paragraph:

"Where the contract includes the placement of base stone or other components of a pavement structure upon the subgrade, the top 6 in. (150 mm) in both cut and fill sections shall be compacted to a density equal to 100 percent of the maximum density in accordance with the provisions of **Subsection 207.04.**"

**Subsectin 206.03-Method and Scope of Work. Revise** the entire subsection to the following:

**206.03-Method and Scope of Work.** Final Dressing shall be performed by hand work and machines to produce a uniform satisfactory finish to all parts of the roadway and other components of the project. The roadbed, shoulders, ditches and slopes shall be shaped within reasonably close conformity to the specified lines, grades and cross sections. Spoil banks, borrow areas, waste areas, etc. shall be dressed in a satisfactory manner in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual. Rock cuts shall be scaled of all loose fragments and left in a neat, safe and workmanlike condition.

The entire rights-of-way shall be cleaned of all weeds, briars and brushes unless otherwise specified on the Plans. All structures, both old and new, shall be cleared and cleaned of all brush, drifts, heavy vegetation, sediment, rubbish, obstructions and other objectionable material.

Final dressing shall be performed prior to sodding and seeding operations when these construction items are included in the Contract.

Tracked machines used in the dressing of slopes shall be run up and down slopes as opposed to longitudinally.

**Section 209, Revise** Section title to the following:

## SECTION 209-PROJECT EROSION PEVENTION AND SEDIMENT CONTROL

**Subsection 209.01, Revise** entire Subsection to the following:

**209.01-Description.** This work shall consist of temporary and permanent best management practices to prevent erosion and control sediment through the use of structural and non-structural controls.

Erosion prevention and sediment control (EPSC) measures shall be implemented during all phases of construction, including all approved waste and borrow areas. EPSC measures shown on the Stormwater Pollution Prevention Plan (SWPPP) must be in place before any soil disturbing activities begin.

The Contractor must identify both natural and created steep slope areas as defined in the TN Construction General Permit. These slopes must be marked in the SWPPP. Management and stabilization of steep slopes must comply with the TN Construction General Permit and any other applicable environmental permits.

In addition to installing the EPSC measures included in the SWPPP, the Contractor is responsible for compliance with all other provisions of the SWPPP. Additional EPSC measures beyond those shown in the SWPPP may be required to maintain compliance with permits

**Subsection 209.02, Revise** Subsection to the following:

**209.02-Classification.** Structural and Non-Structural best management practices will be classified in accordance with manual for Management of Storm Water Discharges Associated with Construction Activities. Best management practices are structural and non-structural controls required for the project and shall be implemented in accordance with the TN Construction General Permit, Manual for Management of Storm Water Discharges Associated with Construction Activities, the project Stormwater Pollution Prevention Plan, and Roadway Standard Drawings, whichever is more restrictive.

**Subsection 209.04, Revise** entire Subsection to the following:

**209.04-Project Review.** Prior to the preconstruction conference the Contractor shall meet with the Engineer to discuss potential problems with erosion prevention and sediment control due to construction activities and actions to be taken to prevent such problems. Should the Contractor's operations and construction staging differ significantly from the SWPPP prepared for the project, the Contractor shall prepare a comprehensive SWPPP in accordance with **Subsection 209.05** below that does not conflict with the requirements of the TN Construction General Permit, the conditions of any ARAP for the project, or other environmental permits. The SWPPP shall be continuously implemented to effectively control erosion and protect streams, wetlands, and adjoining properties during the term of the contract.

If it is determined that a waste or borrow area is needed, the Contractor shall prepare a waste and borrow plan in accordance with the Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects Manual.

**Subsection 209.05, Revise** entire Subsection to the following:

**209.05-Preconstruction Conferences.** Each project will have a preconstruction conference. In addition to the preconstruction conference, for sites that have environmental permits, an environmental preconstruction conference will be held. These conferences can be held jointly or separately, as determined by the Project Supervisor.

At the preconstruction conference the Contractor shall submit for acceptance his plan for the staging of his operations. If the staging plan requires additional erosion prevention and sediment control measures or causes the existing SWPPP for the project to be modified, the Contractor shall submit these modifications to the project Supervisor and discuss the modificaitons during the preconstruction conference. The staging plan must address: (1) All areas within the rights-of-way as are applicable for clearing and grubbing, grading, bridges and other structures at water courses, paving and incidental construction (2) Areas outside the rights-of-way that will be disturbed by the construction such as waste and borrow areas (which must have an approved waste and borrow plan and be properly permitted), haul roads, utilities, and staging areas, and utility work in general. The Contractor's modified SWPPP shall incorporate and supplement, as applicable, the basic control devices shown in the plans to provide acceptable temporary and permanent erosion prevention and sediment controls during all stages of construction as well as to comply with all applicable environmental permit conditions. The Contractor’s modified SWPPP shall include controls for managing and stabilizing natural and created steep slope areas as defined in the TN Construction General Permit. No work shall be started until the erosion prevention and sediment control plan, including the staging of temporary and permanent erosion control measures, has been accepted by the Engineer. Rejection of all or part of the plan shall not constitute a basis for an extension of contract time.

The Project Supervisor and Contractor will discuss how utilities are to be managed on the project, specifically if the utilities are within the Construction contract or are separate from the Construction contract. The Prime Contractor will coordinate a start date for utilities with the Project Supervisor if utility work will begin before the project start date. Unless approved in advance by the Project Supervisor, utilities that are within the Construction contract cannot begin construction on the project until the Project Supervisor has approved the work.

The erosion prevention and sediment control plan shall be updated as work progresses to show changes due to revisions in work schedules or sequence of construction, or when directed by the Engineer. Additional measures shall be installed in the field as needed to manage erosion and sediment and to prevent pollutants from discharging into waters of the state or off the project.

An environmental preconstruction conference will also be held prior to beginning construction on sites that have environmental permits. The environmental preconstruction conference will include a review of the project’s environmental permits and any additional environmental commitments required for the project. This meeting will discuss the required marking of clearing limits and the marking of sensitive environmental areas per any applicable environmental permits. The Contractor will discuss potential problems with implementing the requirements of any environmental permits due to construction activities. The Contractor shall also discuss actions to be taken to prevent conflicts between environmental permits and construction activities.

**Subsection 209.06, Revise** entire Subsection to the following:

**209.06-Construction Requirements.** Disturbed area limits and environmental boundaries shall be marked in the field prior to construction in each section or portion of the project. Prior to or simultaneously with the clearing and grubbing operations, the Contractor shall install erosion prevention and sediment control devices in accordance with the approved SWPPP. Such work may involve the construction of temporary berms, dams, silt fences, sediment basins, lined channels, permanent cut-off ditches, slope drains or other control devices as necessary to prevent and control erosion. Water from cofferdams or other dewatering activities is not to be pumped directly into streams, but is to be pumped into sediment basins, traps, or filter bags or otherwise adequately treated prior to discharging. No grading shall be performed until the erosion prevention and sediment control devices are in place to the satisfaction of the Engineer. Areas to be graded may be cleared and grubbed prior to beginning grading operations in accordance with the TN Construction General Permit, provided adequate controls are in place. Stockpiled topsoil or fill material is to be protected so the sediment runoff will not contaminate surrounding areas or enter nearby streams. In order to reduce sediment in runoff, erosion prevention and sediment control structures shall be installed promptly during all construction phases and maintained until the areas they are serving have been permanently stabilized.

The Contractor must identify both natural and created steep slope areas as defined in the TN Construction General Permit. These slopes must be marked in the SWPPP. Management and stabilization of steep slopes must comply with the TN Construction General Permit and any other applicable environmental permits.

The Contractor's operations shall be staged so that graded or otherwise disturbed erodible surfaces are protected as the work progresses. Once the Contractor begins grading for a roadway cut or embankment, he shall maintain a continuous, viable operation to complete the cut or embankment to subgrade elevation, unless otherwise approved in writing by the Engineer. Exposed erodible cut or embankment slopes shall be final dressed, topsoiled and protected with permanent seeding, sodding, matting or other acceptable erosion prevention and sediment control measures in vertical increments not exceeding 25 ft. (7.5 m) as the work progresses; and no portion of these slopes shall remain unprotected longer than allowed by the TN Construction General Permit unless the Engineer determines that weather conditions or other special circumstances preclude current placement of permanent control measures. Temporary erosion control measures shall be implemented as directed by the Engineer.

Seeding, sodding, matting or other acceptable erosion prevention and sediment control operations shall be initiated within 48 hours after any one of the following conditions occurs:

1. Each 25 ft. (7.5 m) vertical increment is graded or
2. Upon suspension or completion of grading operations in a specific area.

The above requirements for progressive erosion prevention and sediment control, as well as additional requirements, also apply to graded areas off the rights-of-way such as waste areas, borrow areas and haul roads. A borrow and waste site plan must be developed for any waste or borrow area selected according to Statewide Storm Water Management Plan – Procedures for Providing Offsite Waste and Borrow on TDOT Construction Projects.

The Contractor shall incorporate all permanent erosion prevention and sediment control practices into the project at the earliest practicable time and in accordance with the TN Construction General Permit requirements. Temporary erosion prevention and sediment control features shall be used to control erosive conditions that warrant protection prior to installation of

permanent control features or that are needed to temporarily control erosion that develops during construction but which is not associated with permanent control features on the project. Temporary stabilization of disturbed areas shall be in accordance with the requirements of the TN Construction General Permit.

Where construction activities cross or border areas of depression (i.e. Sinkholes without openings or open throats), erosion prevention and sediment control measures shall be installed and maintained as shown in the plans and as required by the TN Construction General Permit and any other applicable environmental permits.. When construction activities encounter an open throated sinkhole (Class V Injection Well), the Engineer shall be notified immediately and applicable measures as described in the approved SWPPP shall be employed. The measures mentioned above shall encircle the sinkhole opening so as not to allow any silt or other potential pollutants to enter the opening.

In the event of conflict between these requirements and TN Construction General Permit, rules or regulations of other Federal or State or local agencies, the more restrictive laws, rules or regulations shall apply.

**Subsection 209.07-Construction of Structures. Revise** entire subsection to the following:

**209.07-Construction of Structures** Structural controls include, but are not limited to, bonded fiber matrix, riprap, inlet protection, check dams, silt fence, and sediment basins. Structural measures shall be installed and maintained in accordance with the Manual for Management of Storm Water Discharges Associated with Construction Activities, TN Construction General Permit, and the Roadway Standard Drawings.

Erosion prevention and sediment control measures shall be installed as indicated on the Roadway Standard Drawings, except as follows:

(a) **Sediment Filter Bags.**

The sediment bags may be utilized either on slope drains, pipe culverts, box bridges, or for pumping sediment from sediment traps and sediment basins. This activity shall be performed as shown on plans or as directed by the Engineer. The material shall be a non-woven geotextile fabric bag resistant to rot, mildew, puncture and tearing, with a minimum seam breaking strength of 200 lbs (90 kgs) the seams shall demonstrate less elongation and Deformation of the geotextile fabric. The Division of Materials and Test will certify the fabric for the Temporary Sediment Filter Bags and place them on the Department's Qualified Products List. Temporary Sediment Filter Bags shall meet the following specifications.

**GEOTEXTILE FABRIC SPECIFICATIONS**

| Properties | | Test Method |
|---|---|---|
| Weight | 10.0 oz/yd | ASTM D 3776 |
| Tensile Strength | 250 lbs. | ASTM D 4632 |
| Tensile Elongation at Break | 50% | ASTM D 4632 |
| Puncture Strength | 115 lbs. | ASTM D 4833 |
| Trapezoidal Tear | 100 lbs. | ASTM D 4533 |
| Mullen Burst | 350 lbs. | ASTM D 3786 |

| | | |
|---|---|---|
| Water, Flow Rate | 80 gpm/ft.2 | ASTM D 4491 |
| Permittivity | 1.2 sec.-1 | ASTM D 4491 |
| UV Resistance | 70% str. Ret. | ASTM D 4355 |

Standard Bag Minimum Dimensions
15 x 10 ft. and 15 x 15 ft.

Maximum Flow Rate
15 x 10 ft. up to 1,500 gpm
15 x 15 ft. up to 2,000 gpm

A manufacturer's label designating the maximum allowable flow rate of the bag in gallons per minute shall be permanently attached to each bag. The flow into the filter bag shall not exceed the designated flow rate. Care shall be taken to correctly connect the filter bag to the pump hose, as recommended by the manufacturer. Upon project completion, the sediment filter bag shall be completely removed and the disturbed areas at the dewatering structure location shall be permanently stabilized. The bag and sediment contained in the bag shall be disposed as directed by the Engineer.

(b) Sandbag Berms and Temporary Plugs.

Sandbag berms and temporary plugs may be used for velocity control, runoff management, sediment control and separating streamflow from work areas. These sandbag measures should not be used for filtration. Sandbag berms and temporary plugs should not be used in high concentrated flow areas where the sand bags may be displaced by flow. Sandbags should not be used in areas where equipment and/or traffic may damage the bags. The ends of sandbags must be tightly abutted and overlapped to direct flow away from bag joints.

Sandbags for the sandbag berms and channel plugs shall be made of durable, weather resistant geotextile fabric. Use of burlap is not acceptable for sandbags used in sandbag berms and temporary plugs. The bag fabric pores must be tight enough to retain the bag filler material. Typical bags measure approximately 24 inches x 12 inches x 6 inches. The sandbag fill material shall be a clean non-cohesive sand material.

Where sandbags are used to construct sandbag berms or temporary plugs across a ditch or channel, the sandbags should be installed along a level contour. The sandbags at the ends of the measure should be turned upstream.

Sandbag berms may be installed in both unpaved and paved ditches and channels. The sandbag berm must be wider than the high water mark of the ditch or channel to prevent undercutting. The center of the sandbag berm must be lower than either of the edges. For multiple sandbag berms installed in ditches, the maximum spacing between the berms should be such that the toe of the upstream sandbag berm at the same elevation as the top of the downstream sandbag berm.

Sandbag temporary plugs are constructed to separate stream flow from work areas, especially for projects requiring temporary diversions. Sandbag temporary plugs shall be constructed as required for the temporary diversion. The temporary plugs should be constructed as appropriate to be free of leaks between the bags.

Sandbags shall be removed and replaced if bags become torn or damaged to prevent the bag filler material from becoming a stormwater pollutant. Remove any sediment accumulations at sandbags when the sediment accumulation has reached half the original height of the sandbags. Where the ends of sandbag structures are breached, place new bags in the breach and extend the ends of the berm to a higher elevation. If needed, repair the bank damage. Where sandbags are undermined, do not repair the sandbags in place as additional undermining may occur. Move the sandbags downstream of the damaged location.

Upon project completion, all sandbags shall be removed and any disturbed areas underlying the sandbags shall be permanently stabilized with measures such as permanent seed and mulch.

(c) Flocculants .

This work shall consist of furnishing and applying flocculant materials for controlling erosion on disturbed areas and for use with sediment control devices for the purpose of reducing turbidity from stormwater runoff. Flocculant materials shall be manufactured and applied in strict accordance with the Specifications herein.

**Equipment**

All equipment necessary for the satisfactory performance of this work shall be on the project and approved, before work will be permitted to begin.

If using a liquid application system, it may be necessary to pump a surfactant through the delivery system prior to liquid flocculant injection and afterwards in order to prevent clogging of pipes and valves.

After application of flocculant materials, all equipment used for application shall be cleaned per the flocculant manufacturer's recommendations in order to prevent the formation of dried residues that may impede future equipment performance.

Applications of dry flocculant materials shall be performed with a hand-held fertilizer spreader or a tractor-mounted spreader. If approved by the flocculant manufacturer, the mixing of certain dry flocculants with dry silica sand will aid in the spreading of flocculant material.

**Limitations**

Cationic PAM blends will not be approved for use and shall not be applied in any circumstance due to aquatic toxicity.

Flocculants shall never be applied directly to streams, wetlands, or other natural water resources. Flocculants shall never be applied directly to sediment ponds. Flocculants applied to any area of the construction site, including slopes, shall be applied in such a manner so that all flocculant-applied runoff flows into a sediment trap, sediment pond, or series of multiple sediment-control BMPs prior to discharge from the site. Flocculants shall not be applied to slopes that produce runoff directly into a stream, wetland, or other natural water resource. Flocculants for both erosion and sediment control shall always be used in conjunction with approved stormwater BMPs, as given in the TDOT Standard Drawings.

Dry flocculant applications must be applied in dry weather conditions with light winds. Anionic PAM shall not be applied during rainfall or onto saturated soils.

All flocculant applications shall be applied at least 60 feet from any stream, wetland, or other natural water resource located on or adjacent to the construction site.

Emulsion forms of coagulant/flocculants should never be applied directly to stormwater runoff or to streams, wetlands, or other water resources due to surfactant toxicity. Emulsions may only be used in the preparation of liquid flocculants specifically used for erosion control applications, i.e., soil binders and tackifiers.

**Preparation of Treatment Areas**

Prior to use of flocculants, site-specific soil samples must be obtained and tested to identify the optimum flocculant blends to use for effectiveness. The Contractor shall provide site specific soils from given construction site to select an appropriate and effective flocculant blend for dry, liquid, emulsion, and brick/log flocculant materials. Soil samples must be obtained from each soil horizon to be accessed during excavation.

**Application Requirements**

Flocculants shall be used in conjunction with other BMPs (with the bulk of structural sediment-control BMPs, including sediment ponds, positioned down slope of the flocculant-application areas) to increase flocculant performance. Stormwater runoff from flocculant-treated soils shall be directed to pass through a series of sediment control BMPs prior to discharge to surface waters, with flow passing through, at least, a minimum of 3 enhanced rock check dams and a silt trap. It is preferable that runoff from flocculant-treated areas be directed into a sediment pond.

Flocculant materials shall be stored in covered areas. Many flocculants demonstrate a decrease in effectiveness after exposure to sunlight and air. Anionic PAM loses its effectiveness within three months after exposure to sunlight and air. Anionic PAM as well as certain other flocculant materials, when combined with water, become very slippery and can produce a safety hazard. Care must be taken to prevent spills of flocculants, in liquid, emulsion, or powder form, onto paved surfaces.

Application of flocculants will be most effective when applied as follows:

a) During rough grading operations;

b) On stockpiles and borrow areas;

c) Temporary haul roads before placement of crushed rock surface;

d) Compacted soil road base;

e) After final grading and before paving and/or final seeding;

f) Along the interior surface area of ditches;

g) Sites where work has been temporarily suspended (e.g., winter shutdown), and

h) Areas that will be mulched.

Flocculants should not be applied over surfaces of pure sand or gravel with no fines and should not be applied over snow cover.
The use of a visible tracer or colorant to visibly track flocculant application is recommended.

Liquid applications of flocculants will require the use of source water for mixing with a low turbidity (20 NTUs or less).

For turbidity reduction within sediment ponds, apply flocculants to conveyance ditches above the pond that discharge into the pond. Flocculants shall not be applied directly to pooled water within sediment ponds.

For **dewatering** and suspended solids removal of turbid pooled water within pipe tranches, silt traps, or other areas, flocculants may be introduced, in either liquid or solid forms, into the turbid water during pumping/evacuation of the pooled water. The pumping will provide turbulence for optimum mixing, with the discharge either pumped through a filter bag or jute-lined treatment ditch prior to ultimate discharge. Application rates as given in this specification for turbidity reduction for anionic PAM (and as given by the manufacturers' requirements for other types of flocculants) shall be strictly followed during dewatering.

Application requirements for the two main classifications of flocculants are as given below:

**I. Anionic Polyacrylamide**

Prior to use of any flocculant, the flocculant manufacturer's written application, storage, and mixing requirements and specifications shall be supplied to both TDOT and the Contractor. Anionic PAM shall be stored, handled, mixed and applied in strict accordance with the flocculant manufacturer recommendations and in strict compliance with OSHA Material Safety Data Sheet requirements, complying with all applicable federal, state, and local regulations. Proper personal protective equipment shall be used when handling the flocculant per industry, manufacturer, state, and federal regulations.

**SPECIAL CARE SHALL BE GIVEN TO THE APPLICATION RATES FOR ANIONIC PAM SPECIFIED HEREIN TO ENSURE THAT THE MAXIMUM APPLICATION RATES ARE NEVER EXCEEDED. ADDING ADDITIONAL PAM BEYOND THE RATES SPECIFIED WILL NOT IMPROVE THE EFFECTIVENESS OF PAM BUT COULD PRESENT TOXICITY ISSUES TO RECEIVING STREAMS DOWN GRADIENT OF THE PAM APPLICATION ZONE.**

For erosion control applications on sloped areas:

a) With hydroseeding applications, anionic PAM should be added as the last component to the hydroseeding mixture. When mixing, the Contractor shall never add water to anionic PAM. The Contractor shall add PAM at a slow rate to water. Mixing of anionic PAM for hydroseeding shall include agitation of the PAM/water mixture. The application method chosen must ensure uniform flocculant coverage to the target area.

b) The Contractor shall never use anionic PAM as the sole erosion control method for slopes; slope applications of PAM shall be accompanied with mulching.

c) For PAM tackifiers, dry PAM shall be dissolved with a known quantity of clean water in a container for several hours (preferably overnight.) PAM is to be applied at a rate in the range of 0.5 lb to 1.0 lb (maximum) per 1,000 gallons of water per acre application area via a hydro- mulch machine.

d) For soil binder applications, the Contractor shall dissolve pre-measured dry PAM with a known quantity of clean water in a container for several hours (preferably overnight.) PAM is to be applied at a rate range between 2/3 lb to 1 lb (maximum) PAM per 1000 gallons water per acre of bare soil.

e) Emulsion batches shall be mixed per the recommendations of the flocculant manufacturer to determine the proper product type and application rate to meet site-specific requirements. The chosen application method must ensure uniform coverage of the target application area.

f) When using an emulsion form of anionic PAM to slopes, apply no greater than 1.5 gallons emulsion per acre per event. Solution mixtures shall be 1.5 gallons (maximum) anionic PAM emulsion per 3000 gallons of water. Note: Water volumes that are less than 3000 gallons of water shall not be used due to increased viscosity issues.

g) The Contractor shall **s**pray the anionic PAM/water mixture uniformly across the dry soil slope until completely wetted.

h) For dry anionic PAM applications for erosion control, anionic PAM shall be applied as a powder at the following rates:

- For slopes less than 25% - Apply at 10 lbs per acre (maximum)
- For slopes greater than or equal to 25% - Apply at 20 lbs per acre (maximum)

i) Liquid anionic PAM for erosion control shall be reapplied on <u>actively worked areas</u> after a 48-hour period.

j) Liquid anionic PAM shall not be applied to the same slope area more than once in a 48-hour period and no more than 7 times in a 30-day period.

k) For inactive slope areas where anionic PAM has been applied, a reapplication shall be required once every two months.

l) **Note: Anionic PAM applications (dry or liquid) shall not exceed 200 lbs/acre per year.**

For turbidity reduction within ditches:

a) It is highly recommended that flocculant application be applied as erosion control in the watershed above the treatment ditches in conjunction with the application of flocculants within treatment ditches for turbidity control.

b) The surface area of stormwater ditches, as well as the surface area of ditch check dams, shall be lined with jute mesh.

c) Dry powder anionic PAM shall be applied over the jute mesh at a rate of 0.25 lb to 0.5 lb per 1000 square feet of ditch surface area.

d) Dry powder anionic PAM shall be re-applied to jute mesh in ditches every 3 to 5 storm events. **Dry anionic PAM application shall not exceed 4.6 lbs/1000 square feet per year.**

e) Anionic PAM bricks/logs shall be of appropriate size, shape, and number to deliver the appropriate dosage to the water within the conveyance. The flocculant manufacturer shall be consulted to provide brick/log dissolution rates and dosages.

f) Anionic PAM bricks/logs shall be located in a shaded, preferably moist, installation zone during application.

g) Anionic PAM bricks/logs shall be placed near the main flow area of the ditch, and they shall be placed at an appropriate distance above sediment ponds or traps to maximize mixing and flocculation. The manufacturer shall be consulted to provide guidance for flocculant mixing time required and block/log spacing configurations.

h) The Contractor shall install one anionic PAM brick/log for every 65 to 70 gpm of flow to be treated, unless otherwise specified by the flocculant manufacturer.

i) Unless otherwise specified by the flocculant manufacturer, anionic PAM bricks/logs are estimated to treat, on average, 475,000 to 550,000 total gallons of flow volume.

j) Stakes, mesh bags, cages, and other mechanisms to anchor bricks/logs in place shall be carefully installed to provide stability during flows and to maximize exposure of the brick/log surface area to flows.

k) Anionic PAM bricks/logs shall be replaced at least every 3 - 4 months or earlier if bricks/logs have excessive sediment/debris deposition on the outer brick/log surface area or excessive degradation of brick/log mass.

**II. Miscellaneous Coagulant/Flocculant Materials**

Miscellaneous flocculant materials shall include all other flocculants that are not polyacylamide blends and that have been pre-approved for use on TDOT projects through the TDOT Materials and Testing Division. Submittals of required information as given in the ***Materials*** and ***Classifications*** sections of this specification shall be strictly followed.

Prior to use of any flocculant, the manufacturer's written application, storage, and mixing requirements and specifications shall be supplied to both TDOT and the Contractor. Flocculants shall be stored, handled, mixed and applied in strict accordance with the flocculant manufacturer recommendations and in strict compliance with OSHA Material Safety Data Sheet requirements, complying with all applicable federal, state, and local regulations. Proper personal protective equipment shall be used when handling the flocculant per industry, manufacturer, state, and federal regulations.

Special care shall be given to the application rates for flocculants specified by the manufacturer to ensure that the maximum application rates are never exceeded.

For erosion and sediment control applications for sloped areas and ditches:

a) The Contractor shall strictly follow the manufacturer's requirements for application mixtures and rates.

b) With hydroseeding applications, flocculants shall be mixed in strict accordance with manufacturers written recommendations, as provided to TDOT and the Contractor.

c) Flocculants shall not be used as the sole erosion control method for slopes; slope applications of flocculants shall be accompanied with mulching. Flocculant use for turbidity reduction in ditches shall be used in conjunction with other structural sediment-control BMPs.

d) Re-application frequency and rates shall strictly follow manufacturer's written recommendations, as provided to TDOT and the Contractor.

e) Storage of flocculants shall follow manufacturers written requirements, as provided to TDOT and the Contractor.

**Documentation and Maintenance**

Flocculants will enhance the deposition of soil solids in downstream ditches, pipes, and ponds. These hydraulic structures shall be inspected regularly with solids routinely removed from these structures to ensure optimization of performance.

The Contractor shall provide suitable means for storing and protecting flocculants against moisture and sunlight.

TDOT field personnel shall maintain records of all flocculant applications including the following information:

a) Date, time, and specific location of application;

b) Rates of application;

c) Method of application;

d) Weather conditions, and

e) Type of flocculant applied including manufacturer name and product name.

**Final Cleanup**

The Contractor shall clean liquid or dry flocculant spills per the manufacturer's requirements. Flocculant mixing and application equipment shall be rinsed thoroughly with water to prevent the formation of residues. Unused flocculant mixtures should be minimized. Rinse residues can be applied to exposed slopes for erosion control. The Contractor shall dispose of excess flocculant material in compliance with federal, state, and local environmental regulations. Excess material shall not be disposed within stormwater conveyances, sewers, or streams.

The Contractor shall install and maintain all temporary erosion prevention and sediment control features and pollution prevention measures until no longer needed or permanent control measures are installed. Any materials removed shall become the property of the Contractor. In order to insure erosion prevention and sediment control structures work properly, it is imperative the sediment be removed and structural components of the measures maintained; therefore, inspection and maintenance of structures is to be performed on a regular basis. During sediment removal, the Contractor shall take care to insure that structural components of erosion prevention and sediment control structures are not damaged and thus made ineffective. If damage does occur, the Contractor shall repair the structures at his own expense. Upon complete removal of sediment traps, special ditches, etc., the area where they were constructed is to be topsoiled, seeded and mulched or otherwise stabilized.

In the event that temporary erosion prevention and sediment control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense. (See special provisions 107FP if applicable)

Where temporary erosion prevention and sediment control or pollution prevention work is acceptably performed and failure of all or any part of the system occurs but is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work will be paid for at the proper contract prices except as noted below. Should the temporary erosion prevention and sediment control or pollution prevention work not be comparable to the project work under the applicable contract items, the Contractor shall be ordered to perform the work on a force account basis, or by agreed unit prices in compliance with **Subsection 109.04**.

Except as noted below, payment also may be made for replacement of temporary erosion prevention and sediment control and pollution prevention devices installed according to the plans or as approved by the Engineer provided such devices are no longer effective because of deterioration or functional incapacity, except that no payment shall be made for replacement of erosion prevention and sediment control or pollution prevention devices ineffective due to improper installation, lack of reasonable maintenance or because of failure of the Contractor to pursue timely installation of permanent control devices in accordance with the Plans and Specifications or as directed by the Engineer.

Unless provided for on the plans, no direct payment will be made for temporary and permanent erosion prevention and sediment control or pollution prevention measures in disturbed areas outside the rights-of-way such as borrow areas, waste areas and haul roads unless the borrow areas or waste areas are provided for by the Department, and except for permanent Seeding (with Mulch) on borrow areas and waste areas within the limitations prescribed in **Subsection 203.0**4 and **Subsection 203.07**, respectively. Where the plans show separate quantities for erosion prevention and sediment control or pollution prevention items to be used outside the rights-of-way in connection with waste areas, borrow areas or other project related construction, payment will be made for these items used and accepted to the extent of these separately listed plans quantities; but the cost of any overruns in these items, or the cost of any additional items required for erosion prevention and sediment control or pollution prevention off the rights-of-way, shall be borne by the Contractor unless prior approval in writing is received from the Engineer.

In case of failure of the Contractor to control project related erosion or the discharge of pollutants, either on or off the rights-of-way, the Engineer may withhold payment of future progress estimates until the Contractor has satisfactorily performed the necessary corrective measures. If deemed necessary, the Engineer may employ outside assistance or use his own forces to provide the needed protective measures, with all incurred direct costs plus project engineering costs being charged to the Contractor by appropriate deductions from the Contractor's monthly progress estimate.

**Subsection 209.08-Revise** entire subsection to the following:

**209.08-Method of Measurement.** Erosion prevention and sediment control devices shall be measured in accordance with the appropriate Standard Drawing or as noted below.

Temporary seeding and mulching operations will be measured in accordance with the appropriate provisions of **Subsection 801.09**.

Seeding (without Mulch) and Crown vetch mixture (without Mulch) shall be measured per unit.

The accepted quantities of Road and Drainage Excavation will be measured in C.Y. ($m^3$).

Sediment removal and disposal for maintaining erosion prevention and sediment control measures will be measured by the cubic yard (cubic meter).

For catch basin filter assemblies, structure maintenance including cleaning to prevent clogging is included in the price bid for the structure. Sediment removal and disposal for maintaining these assemblies is not to be measured and paid directly.

Sand bags will be measured by the square foot area of berm face.

Flocculants used for turbidity reduction will be measured and paid for by the actual weight in pounds of flocculant materials applied or, for brick or log forms of flocculant material, the brick/logs will be measured by the unit, per each. Such price and payment will be full compensation for all work covered by this section, including, but not limited to, furnishing all materials, labor, equipment and incidentals necessary to apply the flocculant materials. Flocculants used as either a soil binder or tackifier for erosion control applications shall be measured by the acre.

**Subsection 209-09. Revise** entire subsection to the following:

**209.09-Basis of Payment.** All Non-Structural Best Management Practices shall be included in the bid cost of the project.

Items used to install erosion prevention and sediment control devices include basis of payment information along with measurement information on the standard drawings. The standard drawing item numbers and measurement units shall be used for measurement and payment unless otherwise specified. All measures shall be constructed and accepted according to the applicable Standard Drawings and specifications prior to measurement and payment.

Additional information regarding basis of payment for erosion prevention and sediment control measures and components is listed below.

Unless otherwise stated on the corresponding Standard Drawings, payment for erosion prevention and sediment control measures shall include all materials and labor necessary for the measure's construction, maintenance and removal.

For catch basin filter assemblies, structure maintenance including cleaning to prevent clogging is included in the price bid for the structure. Sediment removal and disposal for maintaining these assemblies is not to be measured and paid directly.

Seeding (with Mulch), Seeding (without Mulch), Temporary Seeding (with Mulch) Crown vetch mixture (without Mulch) and Mulch items will be paid for in accordance with the appropriate provisions of **Subsection 801.10**.

The accepted quantities of Road and Drainage Excavation will be paid for at the contract unit price per C.Y. ($m^3$).

Sediment removal and disposal for maintaining erosion prevention and sediment control measures will be paid for at the unit price per C. Y. ($m^3$).

For catch basin filter assemblies, structure maintenance including cleaning to prevent clogging is included in the price bid for the structure. Sediment removal and disposal for maintaining these assemblies is not to be measured and paid directly.

Rock used for inlet and outlet control on erosion prevention and sediment control measures will be paid for at the contract unit price per ton (tonne).

Pipe used in the construction of erosion prevention and sediment control measures will be paid for in accordance with the appropriate provisions of **Subsection 607.13**.

Concrete used in the construction of spillways or other structures pertaining to sediment structures will be paid for in accordance with the appropriate provisions of **Section 703**.

Water used in preparation of the seed bed and for maintenance will paid for at the contract unit price per M.G. (1,000 gal.) ( $m^3$) of water.

Sand bags will be counted per bag and will be paid for at the contract unit price per bag.

For flocculants, the accepted quantities, determined as provided above, will be paid for at the contract unit prices, which payment shall be full compensation for all equipment, materials, labor, and incidentals necessary to complete the work.

The Sediment Filter Bags will be paid for at the contract price bid per each for the size bag used which includes installation and/or replacement along with all materials, equipment, tools, labor, and incidentals to complete the work. Payment for removal and disposal of material from bag shall be made by the C.Y. ($m^3$) at contract price for sediment removal.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 06-01-06)
(Rev. 02-01-07)
(Rev. 12-30-08)
(Rev. 01-05-10)

March 1, 2006

**Supplemental Specifications - Section 300**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 303.08** (c) Second paragraph after (c), first sentence **Add** the word "exceeds" between the words "course" and "6 in. (150 mm)"

**Subsection 303.13;** Delete the second and third paragraphs and replace with the following:

> The weight of total moisture, as determined by dry weights, of the base material at the time of weighing in excess of 3 percentage points of optimum moisture content, will be deducted. When mixing is performed in a stationary plant, no direct payment for water will be made. When road mixing is performed, water added to the material during mixing at the direction of the Engineer will be made for payment.

**SECTION 304-SOIL-CEMENT BASE Insert** the following in the Table of Contents section of 304

**"304.11-Thickness and Surface Tolerances.**"

**Subsection 304.04** Last paragraph, add the word "be" in this section of the paragraph

"the entire section shall be reconstructed…"

**Subsection 307.03b Composition of Mixtures, Revise** entire subsection b to the following:

(b) Recycled Asphalt Pavement.

The Contractor may utilize asphaltic concrete removed from a Department project or other State Highway Agency project by an approved method and stored in a TDOT approved stockpile. Recycled Asphalt Pavement (RAP) combined with the appropriate aggregate, asphalt cement, and anti-strip additive when required shall produce a mixture that will otherwise meet all the requirements of **Subsection 903.06** and the requirements herein **Section 307**. RAP shall be allowed in each mix listed in the following table:

| Mix Type | %RAP (Non-processed) | Maximum %RAP (Processed) | Maximum % RAP Processed and Fractionated | Maximum Particle size |
|---|---|---|---|---|
| **307ACRL** | 0 | 00 | - | - |
| **307AS** | 0 | 00 | - | - |
| **307A** | 15 | 20 | 35 | 1 ½ in. (38 mm) |
| **307B** | 15 | 30 | 35 | 1 ½in. (38 mm) |
| **307BM** | 15 | 30 | 35 | ¾ in. (19 mm) |
| **307BM2** | 15 | 30 | 35 | ¾ in. (19 mm) |
| **307C** | 15 | 30 | 35 | 3/8 in. (9.5 mm) |
| **307CW** | 15 | 30 | 35 | ½ in. (13 mm) |
| **307CS** | 0 | 15 | 25 | 5/16 in. (8 mm) |

**RAP** that has been crushed and screened or otherwise sized such that the maximum recycled material particle size is less than that listed in the table above prior to entering the dryer drum, shall qualify as "Processed". "Non processed" **RAP** shall be similar material that has not been crushed and screened or otherwise sized previous to its use. When RAP is processed over more than one screen, producing sources of various maximum particle size (i.e. – ¾" to ½", ½" to #4, etc.), it will be referred to as "fractionated", and larger percentages will be allowed as noted above. These increased percentages will only be allowed provided the individual fractions are introduced into the plant as separate material sources for increased control.

All mixes shall contain at least 65% virgin asphalt.

The Contractor shall obtain a representative sample from the recycled material stockpile and establish a gradation and asphalt cement content as required. The Contractor shall determine the gradation and asphalt content of the recycled material at the beginning of a project and every 2,000 tons(2,000 metric tons) thereafter. The stockpile asphalt cement content for all recycled material shall not vary by more than 0.8%. The stockpile gradation tolerance for all recycled material on each sieve is listed below.

3/8 in. (9.50 mm ) sieve and larger± 10%
No. 4(4.75 mm) sieve.....± 8%
No. 8(2.36 mm) sieve.....± 6%
No. 30(600 µm) sieve .....± 5%
No. 200(75 µm) sieve .....± 4%

The mixture will be accepted for aggregate gradation and asphalt content based on extractions

A special design with asphalt content in the range of 5 to 7% shall be required where 307 C Mix is used as a surface on the shoulder.

The Contractor shall be responsible for his own sampling and testing of the planings as well as new materials for bid purposes, and for the submission of the job mix formula in accordance with Subsection 407.03. All additives shall be submitted to the Engineer for approval at the same time other materials are submitted for design verification.

If the Department has performed tests on the pavement to be cold planed, the results of all tests will be available at the Materials and Tests Division in Nashville, Tennessee during normal working hours. This information is advisory only and shall not be construed as necessarily complete nor accurate.

Where it is necessary to obtain a sample of the existing pavement for mix design, the Contractor shall mill the existing pavement to the full depth shown on the plans for pavement removal for a length of approximately 300 ft. (100 m) in an area approved by the Engineer. The removed pavement shall be replaced as specified on the plans or directed by the Engineer.

After mixing, the moisture content of the total mix shall be no more than 0.1% as determined by oven drying, and the provisions for lowering the temperature because of boiling or foaming shall not apply.

(c) Anti-Strip Additive - Asphaltic concrete mixtures (Grading A, AS, ACRL, B, BM, BM2, C, CS and CW) shall be checked for stripping by the following methods:

1. The Ten Minute Boil test for dosage rate and the Root-Tunnecliff procedure (ASTM D 4867) for moisture susceptibility.
2. For mixtures not requiring design - the Ten Minute Boil test for dosage rate and moisture susceptibility.

   * Root-Tunnecliff procedure (ASTM D 4867) shall not be used with the following mixtures: Grading A, AS, ACRL and B

If moisture susceptibility is indicated, then an approved anti-strip agent shall be mixed with the asphalt cement at the dosage recommended by the respective test and as specified in **Subsection 918.09(B).**

**Subsection 307.08 Method of Measurement, Revise entire subsection to the following:**

**307.08-Method of Measurement.** Aggregate and Asphalt Cement for Bituminous Plant Mix Base (Hot Mix) will be measured by the ton (metric ton) in accordance with the provisions of **Subsection 407.19**. Materials for prime or tack coat, if specified, will be measured as prescribed in **Section 402** or **403**, respectively.

If recycled mix is permitted, the completed mix, including new mineral aggregate, planings, asphalt cement and additive, shall be measured by the ton (metric ton) in accordance with **Section 109**. For bidding purposes, the asphalt cement content of the specified mixes shall be used in the chart below:

| Mix Type | Asphalt Content |
|---|---|
| 307 A | 4.0% |
| 307 B | 4.3% |
| 307 BM | 5.0% |
| 307 BM2 | 5.0% |
| 307 C | 5.0% |
| 307 CW | 6.0% |
| 307 CS | 6.5% |

In the event that the Engineer sets an asphalt content other than that stated above, a price adjustment will be made based on the asphalt content set by the Engineer and the Monthly Bituminous Index for the specific grade asphalt on the mix design. The price adjustment will be calculated according to the following formula:

PA = [MBI x (DA-BA) x T] / 100

Where:

PA = Price Adjustment
MBI = Monthly Bituminous Index
DA = Percent asphalt set on the mix design
BA = Percent asphalt specified above to be used for bidding
T = Total tons(metric tons) asphalt mix for price adjustment

The liquid anti-strip additive will be measured by the gallon(liter) and paid as outlined in **Subsection 307.09**. Hydrated Lime will be measured by the ton (metric ton) and paid as outlined in **Subsection 307.09.**

No direct payment will be made for polymer or latex additives and cost thereof shall be included in the price bid for the modified asphalt cement or modified mixture.

**Subsection 309.13;** Delete the second and third paragraphs and replace with the following:

> The weight of total moisture, as determined by dry weights, of the base material at the time of weighing in excess of 3 percentage points of optimum moisture content, will be deducted. When mixing is performed in a stationary plant, no direct payment for water will be made. When road mixing is performed, water added to the material during mixing at the direction of the Engineer will be made for payment.

**Subsection 312.08** Last sentence, Add the word “exceed”

> “1 layer shall not exceed 8 in. (200 mm).”

**Subsection 313.02-Materials, Add** the following to the end of this section

Liquid Membrane – Forming Compounds 913.05

**Subsection 313.05; section (a) 1. Add** to the end of the paragraph

> As an alternative to the steel wheel roller, the cement treated permeable base may be placed with a high-density screed with dual tamping bars.

**Subsection 313.05; section (a) 2. Revise** the first paragraph to read as follows

**Curing;** Immediately after spreading and compacting, the cement treated permeable base shall be cured by covering the entire surface and exposed edges with transparent or white polyethylene sheeting in accordance with **Subsection 501.18**, or a white pigmented wax base curing compound meeting the requirements of AASHTO M148. The polyethylene sheeting shall have a thickness of at least 4 mils (100 μm) and shall be held in place for a minimum of 7 days by a method approved by the Engineer. The surface of the cement treated permeable base shall be thoroughly wetted prior to placing the sheeting. The wax based curing compound shall be placed at a rate of 0.04 to 0.05 gallons per square yard (0.18 to 0.23 liter per square meter).

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006

(Rev. 02-09-09)
(Rev. 08-10-09)
(Rev. 01-05-10)
(Rev. 05-09-2011)
(Rev. 10-31-2011)
(Rev. 02-13-2012)
(Rev. 01-07-2013)

**Supplemental Specifications - Section 400**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 403.02. Revise** entire Subsection to the following:

**403.02-Bituminous Materials.** Bituminous materials shall conform to the requirements of the following Subsections of these Specifications:

| Materials | Subsection |
|---|---|
| **Emulsified Asphalt, SS-1, SS-1h, CSS-1, CSS-1h, TST-1P, CQS 1h, CQS-1hp, TTT-1** | **904.03** |
| **Asphalt Cement, PG 64-22** | **904.01** |
| **Chemical Additive** | **918.09(B)** |

The ranges of application temperatures in degrees F(C) shall be as follows:

SS-1, SS-1h, CSS-1, TST-1P,CQS-1h, and CSS-1h, 60-140° F (15-60° C)
PG 64-22, 70-22, 76-22, or 82-22 with Chemical Additive 375-400° F(190-205° C)
TTT-1, 160-180°F (70-80°C)
CQS-1hp, 60-140°F (15-60°C)

When emulsified asphalt is used, water as approved by the Engineer may be added to the asphaltic emulsion and thoroughly mixed therewith in such proportion, not to exceed 30% by volume of added water, that the resulting mixture will give the desired cover of residual bitumen. The exact quantity of added water will be established by the Engineer.

**Subsection 403.05. Revise** entire Subsection to the following:

**403.05-Application of Bituminous Material.** Immediately after cleaning the surface, emulsified asphalt shall be applied with the pressure distributor at a rate directed by the Engineer, between 0.05 gal/yd$^2$ (0.23 L/m$^2$) and 0.10 gal/yd$^2$ (0.46 L/m$^2$) of applied emulsion. If the bituminous material is to be placed upon a milled surface, the rate of application shall be determined by the Engineer between 0.08 gal/yd$^2$ (0.36 L/m$^2$) and 0.12 gal/yd$^2$ (0.54 L/m$^2$) of applied emulsion.

When Asphalt Cement is used as a tack coat, the application rate shall be 0.05 to 0.10 gal./s.y.(0.2 to 0.5 liter/m$^2$).

The surfaces of trees and structures adjacent to the area being treated shall be protected in such a manner as to prevent their being splattered or marred.

The tacked surface shall be allowed to dry until it is in a proper condition to receive the next course. Tack coat shall be applied only so far in advance of the paving operations as is necessary to obtain this proper condition of tackiness. The Contractor shall protect the tack coat from damage until the next course is placed.

Proper application of tack coat shall be achieved through the use of equipment and methods demonstrated on a tack coat test strip. This test strip shall be demonstrated at the same time an initial roller pattern and density test strip is set up for the first layer of asphalt mixture. This test strip application rate shall be between 0.05 and 0.10 gallons of applied emulsion per square yard. If the bituminous material is placed upon a milled surface, the test strip rate of application of tack material shall be between 0.08 and 0.15 gallons of applied emulsion per square yard. In all cases the application will result in a minimum double overlap of the actual track spray as it lands on the surface. The adjustment of the spray-bar and the nozzles may be necessary to achieve this minimum double overlap. Under no circumstances will corn-rows or any other pattern which would result in less than double overlap coverage of the tack coat be acceptable for the tack application. The goal is a very thin but uniform coating of asphalt left on the surface when the emulsion has broken.

Once the test strip has been demonstrated and approved by the Engineer, then this same procedure and application rates shall be applicable for the entire project or until another design is proposed and accepted.

When bituminous material for fog sealing of shoulders is included in the contract it shall be accomplished with emulsified asphalt meeting the requirements of Subsection 403.02. The application rate of diluted emulsified asphalt shall be 0.10-0.15 gal./s.y.(0.45-0.68 liter/m$^2$) based on a dilution rate of 1 part emulsified asphalt to 1 part water. This application may require 2 equal increments if run-off occurs.

**Subsection 403.06. Revise entire Subsection to the following:**

**403.06-Method of Measurement.** Bituminous Material for Tack Coat and Fog Sealing will be measured by the ton(metric ton), as delivered from the terminal, in accordance with the provisions of **Section 109,** Measurement and Payment. Water used for dilution of Asphalt Emulsions will not be measured for payment.

**Subsection 403.07. Revise** entire Subsection to the following:

**403.07-Basis of Payment.** The accepted quantities of Tack Coat will be paid for at the contract unit price per ton (metric ton) for Asphalt Emulsion or Asphalt Cement complete in place. The accepted quantities of Fog Seal will be paid for at the contract unit price per ton (metric ton) for Asphalt Emulsion complete in place.

The work required for preparing the designated surface as provided for under **Subsection 403.04** will be measured and paid for in accordance with the provisions of the applicable Section or Subsection under which the work is performed.

**Subsection 407.02 Materials, Add** the following at the end of this subsection:

When warm mix asphalt additive is used as described in subsection **918.09(B)**, it shall be added by approved blending equipment at the contractor's mixing plant, or it shall be pre-mixed and delivered with the asphalt cement.

**Subsection 407.03** (C) Replace the first paragraph with the following:

At least 14 working days prior to the scheduled start of production of any asphaltic paving mixture, the Contractor shall submit in electronic form(e-mail or on a floppy disk) a proposed Job Mix Formula and Laboratory Design, where applicable, prepared in accordance with the Marshall Method of Mix Design (AASHTO R-12), as modified by TDOT, or by Gyratory Compaction (AASHTO T 312, Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by means of the Superpave Gyratory Compactor). Regardless of which method is used, trial blends with at least 4 different asphalt contents (at least 2 above the optimum and 2 below the optimum) shall be made. When the gyratory method of compaction is utilized, the specimens shall be compacted to 65 gyrations with the optimum asphalt content and mixture volumetrics determined at that compaction level. If the specification requirements are not met, it will be necessary to make adjustments to the aggregate types and proportions. In addition the Contractor shall submit an asphalt barge certification with temperature-viscosity curve for each mixture to the Engineer for approval. A sample of each material to be used in the mix shall be delivered to the location designated by the Engineer.

**Subsection 407.03** (D) 2 (c) Quality Control System: 8 d **Insert** as the second sentence

"The Contractor, at his risk, may continue to produce and place mixture after the first 500 tons without the test results complete, however all mixture subject to price adjustment or removal at the discretion of the Engineer if the test results do not comply with the specifications."

**Subsection 407.03** (D), first paragraph, fourth sentence: **Remove** "on a random basis".

**Subsection 407.03** (D) 2 (c) Quality control System, 6, last sentence: **Remove** "on a random basis".

**Subsection 407.03** (D), **Table 407-01, Replace** "Required" with "Recommended" in the table heading.

**Subsection 407.04a Bituminus Mixing Plant, Add** the following to subsection "a" as the 12th bullet:

12. Warm Mix Asphalt process equipment.

    Modifications may be made to plants to reduce production and placement temperatures in accordance with subsection 407.21. Plant modifications for warm mix asphalt production temperatures shall be pre-approved by the department, and shall not detriment the plant's ability to maintain temperature control or mixture proportions.

    Modifications made to the plant to reduce mixing temperatures must meet the requirements listed for warm mix asphalt additives in the department's QPL.

**Subsection 407.06-**Bituminous Pavers: replace second sentence with:

"All paver extensions shall be full assembly extensions, including activated and heated screeds, auger extensions, auger guards, and throw-back blades to place mix beneath the auger gearbox."

**Subsection 407.09** Replace subsection in its entirety with the following:

**407.09 Weather Limitations.** Bituminous plant mix may be placed on properly constructed and accepted sub-grade or previously applied layers provided the following conditions are met:

1. The sub-grade and the surface upon which the bituminous plant mix is placed shall be free of excessive moisture.
2. The bituminous plant mix shall be placed in accordance with the temperature limitations of the following table and only when weather conditions otherwise permit the pavement to be properly placed, compacted and finished.

**TEMPERATURE LIMITATIONS**

| Compacted Thickness | Minimum Air or Surface Temperature | |
|---|---|---|
| | Unmodified mixes (PG 64, 67) | Modified mixes (PG 70, 76, 82) |
| 1.5 in. (40 mm) or less | 45° F (7° C) | 55° F (13° C) |
| > 1.5 in. (40 mm) to < 3.0 in. (75 mm) | 40° F (5° C) | 50° F (10° C) |
| ≥ 3.0 in. (75mm) | 35° F (2° C) | 45° F (7° C) |

3. No bituminous plant mix, with a compacted thickness of 1.5 in. (40 mm) or less, shall be placed between November 30 and April 1; and further, no bituminous plant mix, with a compacted thickness greater than 1.5 in. (40 mm), shall be placed between December 15 and March 16.
4. The contractor may request for approval a variance from the above required temperature and seasonal limitations to pave at lower temperatures when there is a benefit to the public. The request shall be in writing, be submitted at least one week prior to the anticipated need, and must include a "Paving and Compaction Plan for Cold Weather" in

accordance with the TDOT Procedure. The plan shall identify what practices and precautions the contractor intends to utilize to assure the mixture is placed and compacted to meet the specifications. The plan shall include compaction cooling curves estimating the time available for compaction, the intended production, haul, and compaction rates with paver and roller speeds estimated. Practices that should be considered include the addition of rollers, reduced production and paving rates, insulated truck beds, and heating the existing surface.

If the Contractor cannot obtain the specified densities, then all paving operations shall cease and a new plan shall be developed. All mixture failing to meet specifications will be subject to price adjustments or removal and replacement at the Contractors expense.

**Subsection 407.11 Preparation of Bituminous Material, Replace** entire subsection with the following:

**407.11-Preparation of Bituminous Material.**

A. **Hot Mix Asphalt (HMA).** The bituminous materials for hot mixes shall be heated to the required mixing temperature in accordance with the following **Table B**:

**Table B**

| PG Binder Grade | Minimum Temp. | Maximum Temp. |
|---|---|---|
| **PG 64-22, PG 67-22** | 270° F(132° C) | 310° F(154° C) |
| **PG 70-22** | 290° F(143° C) | 330° F(166° C) |
| **PG 76-22** | 290° F(143° C) | 330° F(166° C) |
| **PG82-22** | 290° F(143° C) | 330° F(166° C) |

The temperature for Grading AS and Grading ACRL mixtures shall be between 225 and 275° F(110 and 135° C), except when modified binders are used, and then the temperatures shall be between 275 and 330°F (135 and 166°C). Aggregate should be coated and no visible drain down should occur in storage silos or hauling equipment."

B. **Warm Mix Asphalt (WMA).** The produced mixture may be subjected to reduced production and placement temperatures by means of either the addition of a chemical warm mix additive in accordance with subsection **918.09(B)** or by use of plant modifications in accordance with subsection **407.04(a).**

When either WMA technology is utilized, the maximum mixing temperature for any grade of asphalt cement shall be no more than 300ºF (135ºC). At the beginning of a day's production, the producer may produce up to five truckloads at temperatures in accordance with Table B in order to pre-heat placement equipment (pavers, transfer devices) prior to producing WMA. The laboratory mixing and compaction temperatures shall be stated on the job mix formula during the mix design approval process. A tolerance of ±5.0ºF (2.8ºC) for each temperature will be allowed.

During test strip construction, the plant-produced WMA must exhibit the ability to meet test requirements for tensile strength ratio (TSR), conditioned tensile strength, Marshall Stability and flow, and boil test listed for HMA in specifications **307, 407,** and **411.**

**Subsection 407.15 Revise** the entire subsection to the following:

**407.15-Compaction.** After the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly compacted. The method employed must be approved by the Engineer and be capable of compacting the mixture to the specified density while it is in a workable condition. When no density requirements are specified, a system of compaction for roadway pavements shall be employed which has previously produced required bituminous pavement densities. A control strip and random density samples may be employed to aid the Engineer in evaluating the system.

In general, compaction shall be accomplished by the use of a combination of the equipment designated in **Subsection 407.07**. The following are minimum roller requirements; however, the number of rollers shall be increased if the required results are not being obtained.

Except as noted below, each paving train shall consist of a minimum of 3 rollers as specified in **Section 407.07**. The intermediate roller in each train shall be a pneumatic type. If the surface course contains a latex or polymer additive, a steel wheel type roller for intermediate rolling may be used instead of a pneumatic type provided the surface course meets density requirements.

A minimum of 2 rollers will be required when placing 307 CS mix. Breakdown rolling shall be performed, as soon as possible and while the mixture is sufficiently hot, by a pneumatic tire roller having a minimum contact pressure of 85 psi (585 kPa). A combination roller may not be substituted for a pneumatic roller when placing CS mix. The paver speed shall be regulated so rollers can maintain proper compaction of the mixture as determined by the Engineer.

The minimum number of rollers listed above may, with the approval of the Engineer, be reduced to 1 roller of either the steel-wheel or vibratory type on the following types of construction; (a) On shoulder construction, (b) On incidental construction such as bridge approaches, driveways, etc., and (c) on projects containing less than 10,000 s.y. (9,000 m2) of bituminous pavement.

Unless otherwise directed, rolling shall begin at the low side and proceed longitudinally parallel to the road centerline. When paving in echelon or abutting a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. When paving in echelon, rollers shall not compact within 6 in. (150 mm) of an edge where an adjacent lane is to be placed. Rollers shall move in a slow uniform speed with the drive wheels nearer the paver and shall be kept as nearly as possible in continuous operation. Rolling shall continue until all roller marks are eliminated. Rollers shall not park on the bituminous pavement.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. An excess of liquid shall not be used.

Rollers shall not be refueled on the bituminous pavements.

**Density Requirements.**

**ADT 1,000 or less**

| MIX TYPE | % OF MAXIMUM THEORETICAL DENSITY (AVERAGE) | NO SINGLE TESTS LESS THAN, % |
|---|---|---|

| | | |
|---|---|---|
| **A** | 90 | 87 |
| **B, BM & BM2** | 90 | 87 |
| **C & CW** | 90 | 87 |
| **D** | 90 | 87 |
| **E** | 90 | 87 |
| | | |

**ADT 1,000 to 3,000**

| | | |
|---|---|---|
| **A** | 91 | 89 |
| **B, BM & BM2** | 91 | 89 |
| **C & CW** | 91 | 89 |
| **D** | 91 | 89 |
| **E** | 91 | 89 |
| | | |

**ADT 3,000 or greater**

| | | |
|---|---|---|
| **A** | 92 | 90 |
| **B, BM & BM2** | 92 | 90 |
| **C & CW** | 92 | 90 |
| **D** | 92 | 90 |
| **E** | 92 | 90 |
| | | |

**Any ADT**

| | | |
|---|---|---|
| **Shoulder Mix (B, BM, BM2, D or E)** | 88 | 85 |
| **A S and A-CRL** | None* | None |
| **CS** | None* | None |
| | | |

* Density requirements shall be waived on Bituminous Plant Mix Base Grading ACRL, Grading AS and Bituminous Plant Mix Leveling Course, Grading CS; however, a system of compaction for roadway pavements shall be employed which has been approved by the Engineer. When placing Bituminous Plant Mix Base Grading ACRL and Grading AS, the intermediate roller (pneumatic tire) specified previously may be replaced by a steel wheel type if irreparable damage to the pavement is occurring.

The density (bulk specific gravity) determination for a compacted asphalt mixture shall be performed in accordance with AASHTO T-166, Method A only. All core samples shall be COMPLETELY DRY before testing. Air drying is permitted provided core samples are weighed at 2-hour intervals until dry in accordance with AASHTO T166, Section 6.1. Cores may also be dried in accordance with ASTM D7227.

Any base or surface course that tests below the minimum density shall be corrected until the density of the area is equal to or above minimum before it can be used to determine the average density of the lot. No successive layer, where applicable, shall be placed until the area has been corrected. When it is necessary to determine the classification of open graded or dense graded mixes and to measure segregation, ASSHTO T-269 or ASTM D-3203 shall be used.

For density testing purposes, the pavement shall be divided into lots of 10,000 s.y.(9,000 m2), except for 307 Gradings A, B and BM which shall be divided into lots of approximately 5,000 s.y.(4,500 m2). Five density tests shall be performed in each lot and the average results

compared with the requirements listed above. At the beginning of the project or at any time it is deemed advisable, smaller lots may be considered in order to evaluate compaction methods or for other reasons which are approved and/or directed by the Engineer.

Acceptance test must be selected randomly and be representative of the lot or sublot. Additional compaction after the acceptance test is acceptable but the original test result must be used to determine lot density. TDOT may take information only samples to spot check compaction. These tests shall not be used as acceptance test.

Along forms, curbs, headers, walls and other places not accessible to the rollers, the mixture shall be compacted thoroughly with hot hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used to compact the mix.

Any defective mixture shall be repaired or replaced to the satisfaction of the Engineer.

**Test Strips.**

Test Strips shall be required for all A, B, BM, C, CW, D, E and F mixes to establish rolling patterns, to calibrate nuclear gauges, to verify that the base course or surface course meets the density requirements of the specifications, and for mix design/ production verification as required.

Construction of the test strip shall be as follows:

1. The base course or other pavement course upon which a test strip is constructed shall have been approved by the Engineer prior to the construction of the test strip.
2. Equipment proposed for use in the compaction of test strips, shall meet the requirements set forth in this subsection and **Subsection 407.07**.

The test strip shall be constructed at the beginning of work on the pavement course. New test strips shall be required when:

1. a change in the job mix formula is necessary
2. a change in the source of materials occurs
3. a change in the material from the same source is observed
4. There is reason to believe that the test strip density is not representative of the bituminous mixture being placed.
5. a change in paving or compaction equipment occurs

With the approval of the Engineer, the Contractor may be permitted to construct additional test strips.

Each test strip shall be constructed with approved bituminous mixture and shall remain in place as a section of the completed work. Each test strip shall be 1 paver width wide and have an area of at least 400 s.y. (350 $m^2$) and shall be of the depth specified for the pavement course concerned.

Compaction of the test strip shall commence immediately after placement of the bituminous mixture and be continuous and uniform over the entire test strip.

The compaction of the test strip shall be continued until no appreciable increase in density (1 lb/c.f.. (15 kgs/$m^3$)) as measured with the nuclear gauge can be obtained by additional roller coverage. The roller coverage necessary to obtain this maximum density shall be used as the rolling pattern for the remainder of the project. Cores shall be taken by the Contractor on the test

strip at 10 randomly selected locations. Cores shall not be taken within 2 feet of the longitudinal edges for calibration or determining average densities. These cores shall be given to the State for use in calibrating the nuclear gauge and to verify that the average density of the test strip meets the density requirements of the specifications. All densities will be reported using the corrected nuclear gauge readings. Correction factors shall be specific to the nuclear gauges utilized during test strip construction. In the event that a different nuclear gauge needs to be utilized for acceptance, new cores will need to be cut from the ongoing pavement construction to calibrate the new gauge.

In the event the density of the asphaltic concrete in the test strip does not meet specification requirements, the Contractor shall make whatever changes are necessary to obtain the specified density. Other sources and combinations of aggregates shall be used as required, subject to approval of the Engineer, to produce a mix meeting the required density.

**Subsection 407.16 – Joints**, Replace the entire subsection with the following:

**407.16-Joints.** Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Engineer. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A brush coat of bituminous material shall be used on contact surfaces of longitudinal and transverse joints just before additional mixture is placed against the previously rolled material.

**Subsection 407.20 B 1, Remove and replace** the Quantity/Sublot Table with the following:

| Quantity | Number of Sublots |
|---|---|
| 3001-4500 tons | 4 tests |
| 2001- 3000 tons | 3 tests |
| 501-2000 tons | 2 tests |
| Less than 500 tons | 1 test |

**Subsection 407.20 B 3 (b), Add** the following as the first sentence:

Washed gradation of the residual aggregate shall be performed according to AASHTO T-30.

**Subsection 407.20, Table 407-2, Revise** table to the following:

The percents passing the sieves will be determined in accordance with AASHTO T-30.

**TABLE 407-2**

| **ACCEPTANCE SCHEDULE OF PAYMENT** (Asphalt Plant Mix Characteristics) | | | |
|---|---|---|---|
| **Characteristics** | **Pay Factor** | **Average Arithmetic Deviation of the Lot Acceptance Test from the Job Mix Formula** | |
| | | | |
| | | 1 Test | 2 Tests or more |
| Asphalt Cement | 1.00 | 0.00-0.30 | 0.00-0.25 |
| Content *** | 0.95 | 0.31-0.35 | 0.26-0.30 |

| | | | |
|---|---|---|---|
| (Extraction or | 0.90 | 0.36-0.40 | 0.31-0.35 |
| ignition oven) | 0.80* | over 0.40 | over 0.35 |
| | | | |
| Gradation | | | |
| 3/8 In. | 1.00 | 0.00-6.50 | 0.00-5.70 |
| (9.5 mm), | 0.95 | 6.51-7.08 | 5.71-6.20 |
| Sieve and | 0.90 | 7.09-7.66 | 6.21-6.69 |
| Larger | 0.80* | over 7.66 | over 6.69 |
| | | | |
| Gradation | | | |
| No. 4 Sieve** | 1.00 | 0.00-4.62 | 0.00-4.00 |
| (4.75 mm) | 0.95 | 4.63-5.20 | 4.01-4.50 |
| | 0.90 | 5.21-5.77 | 4.51-5.00 |
| | 0.80* | over 5.77 | over 5.00 |
| Gradation | | | |
| No. 8 16, 30 & 50 | 1.00 | 0.00-3.80 | 0.00-3.30 |
| (2.36 mm, 600 µm | 0.95 | 3.81-4.46 | 3.31-3.91 |
| & 300 µm , ) Svs** | 0.90 | 4.47-5.12 | 3.92-4.52 |
| | 0.80* | over 5.12 | over 4.52 |
| | | | |
| Gradation | | | |
| No. 100 & 200 | 1.00 | 0.00-1.80 | 0.00-1.60 |
| (150 µm & 75 µm) | 0.95 | 1.81-2.00 | 1.61-1.75 |
| Sieves** | 0.90 | 2.01-2.20 | 1.76-1.90 |
| | 0.80* | over 2.20 | over 1.90 |

*If approved by the Engineer, the Contractor may accept the indicated partial pay. The Department may require removal and replacement at no cost. The Contractor has the option to remove and replace at no cost to the Department at any time.

**Subsection 411.03 Composition of Mixtures, Replace** entire subsection with the following:

**411.03-Composition of Mixtures.**

(a) General Composition of mixtures used in this construction shall meet all applicable requirements of Subsection 407.03.

(b) The specified mineral aggregate and asphalt cement shall be combined in such proportions as to produce mixtures within the following master composition limits.

**Proportions of Total Mixture, Per Cent by Weight**

| **Surface Courses** | Effective Combined **Mineral Aggregate** | **Asphalt Cement** |
|---|---|---|
| **Grading D** | 93.0- 94.3 | 5.7-7.0* |
| **Grading E** | 93.0- 94.3 | 5.7-7.0* |
| **Grading E (shoulders)** | 92.0-94.7 | 6.0-6.5* |

*If the effective combined specific gravity of the aggregate exceeds 2.80, the above proportions may be adjusted as directed by the Engineer. The upper limit for Flow values shall not apply to mixes with modified asphalt liquids.

Grading D

In addition to the other requirements of these specifications the composition of the mineral aggregate shall be such that when combined with the required amount of bitumen the resultant mixture shall have:

**All Roads**

| Mix | Stabil. Min. lbft* (kN) | Flow 0.01 in. (mm) *** | Design Void content%* | Production Void Content %* | Min. VMA%* | Dust-Asphalt Ratio** |
|---|---|---|---|---|---|---|
| 411D | 2,000 (9.0) | 8-16 (2-4) | 4.0±0.2 | 3-5.5 | 14 | 0.6-1.2 |

*Tested in accordance with AASHTO T 245 with 75 blows of the hammer on each side of the test specimen, using a Marshall Mechanical Compactor.

**The dust to asphalt ratio is the percent of the total aggregate sample that passes the 200 mesh(75 µm) sieve as determined by AASHTO T 11 divided by the percent asphalt in the total mix

***Flow will only be required when using a non-modified binder (PG 64-22 or 67-22)

****In order to identify critical mixes and make appropriate adjustments, the mix design shall have these required production properties for the bitumen content range of Optimum Asphalt Cement ±0.25%.

When limestone screenings or agricultural limestone are utilized, the maximum amount by weight of the mineral aggregate shall be 25% unless the material is shown to meet the same coarse surface aggregate requirements for limestone as listed in **Subsection 903.11 (c) Grade D** (Types I, II, III, IV). In no case shall the combined aggregate blend consist of less than 75% non-skid material. When natural sand is used as fine aggregate, it shall be limited to a maximum amount of 25% by weight of the mineral aggregate. A maximum of 5% mineral filler meeting the requirements of **Subsection 903.16** may be substituted for an equal quantity of the limestone fines. If the mixture does not comply with the design criteria, another source of aggregate shall be required.

When gravel is used as the coarse aggregate for a 411 Grading D mix, a minimum of 20% by weight limestone screenings, agricultural limestone and/or mineral filler shall be required.

Grading E

In addition to the other requirements of these specifications where Grading E is used for the riding surface the composition of the mineral aggregate shall be such that when combined with the required amount of bitumen the resultant mixture shall have:

**High Volume Roads (ADT over 1,000)**

| Mix | Stability Min. lbft* (kN) | Flow 0.01in. (mm) ** | Design Void content %* | Production Void Content %* | Min. % VMA * |
|---|---|---|---|---|---|
| **411 E** | 2,000 (9.0) | 8-16 (2-4) | 4.0±0.2 | 3-5.5 | 14 |

**Low Volume Roads (ADT 1,000 and below)**

| Mix | Stability Min. lbft* (kN) | Flow 0.01in. (mm)** | Design Void content %* | Production Void Content %* |
|---|---|---|---|---|
| **411 E** | 1,500 (6.75) | 8-16 (2-4) | 3.5±0.5 | 2-5 |

*Tested in accordance with AASHTO T 245 with 75 blows of the hammer on each side of the test specimen, using a Marshall Mechanical Compactor.

**Flow will only be required when using a non-modified binder (PG 64-22 or 67-22)

*** Minimum stability for shoulder mixes will be 1500 lb.ft. (kN) and optimum Asphalt Cement content for shoulder mixes shall be as directed by the Regional Materials Supervisor.

If the design criteria above cannot be obtained with the aggregate, submitted to the laboratory for design, another source of aggregate will be necessary.

(c) Recycled Asphalt Pavement

The Contractor may utilize asphalt pavement that has been removed from a Department project or other State Highway Agency project by an approved method and stored in a TDOT approved stockpile. Recycled Asphalt Pavement (RAP) combined with the appropriate aggregate, asphalt cement, and anti-strip additive when required shall produce a mixture that will otherwise meet all the requirements of **Subsection 903.11** and the requirements herein **Section 411**. RAP shall be allowed in each mix listed in the following table:

| Mix Type | %RAP (Non-processed) | Maximum %RAP (Processed) | Maximum % RAP Processed and Fractionated | Maximum Particle size |
|---|---|---|---|---|
| 411D(PG64-22, PG67-22) | 0 | 15 | 20 | ½ in. (12.5 mm) |
| 411D(PG70-22) | 0 | 10 | 15 | ½ in. (12.5 mm) |
| 411D(PG76-22, PG82-22) | 0 | 10 | 15 | ½ in. (12.5 mm) |
| 411E(Roadway) | 0 | 15 | 20 | ½ in. (12.5 mm) |
| 411E(Shoulder) | 15 | 30 | 35 | ½ in. (12.5 mm) |

RAP that has been crushed and screened or otherwise sized such that the maximum recycled material particle size is less than that listed in the table above prior to entering the dryer drum, shall qualify as "Processed". "Non processed" RAP shall be similar material that has not been crushed and screened or otherwise sized previous to its use. When RAP is processed over more than one screen, producing sources of various maximum particle size (i.e. – ¾" to ½", ½" to #4, etc.), it will be referred to as "fractionated", and larger percentages will be allowed as noted above. These increased percentages will only be allowed provided the individual fractions are introduced into the plant as separate material sources for increased control.

All mixes shall contain at least 80% virgin asphalt except for 411E Shoulder Mix which shall have at least 65% virgin asphalt.

The Contractor shall obtain a representative sample from the recycled material stockpile and establish a gradation and asphalt cement content as required. The Contractor shall determine the gradation and asphalt content of the recycled material at the beginning of a project and every 2,000 tons (2,000 metric tons) thereafter. The stockpile asphalt cement content for all recycled material shall not vary from the Job Mix Formula by more than ± 0.8 %. The stockpile gradation tolerance for all recycled material on each sieve is listed below.

3/8in. (9.50 mm) sieve and larger .....± 10%
No. 4(4.75 mm) sieve.....± 8%
No. 8(2.36 mm) sieve.....± 6%
No. 30(600 µm) sieve.....± 5%
No. 200(75 µm) sieve.....± 4%

The Contractor will be responsible for his own sampling and testing of the RAP as well as new materials for bid purposes, and for the submission of the job mix formula in accordance with **Subsection 407.03**. After mixing, the moisture content of the total mix shall be no more than 0.1% as determined by oven drying, and the provisions for lowering the temperature because of boiling or foaming shall not apply.

The mixture will be accepted for aggregate gradation and asphalt content based on extractions or in accordance with AASHTO T 308.

(d) Anti-Strip Additive

Asphaltic concrete surface mixtures (Grading D & E) shall be checked for stripping by the Ten Minute Boil test for dosage rate and ASTM D 4867(Root-Tunnecliff procedure) for moisture susceptibility.

If moisture susceptibility is indicated, then an approved anti-strip agent shall be mixed with the asphalt cement at the dosage recommended by the respective test and as specified in **Subsection 918.09(B).**

**Subsection 411.09-Method of Measurement. Remove** and replace the entire subsection with the following:

**Subsection 411.09-Method of Measurement.** Mineral Aggregate including Mineral Filler, when required, and Asphalt Cement for Asphaltic Concrete Surface (Hot Mix) will be measured

as prescribed in Subsection 407.19. Mineral Filler when required will not be measured for payment separately, but will be included as mineral aggregate.

If recycled mix is permitted, the completed mix, including new mineral aggregate, planings, asphalt cement and additive, shall be measured by the ton (tonne) in accordance with Section 109. For bidding purposes, the asphalt cement content of the specified mix shall be used in the chart below:

| Mix Type | Asphalt Content |
|---|---|
| 411-D | 5.9% |
| 411-E Roadway | 6.3% |
| 411-E Shoulder | 6.3% |

In the event that the Engineer sets an asphalt content other than that stated above, a price adjustment will be made based on the asphalt content set by the Engineer and the Monthly Bituminous Index for the specific grade asphalt cement on the mix design. The price adjustment will be calculated according to the following formula:

PA = [MBI x (DA-BA) x T]/100

Where:

PA = Price Adjustment

MBI = Monthly Bituminous Index

DA = Percent asphalt set on the mix design

BA = Percent asphalt specified above to be used for bidding

T = Total tons (metric tons) asphalt mix for price adjustment

The liquid anti-strip additive will be measured by the gallon(liter) and paid as outlined in Subsection 411.10. Hydrated Lime will be measured by the ton(metric ton) and paid as outlined in Subsection 411.10.

No direct payment will be made for polymer or latex additives and cost thereof shall be included in the price bid for the modified asphalt cement or modified mixture.

**Subsection 414.03, Revise** entire section as follows:

**414.03-Composition of Mixture.** At least 2 weeks prior to beginning work the Contractor shall submit a signed original of a mix design covering the specific materials to be used on the project to the Materials and Tests Division for acceptance together with representative samples of each ingredient to be used in the mixture. The samples should contain information relative to sources, type of materials and project number.

This design must have been performed by a qualified laboratory. Once the materials are approved, no substitution will be permitted unless first tested and approved by the laboratory

preparing the mix design. No work shall begin nor will any mixture be accepted until the Materials and Tests Division has evaluated and accepted the mix design.

The laboratory report will show the results of tests performed on individual materials, comparing their values to those required by this specification. Job aggregates will be used in all laboratory design tests. Mixing tests must pass at the maximum expected air temperature in ISSA T113.

Slurry Seal . The laboratory report will provide the following information on the slurry seal mixture.

Quick-Set Emulsified Asphalt Slurry Seal

| | |
|---|---|
| Mixing Time Test, seconds @ 77° F(25° C) (TB #113), | 120 minimum |
| Mix Time @ (50° and 100° F) (10° and 37.7° C) | (informational) |
| Set Time Tests | |
| 30-Minutes-Blotter Test (TB #102) | no brown stain |
| Displacement Test | no displacement |
| Water Resistance Test @ 30 minutes (TB #102) | no discoloration |
| Wet Stripping Test, % coating (TB #114) | 90% minimum |
| System Compatibility (TB #115) | Pass |
| Set Time Tests: 30 minutes (TB #139) | 12 kg-cm minimum |
| Early Rolling Traffic Time: 2 hours (TB #139) | 20 kg-cm minimum |
| Wet Track Abrasion Test, loss in g/ft2 (g/m2) (TB #100) | 75(800) maximum 6 day soak |

In addition to the tests specified above, the following test will be required on roadways having greater than 1500 ADT.

| | |
|---|---|
| ISSA T #109 | Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded Wheel Tester and Sand Adhesion |
| 1,500-3,000 ADT | Maximum 55grams/psf (590g/m$^2$) sand adhesion, 1,000 cycles @ 125 lbs. (57 kgs). |
| 3,000+ ADT | Maximum 50grams/psf (540g/m$^2$) sand adhesion, 1,000 cycles @ 125 lbs.(57 kgs). |

Slurry Seal Composition. Emulsified asphalt slurry seal shall be a uniform mixture of aggregate, emulsified asphalt, latex solids when specified on the Plans, mineral filler and water. Compatibility of all ingredients (including the mix set additive) of the mix shall be certified by the emulsified asphalt manufacturer.

The percent of residual asphalt based on the weight of the dry aggregate shall be between 7.5 and 13.5 with a mixture control tolerance of ±0. 50%.

The aggregate gradation and percent residual asphalt, as provided in the slurry seal design accepted by the Engineer, shall be maintained within the mixture control tolerances stated herein.

Portland cement may be added to obtain the desired dispersion and working characteristics of the slurry. Such addition shall be stated on the slurry seal design, shall not exceed 3% of the weight of the aggregate, and shall have a mixture control tolerance of ±0.25%.

Portland cement added for dispersion of the slurry seal shall be a commercial quality, non-air entraining cement and shall not be considered as mineral filler for the purpose of satisfying the gradation requirements of the aggregate.

The aggregate shall be prewetted with a minimum amount of water prior to blending with the emulsified asphalt to obtain a fluid, homogeneous slurry mixture of the proper consistency. No additional water above that quantity required by the slurry seal mix design shall be added to the slurry mix in order to obtain a more workable mixture.

Micro Surfacing. The laboratory report will provide the following information on the micro-surface mixture.

| | |
|---|---|
| Mixing Time Test, secs @ 77° F (25° C), (T-102) | 120 minimum |
| Mix Time @ 50 and 100° F (10° C and 37.7° C) | (informational) |
| Set Time Tests: 30 minutes (T-139) | 12 kg-cm minimum |
| Early Rolling Traffic Time: 60 minutes (T-139) | 20 kg-cm minimum |
| Wet Stripping Test, % coating (T-114) | 90% minimum |
| Wet Track Abrasion Test, loss in $g/ft^2$ ($g/m^2$) (T-100) | 75 (800) max 6 days<br>50 (538) max. 1 hour |
| Measurement of Excess Asphalt (T-109) | Max. 50 $grams/ft^2$ (540 $grams/m^2$)<br>Sand Adhesion, 1,000 Cycles @ 125 lbs. (57 kgs). |
| Classification Compatibility (T-144) | 11 pt. minimum |
| Loss on Ignition (LOI) Test, TDOT Spec. 40703 E | (informational) |

Micro-Surface Composition. For the paving mixture, the design shall verify the functioning of the set regulating additives and shall present certified test results for the Engineer's approval. Aggregate in the mixture shall represent material to be used on the project.

The Engineer shall approve the design prior to use. Proportions for the design shall be within the following limits:

| | |
|---|---|
| Modified Emulsified Asphalt Residue by Dry Wt. of Aggregates | 5.0-9.0% |
| Mineral Additive by Dry Weight of Aggregate | 0.5%-3.0% |
| Latex or Polymer Based Modifier provide the specified properties | 3% minimum and as required to |
| Mix Set Additive | As required to provide the specified properties |
| Water | As required to produce consistency |

Portland cement may be added to obtain the desired dispersion and working characteristics of the mix. Such addition shall be stated on the micro-surface design, shall not exceed 3% of the weight of the aggregate, and shall have a mixture control tolerance of ±0.25%.

Portland cement added for dispersion shall be a commercial quality, non-air entraining cement and shall not be considered as mineral filler for the purpose of satisfying the gradation requirements of the aggregate.

The mixture shall also be proportioned such that the test strip requirements in **Subsection 414.06** are achieved.

**Applicable Specifications.** The following specifications and test methods form a part of this specification.

| Title | Source |
|---|---|
| Mixing, Setting and Water Resistance Test to Identify "Quick-Set" Emulsified Asphalts | ISSA TB-102 |
| Wet Track Abrasion of Micro Seals | ISSA TB-100 |
| Measurement of Micro-Seal Consistency | ISSA TB-106 |
| Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded Wheel Tester | ISSA TB-109 |
| Outline Guide Design Procedure for Slurry -Seal | ISSA TB-111 |
| Method to Estimate Micro-Seal Spread Rates and to Measure Pavement Macrotexture | ISSA TB-112 |
| Trial Mix Procedure for Slurry -Seal Design | ISSA TB-113 |

| | |
|---|---|
| Wet Stripping Test for Cured Slurry-Seal Mixes | ISSA TB-114 |
| Test Method to Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesion Tester. Measurement of Set and Cure Characteristics | ISSA TB-139 |
| Classification Compatibility | ISSA TB-144 |
| Design, Testing and Construction of Micro-Seal | ASTM D 3910 |
| Quantitative Extraction of Bitumen for Bituminous Paving Mixtures | ASTM D 2172 |

The blended asphalt mixture, when combined with aggregate and mineral filler, shall have the following characteristics:

1. Be capable of filling up to ½ in. (13 mm) wheel ruts in one pass.
2. Be capable of field regulation of the setting time.
3. Be suitable for nighttime placement.

**Subsection 414.04, Revise** subsection as follows:

**414.04-Equipment.** All equipment necessary for the satisfactory performance of this work shall be on hand and approved before the work is permitted to begin. All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working condition. The Contractor shall have available at all times a device capable of determining aggregate moisture within 3 minutes.

All trucks shall be covered immediately after loading with a cover of canvas or other suitable material. The cover shall lap down along the sides and rear of the truck bed a minimum of 6 in. (150 mm) and be secured by tie downs at a maximum of 5 ft. (1.5 m) spacing along the sides and rear of the truck bed. All trucks must be equipped to meet the above requirements prior to commencing hauling operations.

Power brooms, power blowers, air compressors, water flushing equipment and hand brooms shall be capable of thoroughly cleaning all cracks and the old surface. Hand squeegees, hand brooms, shovels and other incidental equipment shall be provided as necessary to perform work.

Mixing Equipment. The mixing equipment shall be re-supplied with all materials while depositing the mixture on the roadway in order provide a continuous, non-stop surfacing operation. The paving mixture shall be produced in a self-propelled, front feed, continuous loading, mixing machine equipped with a positive, non-slipping aggregate delivery system and an interconnected, positive displacement water-jacketed gear pump to accurately proportion ingredients.

The mixing machine shall be equipped with an approved fines feeder that has an accurate metering device or method to introduce a predetermined amount of mineral filler into the mixer at the same time and location as the mineral aggregate. A spray bar shall be provided to completely wet the aggregate dropping down to the pug mill with additive and water. The twin-shafted multi-blade pug mill shall be a continuous flow type and a minimum of 50 in. (1.25 m) long. The emulsion shall be introduced above the third point of the mixer to ensure proper

premixing of the aggregate, cement, additive and water when the modified emulsified asphalt is added. Blade size and side clearances shall meet the equipment manufacturer's recommendations.

Mixing shall be done in a manner that does not cause premature breaking of the emulsified asphalt. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients.

The mixer shall be equipped with a remote forward speed control at the back mixing platform so the back operator can control forward speed and level of mixture in paving or rut box. Effective April 1, 2006, the Contractor shall provide a computerized material monitoring system with integrated material control devices that are readily accessible and positioned so the amount of each material used can be determined at any time. The mixer shall be equipped with a back-up electronic materials counter that is capable of recording running count totals for each material being monitored. The mixer shall be equipped with a radar ground measuring device. Each material control device shall be calibrated prior to each mix application and as often thereafter as deemed necessary by the Engineer. The computer system shall have the capability to record, display and print the following information:

- Individual sensor counts for emulsion, aggregate, cement, water and additive
- Aggregate, emulsion, and cement output in lbs.(kgs) per minute
- Ground travel distance. The mixer shall be equipped with a Radar Ground metering device
- Spread rate in lbs./s.y.(kgs/$m^2$)
- Percentages of emulsion, cement, water and additive
- Cumulative totals of aggregate, emulsion, cement, water and additive
- Scale factor for all materials

The computer system shall be functional at the beginning of work, and must be functional during each calibration.

The mixing machine shall be equipped with a water pressure system and fog type spray bar, adequate for complete fogging of the surface preceding spreading equipment of the mixture.

The mixing machine shall include controls for proportioning and calibrating the aggregate feed. The aggregate feed device shall be equipped with a revolution counter so that the amount of aggregate used may be determined at any time and shall have a positive locking feed gate.

The emulsion pump shall be of the positive displacement type and shall be equipped with a device so that the amount of emulsion used may be determined at any time. The emulsion pump, meter and piping shall be arranged to afford a means to calibrate the meter by weighing a metered volume. The pump shall deliver the emulsion to the mixer box at a uniform rate which shall not vary more than 2% from the required quantity.

The water pump shall be equipped with a minimum of 2 valves. One valve shall establish the required water flow. The other valve shall be a quick acting valve to start and stop the water flow.

The mixing machine shall have sight gauges located at the material storage tanks for the asphalt emulsion and water.

The mixing machine shall be equipped with approved metering devices so that it can be accurately calibrated and the quantities of materials used during any 1 period can be closely

estimated. In the event that the metering devices stop working properly, the mixing machine shall no longer be used until necessary repairs have been made.

Satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of emulsion from the pump. Each mixing unit shall be calibrated in the presence of the Engineer prior to construction. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. When calibrating the emulsion system, a minimum of 3 tests shall be run, with each test run being a minimum of 40 gal. (150 liters). Calibration of the aggregate delivery system shall require tests at 3 different gate settings with 2 test runs at each gate setting and a minimum of 425 lbs. (193 kgs) per test run. Calibration of the filler(cement) delivery system shall require 3 tests at a minimum of 25 lbs. (11 kgs) per test. The scales used shall be certified. No machine will be allowed to work on the project until the calibration has been completed and accepted. Additional calibrations may be required during the process of the work as directed by the Engineer.

Spreading Equipment. Attached to the machine shall be hydraulically adjustable(adjustable while applying mixture) type spreader box with a positive screed adjustment for yield control and a positive adjustment for the joint matcher. The box shall be attached to the mixer, equipped with ribbon flights mounted on an adjustable shaft to continually agitate and distribute the materials throughout the box. The box shall be equipped with curb bumpers and replaceable runners with a minimum of 5 ft. (1.5 m) long end runners. The box shall be equipped with a sufficient walkway to provide access to either side of the spreader box without walking through the freshly laid material. The spreader box shall be heavy duty with crossbracing for rigidity and a manufacturer's weight not less than 1,400 lbs. (635 kgs) at a width of 12 ft. (3.6 m). The box must be capable of laying mix to a width of 14 ft. (4.3 m). The equipment shall provide sufficient turbulence to prevent the mix from setting in the box or causing excessive side build-up or lumps. To prevent the loss of the mixture from the box, the Contractor shall attach flexible seals, front and rear, in contact with the road. The full width application box shall be equipped with a secondary strike-off located approximately 2 to 3 ft. (0.5 to 1.0 m) behind the primary strike-off to minimize transverse corrugations. The secondary strike-off shall have elevation and width adjustments similar to the primary strike-off. It shall have a pivot point where it can be tilted for texturing or raised completely off the surface. Rut filling shall require a steel or high density strike-off on the spreading equipment (as approved by the engineer) or the use of a rut box. A rut box shall be used for filling ruts in excess of 3/8 in. (10 mm) unless otherwise specified on the plans. The Contractor shall operate the spreading equipment in such a manner to prevent the loss of the mixture on super-elevated curves. Mixture shall be spread to fill cracks and minor surface irregularities and achieve a uniform skid-resistant surface without causing skips, lumps or tears in the finished mat.

For slurry seals, the use of burlap drags or other drags necessary to obtain the desired finish, shall require approval by the Engineer. Drags having excessive build-up shall be replaced. Drags shall be kept in a completely flexible condition at all times. No drags shall be used on Micro-surfacing.

**Subsection 414.06, Revise** subsection as follows:

**414.06-Application.** Prior to the placement of the mixture, a tack coat of SS-1h, CQS-1h or CQS-1hp emulsion shall be applied with an asphalt distributor. The tack coat shall consist of 1

part emulsion and 3 parts water. The application rate shall be 0.10 to 0.15 gal./s.y.(0.5 to 0.7 L/m$^2$) of the diluted emulsion. The actual application rate shall be determined by the Engineer. The method of application of the tack coat shall be in accordance with **Section 403**.

The emulsified asphalt slurry seal shall be applied at a rate of 16 ±2 lbs./s.y.(of 8.75 ±1 kgs/m$^2$) based on dry aggregate weight unless otherwise specified on the Plans. The rate of application shall be varied within the range specified above as required by the condition of the pavement to obtain a minimum thickness of 1/8 in. (3 mm ) above the high points of the milled areas and ¼ in. (6 mm ) thickness on unmilled areas.

Micro-surface shall be applied as follows:

- Rutfill Course. If a rut fill course is specified, apply enough material to fill the wheel paths without excess crowning (overfilling). An excess crown is defined as 1/8 in. (3 mm) after 24 hours of traffic compaction. Apply rut fill courses in widths from 5 to 6 ft. (1.5 to 1.8 m) for each wheel path. Provide a smooth, neat seam where 2 rut fill passes meet. Take care to restore the designed profile of the pavement cross-section. Feather the edges of the rut fill course to minimize the use of excess material.
- Leveling Course. If a leveling course is specified, apply at a rate of 14 ±2 lbs /s.y. (7.6 ±1.1 kgs/m$^2$) based on dry aggregate.
- Surface Course. If a surface course is specified and it is placed over a leveling course, apply at a rate of 18 ±1 lbs/s.y. (8.7 ±0.6 kgs/m$^2$) based on dry aggregate. If a surface course is specified and it is not placed upon another micro-surfacing course, apply the paving mixture at a minimum rate of 22 lbs/s.y. (11.9 kgs/m$^2$) based on dry aggregate.

Micro-surface shall be applied at the rates as specified on the plans for leveling and surface courses.

The mixture shall be applied based on dry aggregate weight as specified on the plans.

The maximum allowable speed of the machine shall be 130 ft. (40 m) per minute. When rut filling, the maximum allowable speed shall be determined by the Engineer. The final surface seal shall be placed uniformly across the width of the traffic lane unless otherwise specified or directed. The action of the squeegee shall permit the mix to flow freely leaving a smooth, uniformly textured surface.

Unless otherwise directed by the Engineer, the surface shall be pre-wetted with water by fogging ahead of the spreader box. Pre-wetting shall be closely controlled to prevent accumulation of water to the point of running off or puddling.

As the aggregate and emulsion are being loaded into the aggregate/emulsion support trucks or mixing machine, the aggregate shall be given a final screening by sieving it through screening equipment capable of removing any random oversize material.

The mixture shall be of the desired consistency when deposited on the surface after which no additional elements shall be added. A sufficient amount of mixture will be carried in all parts of the spreader at all times so the complete coverage is obtained. No lumping, balling or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the mix will be removed from the pavement. The mixture shall have proper consistency so that excessive splattering and excessive free water is avoided. The spraying of water into the spreader box during lay down operations will not be permitted. Hand tools, lutes and squeegees

shall be used to spread mix on areas not accessible to the machine spreading equipment. Rolling with a pneumatic-tired roller shall be required after proper curing for sections of pavement not to be exposed to traffic. The roller shall be equipped with tires with a pressure of 40-60 psi(275 to 425 kPa).

**Quality Control:** The Contractor shall produce a mixture that will be in compliance with the mix design and the quality control tolerances. The Slurry Seal or Micro-Surface shall be applied at the rates as specified on the plans. The methods described in this section shall be used by the Contractor to measure compliance. Contractor shall maintain all quality control documentation and make available to the Engineer or Project Inspector upon request or at completion of work.

a. Asphalt Content – The Contractor shall calculate the % asphalt content of the mixture from the equipment computer display readings randomly, a minimum of 3 times a day. The quality control tolerances from the mix design is ± 0.5%.

b. Application Rate – The Contractor shall calculate the yield of the course being placed from the equipment computer display readings randomly, a minimum of 3 times a day. The quality control tolerance from the specified application rate is ±2 lbs/s.y. (±1 kg/$m^2$).

c. Documentation – The Contractor shall maintain a daily report and a lot sheet as follows:

   1. Daily Report – The daily report shall include the following information:
      - Aggregate used, ton(metric ton) (dry)
      - Slurry or Micro-Surfacing emulsion used, ton(metric ton)
      - Bituminous Materials for Tack Coat and for Fog Seal, ton (metric ton)
      - Cement used, ton(metric ton)
      - Water used in mixture, gallons(liters)
      - Additive used in mixture, gallons(liters)

d. Test Strip Construction - Prior to production application, the Contractor shall place a 1,000 ±50 ft. (300 ±15 m) test section to verify a quick traffic system is being used. The test strip shall be placed at the same time as paving is to take place, night or day, and under the same ambient conditions. The test strip shall be able to carry normal traffic within 60 minutes. If normal traffic cannot be carried, the emulsion or mixture must be adjusted and another test strip will be required.

   Lot Sheet - The project shall be segmented into lots with any 1 lot not to exceed 20,000 s.y.(16,700 $m^2$). For each lot the Contractor shall maintain a lot sheet, providing the following information:

- Control Section, Job Number, Route, Engineer (Project Inspector)
- Date, Air Temperature
- Control Settings, Calibration Values, Unit Weight of Emulsion (lbs per gallon) (kgs per liter), Percent residue in Emulsion.
- Beginning and Ending Intervals
- Computer display readings for material usage (Beginning, and Ending, and Total)
- Length, Width, Total Area (s.y.) ($m^2$), (lbs.) (kg) of Aggregate, lbs. (kg) of Emulsion, lbs. (kg) of Cement.

- Percent of each Material, Percent of Asphalt Cement, Application Rate, Combined Application Rate (lbs./yd$^2$) (kgs/m$^2$ )
- Mix Design (Percent Portland Cement, Percent Emulsion, Percent Asphalt Cement)
- Contractors Authorized Signature
- Calibration Forms

**Subsection 414.08. Revise** entire subsection to the following:

**414.08-Fog Seal Application.** Fog sealing of shoulders shall meet the requirements of Subsection 403.05.

**Subsection 414.09, Revise** subsection as follows:

**414.09-Weather Limitations. M**icro-surface and slurry seal shall be placed only when the pavement surface temperature and the ambient air temperature are a minimum 50° F(10° C) and rising. These applications will not be placed during foggy or rainy conditions. Placement shall be limited to the period from April 1 to October 31.

**Subsection 414.11, Revise** the first and second paragraphs to as follows:

**414.11-Method of Measurement.** Emulsified Asphalt Slurry Seal will be measured by the square yards(meters) in place as completed and accepted. The quantity of aggregate for Micro Surfacing, including mineral filler, shall be measured by the ton(metric ton) (dry), based on the calibrated metering devices affixed to the micro-surface mixing machine. The quantity of latex or polymer modified emulsion used in the accepted portion of the Micro- surfacing shall be measured by ton(metric ton) of material based on the calibrated metering device affixed to the micro-surface mixing machine. Bituminous Materials for Tack Coat and for Fog Seal, will be measured and paid for by the ton (metric ton) of undiluted emulsion. The quantity for "Bituminous Material for Tack Coat", Item No. 403.01, should be ¼ of the estimated application rate. No direct payment will be made for the latex or polymer additives when used and the cost thereof shall be included in the price bid for the respective items.

For bidding purposes, the emulsified asphalt content on the slurry mix design shall be 15% and for micro-surfacing design the asphalt content shall be 12%. In the event that the Engineer sets an emulsified asphalt content for slurry seal other than that stated above, a price adjustment will be made based on the emulsified asphalt content set by the Engineer and the invoice price of the emulsified asphalt F.O.B. the project delivery point. The price adjustment will be calculated according to the following formula:

**Subsection 415.02,** (**Delete** the third paragraph) "When milling the Interstate…"

**STATE OF TENNESSEE**

March 1, 2006

Rev. 07-01-07
Rev. 12-13-2010

**Supplemental Specifications - Section 500**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 501.03, Remove and Replace** the entire subsection with the following:

**501.03-Proportioning and Quality Assurance of Concrete.**

A. Proportioning :

The Contractor shall submit the proposed concrete design to the Engineer for approval. The design shall be determined using saturated surface dry aggregate weights and shall be verified by the use of trial batches meeting the requirements of these specifications. The concrete design shall be prepared by a TDOT certified Class 3 concrete plant technician, or by an approved independent testing laboratory under the direction of a registered professional civil Engineer, licensed by the State of Tennessee. The concrete plant technician or the Civil Engineer shall certify that the information contained on the design is correct and is the result of information gained from the trial batches. Trial batches for design, including admixtures in the proper proportion, shall be built no more than 90 days prior to the design submittal. All cost of concrete design, preparation and submittal shall be the responsibility of the Contractor.

The concrete design shall be air entrained and produce a workable concrete mix meeting the following design and production parameters:

**CLASS CP - PAVING CONCRETE**

| **28 day Compressive strength, min. (PSI)** | **Minimum cementitous content (pounds per CY)** | **Maximum Water/cement ratio (lb/lb)** | **Air Content (%)** | **(inch)** |
|---|---|---|---|---|
| 3000 | 526[1]<br>545[2] | 0.49 | 5% design<br>3-8 % production | 0-2.0[3]<br>3±1[4] |

[1]-526 lbs required when the coarse aggregate is crushed stone
[2]-545 lbs required when the coarse aggregate is gravel
[3]-Allowable slump for slipform paving
[4]-Allowable slump for other than slipform paving

Chemical Admixtures shall be included in the concrete mixture as specified in the following table based on the ambient air temperature and expected weather conditions.

| **Class of Concrete** | **Temperature less than 85° F(30 ° C) and falling** | **Temperature 85° F(30° C) or greater and rising** |
|---|---|---|
| CP | Type A or Type F | Type D or Type G |

Admixtures to be incorporated into the concrete shall all be from the same manufacturer, shall be incorporated into the concrete in accordance with the manufacturer's recommendations, subject to approval by the Engineer.

The proposed concrete design submittal shall contain as a minimum the following information:

Source of all aggregate
Brand and type of cement
Source and class of fly ash (if used)
Source and grade of ground granulated blast furnace slag (if used)
Specific gravity of cement
Specific gravity of fly ash (if used)
Specific gravity of ground granulated blast furnace slag (if used)
Admixtures (if used)
Gradation of aggregates
Specific gravities of aggregates (saturated surface dry)
Air content (if air entrainment is used)
Percentage of fine aggregate of the total aggregate (by volume)
Slump
Weight per cubic yard(m3)
Yield
Temperature of plastic concrete
Water/cement ratio lb./lb.(kg/kg)
7 day compressive strength [minimum of 3 x 6-in. x12in. (150mm x 300mm) cylinders]
14 day compressive strength [minimum of 3 x-6in. x12in.(150 x 300 mm) cylinders]
28 day compressive strength [minimum of 3 x-6in. x12in.(150mm x 300mm) cylinders]
Weight of each material required to produce a yd3(m3) of concrete

In lieu of the above mix design submittal, the Contractor may submit for approval to use an existing design (Contractor or Department prepared) approved by the Department within the current calendar year. The approval of this concrete design submittal will not relieve the Contractor of the responsibility of providing concrete meeting the requirements of these specifications. A temporary mix design may be issued if the 7 day compressive strengths exceed the required 28 day strengths.

If materials from sources other than those shown on the approved concrete design are to be used, the Contractor must submit and obtain approval of a concrete design showing these sources. No concrete shall be accepted with materials that are not shown on an approved concrete design.

In addition to the option to use Type I-SM cement, the contractor may have the option to replace a portion of Type I cement in Portland cement concrete, up to a maximum specified herein, with fly ash and/or ground granulated blast furnace slag. It is the Contractors responsibility, if he chooses to use fly ash and/or ground granulated blast furnace slag as a partial cement replacement, to provide Portland cement concrete of the design strengths specified in all applicable special provisions, on the plans, or in the standard specifications. Type I-SM cement or Type I cement with fly ash or ground granulated blast furnace slag as a partial cement replacement will not be used in concrete when high early strength is specified. When the Contractor elects to replace a portion of Type I cement with fly ash and/or ground granulated blast furnace slag, the following requirements must be verified prior to producing any Portland cement concrete:

1. Fly ash or ground granulated blast furnace slag shall be stored in silos separate from each other and separate from the Type I cement.
2. The fly ash or ground granulated blast furnace slag is to be added to the concrete by methods and equipment approved by the Engineer, capable of uniformly distributing the materials throughout the mix.
3. The fly ash or ground granulated blast furnace slag may be weighed cumulatively in the weigh hopper with the cement, provided the cement is added first. The temperature of the fly ash or the ground granulated blast furnace slag is not to exceed 160° F(71° C) at the time of introduction to the mix.
4. The mix shall be closely monitored to maintain a consistent air content between 3%and 8%.

Additional testing may be required to verify desired properties of Portland cement concrete with fly ash or ground granulated blast furnace slag. Additional compensation for the expense and/or lost production due to the additional testing will not be allowed the Contractor. The following are examples of additional testing that may be required:

1. Additional air test as felt necessary by the Engineer to monitor the entrained air due to fluctuations in LOI and fineness of the fly ash or ground granulated blast furnace slag material.
2. Additional compressive test specimens may be needed to determine strengths for form removal due to the slowed strength development inherent with fly ash or ground granulated blast furnace slag concrete.

Design of Portland cement concrete with Type I cement modified by the addition of fly ash or ground granulated blast furnace slag. The following table indicates that maximum cement replacement rates (by weight) and minimum substitution ratios(by weight) for the type of modifier specified:

| **Modifier** | **Cement Replacement Rate(Maximum)% (by weight)** | **Minimum Modifier Cement Substitution Rates (by weight)** |
|---|---|---|
| **Ground Granulated Blast Furnace Slag(GGBFS) (grade 100 or 120)** | 35.0 | 1:1 |
| **Class "F" Fly Ash** | 20.0 | 1:1 |
| **Class "C" Fly Ash** | 25.0 | 1:1 |

Ternary cementitious mixtures (mixtures with portland cement, GGBFS, and fly ash) will be allowed for Class CP Concrete provided that the minimum portland cement content is 50%. The maximum amount of fly ash substitution in a ternary blend will be 20%. Substitution rates will be at a 1:1 ratio.

Any request for a change in source of materials or admixtures from the original mix design must be made in writing to the Regional Materials and Tests Engineer explaining the necessity for the change and must be accompanied by a new mix design in accordance with the above provisions. No concrete shall be placed until the new design is approved.

When requested by the Contractor and approved by the Engineer, Class A Concrete for structures, as provided for under **Section 604** and herein modified, will be permitted for use in variable width sections, ramps, and on projects containing 10,000 $yd^2$($m^2$) of concrete pavement or less. The slumpshall be modified to be a maximum of 3 in.(75 mm) and the compressive strength of cylindrical specimens molded, cured and tested in an approved laboratory shall be not less than 3,000 psi(20.7 MPa) in 28 days. No additional payment will be made to the Contractor for increased costs due to the use of the above mixture.

The mix proportions approved by the Department shall govern during the progress of the work, except the Contractor shall make the following adjustments with the approval of the Engineer:

(a) If the cement content of the concrete varies by more than 2% from the designated value, as determined by AASHTO T 121, the proportions will be so adjusted as to maintain a cement content which does not vary more than 2% from the designated value.
(b) If it is found impossible to obtain concrete of the desired plasticity and workability with the proportions originally designed, changes will be made in aggregate weights as required, provided that in no case shall the cement content originally designated be changed except as provided in paragraphs (c), (d) and (e).
(c) If it is found impossible to produce concrete having the required consistency without exceeding the maximum allowable water-cement ratio specified, the cement content shall be increased so that the maximum allowable water-cement ratio will not be exceeded.

(d) If for any reason the concrete must be placed by hand methods and the water-cement ratio established for the vibrated concrete cannot be maintained, the mix proportions shall be adjusted for placement by hand methods and the cement proportion increased by 38 lbs per cubic yard(22 kgs per m3), or more if necessary in order to maintain the water-cement ratio established for the vibrated concrete. No additional payment will be made to the Contractor for the cost of the additional cement.

(e) Change the mix proportions because of a change in the character or source of materials.

(f) Change the mix proportions or mixing procedure in order to maintain the air content within the specified limits.

(g) Change the mix proportions made necessary by the use of retarders or other chemical additives that may be required or approved.

B. Quality Control and Acceptance of Concrete:

It shall be the responsibility of the Contractor to determine and measure the batch quantities of all ingredients (including all water and any specified or approved admixtures) for all concrete produced for the project and to mix, deliver and place the concrete so that the concrete meets the requirements of these specifications. The minimum size of a batch shall be 2.5 cubic yards(2.0 $m^3$). Sampling, testing and inspection for process control of the concrete at the concrete plant shall be performed by a TDOT Class 2 or higher concrete plant technician certified by the Department. This technician must be present at the concrete plant during all batching operations for the project and his primary responsibility during production shall be process control. Sampling, testing and inspection for process control of the concrete at the placement site shall be performed by a concrete technician that holds a TDOT Class 1, ACI Class 1, or higher certification. A technician shall be present at each placement site during all concrete placement. All necessary equipment required for process control shall be furnished by the Contractor and shall be at the plant and at the placement site at all times during concrete placement. Process control shall include, but not be limited to, the following tests and inspections:

1. Test to determine aggregate gradations (AASHTO T 27 with AASHTO T 11 when required).
2. Frequent inspections of the stockpile to ascertain that stockpiles are being maintained in an uncontaminated and unsegregated manner. A current aggregate quality report shall be kept at the plant.
3. Calibration of weighing systems, water meters and admixture dispensing systems prior to starting production.
4. Assurance of accurate weighing of the aggregates and cement, the proper metering of water and admixtures and the quality of water.
5. Assurance that mixing equipment is in proper working condition and the proper mixing speeds and revolutions are controlled as required by the specifications and the Materials and Tests Circular Letter File book.
6. Adjustment of mix proportions due to moisture content of both coarse and fine aggregates (moisture determination to be in accordance with AASHTO T 255).
7. Slump (AASHTO T 119) and Air Test (AASHTO T 152).

8. Yield test (AASHTO T 121) (When yield varies more than ±2% from that shown on the design. All batching operations shall cease until the problem has been identified and corrected or a new concrete design has been obtained.
9. Quality control cylinders and early break cylinders (7-14 day, etc), for compression tests in accordance with AASHTO T 22.
10. Tests for concrete and ambient air temperatures.
11. A report furnished daily to the Engineer showing all pertinent information (Date, Contract and Project, Item number(s), batch weights, moisture corrections, admixtures, slump, air content, temperatures, etc.). A sample daily report will be given to the Contractor as an example.
12. A concrete delivery ticket must accompany each load to the placement site. The ticket shall at a minimum include the following:

    Date
    Contract number
    County
    Class of concrete
    Concrete design number
    Number of cubic yards
    Load number
    Truck number
    Maximum water allowed by design
    Total water added at the plant
    Maximum water allowed to be added on the project
    Actual water added on project
    Number of revolutions at mixing speed at plant
    Number of revolutions at mixing speed at project
    Time loaded
    Time discharged
    Actual and target batch weights of each component including each aggregate, chemical admixture and mineral admixture used.

The Contractor shall develop for approval of the Engineer and maintain at the plant written procedures for sampling, testing and inspection of the concrete. The Contractor shall keep a record of all tests and inspections performed at the plant site and placement site, and this documentation, together with a certification by the Contractor that the concrete incorporated in the work meets the requirements of the specifications, shall be delivered to the Engineer upon completion of the project for inclusion in the project records. Records shall be kept current and shall be made available to the Engineer for review at any time.

It shall be the responsibility of the Contractor to properly make, cure and transport all early break cylinders (7-14 day, etc.) in accordance with AASHTO T 23 and delivered to the Regional laboratory or other established satellite laboratories for tests.

The Department or their representative shall be responsible for performing all acceptance tests. A TDOT Level 1 Certified or ACI Certified Technician shall sample, test air content and slump, and prepare 28 day cylinders for acceptance. The Department shall also be responsible for properly curing and transporting all acceptance cylinders in accordance with AASHTO T 23.

All independent assurance sampling and testing shall be performed by the Department. All sampling and testing for acceptance and independent assurance shall be at the frequencies established in TDOT Procedures. The time and location for obtaining all acceptance and assurance samples will be determined by the Department.

It shall be the responsibility of the Contractor to provide cylinder molds, a wheelbarrow, and provide a level site to perform testing and for initial curing. The Contractor shall also provide a secure storage shed/building for temporary storage of concrete acceptance cylinders in accordance with **Subsection 722.09** of these Specifications.

A TDOT certified class 2 or higher concrete technician, whose duty is process control, shall be at the ready-mix plant during all batching operations. A TDOT or ACI certified class 1 or higher technician is not required to be at the placement site during all small quantity placing operations but is required to perform one complete set of tests during the life of the project. A delivery ticket must accompany each load delivered to the job site.

Batch weights shall be corrected to compensate for any surface moisture on the aggregate at the time of use. The Contractor may elect to withhold some of the water from the mix at the plant provided the delivery ticket indicates the amount of water withheld. If a portion of the water is withheld at the plant, additional water may be added at the work site provided the design water/cement ratio of the mix is not exceeded.

**Subsection 501.09, Revise** the fifth paragraph to the following:

The tolerance of the individual quantity of each cementious material shall be no less than 1% nor no more than 4% of the required weight. Aggregates shall be weighed within a tolerance of 1.5% of the required weight.

**Subsection 501.17,** 2nd full paragraph on page 321, Change the first sentence from "When the pavement being constructed abuts an adjacent pavement" TO:

When the pavement being constructed longitudinally abuts an adjacent pavement

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 03-23-09)
(Rev. 02-08-10)
(Rev. 12-13-10)
(Rev. 05-09-2011)
(Rev.06-25-2012)

March 1, 2006

**Supplemental Specifications - Section 600**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 602.05 (d)** Paragraph one, **Change** 1125°F to 1100°F, **Change** 600°C to 593°C, **Change** the acronym, **ASSHTO** to **AASHTO**

**Subsection 602.05 (d)** Paragraph one, eighth sentence, and in the table below paragraph one, **Delete** the following:

Grades 70W, 100 and 100W, and **Replace** with Grades HPS70W, and HPS100W

**Subsection 602.05 (d)** Paragraph one, eighth sentence **Delete** "only under rigidly controlled procedures" and **Replace** with the following:

"as set forth in the **AASHTO** Guide Specification for Highway Bridge Fabrication with High Performance Steel", current edition and the **AASHTO** "Bridge Welding Code", current edition.

**Subsection 602.05 (d)** Paragraph two, first sentence, **Add** "or either"

"temperature indicating crayons, liquids, or either contact or non-contact…"

**Subsection 602.05 (e) 3** First paragraph, **Delete** the first sentence and **Replace** with the following

"The heat-curving operation shall be conducted in such a manner that the temperature of the steel does not exceed 1200°F (649°C) for Grades 36, 50, 50W and HPS50W; and 1100°F (593°C) for Grades HPS70W and HPS100W as measured by temperature-indicating crayons or other suitable means."

**Section 602.17 Delete** all references to **AASHTO M 253 (ASTM A 490**) bolts unless otherwise noted on the plans.

**Subsection 602.17 (D) Delete** the first sentence and replace with the following

"The following provisions apply when high strength bolts are installed in the field or shop."

**Table 602.17 A-BOLT TENSION, page 352 Delete** the table conversion values for kilograms

**Replace** with (Newton) values

| **TABLE 602.17A-BOLT TENSION**<br>Minimum Bolt Tension (1)<br>in Pounds (Newton) | | |
|---|---|---|
| Bolt Size<br>in inches(mm) | **AASHTO M 164**<br>(**ASTM A 325**)<br>Bolts | **AASHTO M 253**<br>(**ASTM A 490**)<br>Bolts |
| 1/2(13 mm) | 12,000(53,379) | 15,000(66,723) |
| 5/8(16 mm) | 19,000(84,516) | 24,000(106,757) |
| 3/4(19 mm) | 28,000(124,550) | 35,000(155,688) |
| 7/8(22 mm) | 39,000(173,481) | 49,000(217,963) |
| 1(25 mm) | 51,000(226,859) | 64,000(284,686) |
| 1-1/8(28 mm) | 56,000(249,100) | 80,000(355,858) |
| 1-1/4(32 mm) | 71,000(315,824) | 102,000(453,719) |
| 1-3/8(35 mm) | 85,000(378,099) | 121,000(538,235) |
| 1-1/2(38 mm) | 103,000(458,167) | 148,000(658,337) |

**Subsection 602.17(E) 1 b7 Change** "bolt diameter", and "(kips) number", in the table

"(in) 1-1/6 to 1-1/2", "(kips) 42 to 45"

**Subsection 602.17(E) 2(a) 2. Change** "16mm" to "1.6mm"

**Subsection 602.17(E) 2 (b) 5. Change** some information in table

1/2 rotation: **Change** "≥ 8 x" to, "≤ 8 x bolt dia."

2/3 rotation: **Change** "≥ 8 x" to, "> 8 x but < 12 x bolt dia."

**Subsection 602.17(E) 2 (b) 6.** (**Change** some information in table)

| Bolt Length (measured in Step 1 | 4 x bolt dia. or less | > 4 bolt ≤ 8 x bolt dia. | > 8 x bolt dia. |
|---|---|---|---|
| Required Rotation | 2/3 | 1 | 1-1/3 |

**Subsection 602.19-Welds.** Include the following as revisions to the **AASHTO/AWS** "Bridge Welding Code"

Delete 6.1.3.4(1) and 6.1.3.4(2)

**Subsection 602.19-Welds.** First paragraph, page 363; **Add** the word "joint";

"Complete joint penetration groove welds…"

**Subsection 602.26 (b);** Replace the "**THICKNESS IN INCHES (MILLIMETERS)"** Table with the following

| MINIMUM COLD-BENDING RADII | | | | |
|---|---|---|---|---|
| Thickness Inches (t) | Up to 3/4 | Over 3/4 to 1, incl. | Over 1 to 2, incl. | Over 2 |
| 36 | 1.5t | 1.5t | 1.5t | 2.0t |
| 50 | 1.5t | 1.5t | 2.0t | 2.5t |
| 50W | 1.5t | 1.5t | 2.0t | 2.5t |
| HPS70W | 1.5t | 1.5t | 2.5t | 3.0t |
| 100 | 1.75t | 2.25t | 4.5t | 5.5t |
| 100W | 1.75t | 2.25t | 4.5t | 5.5t |

**Subsection 602.26 (b)** Second paragraph, after the Table, **Change** "HPS100W" to "HPS70W"

and **Change** "1125°F" to "1100°C", and "607°C" to "593°C"

**Subsection 602.29** First paragraph, last sentence, **Change** "56°C" to "38°C"

**Subsection 602.29** Third paragraph, last sentence, **Change** the last sentence to read as follows

"The holding temperature for stress relieving **ASTM** A709 Grade HPS70W HPS100W steels shall not exceed 1100°F (593°C)."

**Subsection 602.29** Fourth paragraph, first sentence, **Delete** "Section 4.4" after the wording; and **Replace** with "paragraph 3.9", **Delete** AWS D1.1 and **Replace** with **AASHTO/AWS** D1.5 "Bridge Welding Codes"

**Subsection 602.35** Fifth paragraph, **Delete** reference to "Table 602.35"

**Subsection 602.35 (b)**, **Delete** this section

**Section 602.39- Add the following as the last paragraph**

**Shear Stud Connectors -** After the beams have been erected, the contractor shall be required to attach the shear stud connectors in compliance with OSHA standards. The studs shall be installed in the locations shown in the plans. The contractor will be required to install and test shear studs in accordance with the latest version of AASHTO/AWS D1.5M/D1.5, Chapter 7 Stud Welding. The surface receiving the studs shall be cleaned by shot blasting or grinding to a bright metal surface immediately prior to welding. All studs shall be welded using automatically timed stud welding equipment only. At the beginning of each day or shift each individual welder/operator and equipment must complete the Production Control/ Pre-production testing as stated in section 7.7.1. Only individuals who repeatedly demonstrate satisfactory installation shall be allowed to install the shear studs. The contractor is responsible for the quality of all welds.

The Department shall inspect and randomly test the welds before any reinforcing steel is placed.

**Subsection 602.41** Last sentence, **Add** the wording "Plans and"

"in accordance with **Subsection 105.02**, Plans and Working Drawings."

**602.41 Replace** entire subsection with the following:

**602.41-Temporary Supports**. Temporary supports for steel beam erection shall be properly designed, constructed and maintained to support the loads to which they will be subjected. The Contractor shall prepare and submit to the Engineer construction drawings for temporary supports and working drawings for changes in any existing structure necessary for safely maintaining traffic, in accordance with Subsection 105.02, Plans and Working Drawings.

**Subsection 602.42 Add** " and stamped" after "prepared" in the first sentence.

**Subsection 602.43 (a) Change** the third sentence to read as follows:

"In no case shall the maximum temperature of the **ASTM** A 709 Grade HPS100W, and the HPS70Wsteels exceed 1100°F (593°C)."

**Subsection 602.43 (a) Add** the following to the end of the first paragraph;

"or infrared thermometers (conductor or non-conductor)

**Subsection 602.43 (b) Add** the wording "HPS70W, and HPS100W," after the word "Grade"

**Subsection 602.47 (d) Delete** the second sentence of the second paragraph, and **replace** with the following;

"When the contractor has approval to drill holes for setting anchor bolts, the bolts shall be set accurately, and fixed by completely filling the holes with grout meeting the requirements of **Subsection 918.21**."

**Subsection 602.49 (d) Add** metric equivalents in (kg)

| **Weight per 100** |
|---|
| **Bolts, pounds (kg)** |
| 19.7 (8.9) |
| 31.7 (14.4) |
| 52.4 (23.8) |
| 80.4 (36.5) |
| 116.7 (52.9) |
| 165.1 (74.9) |
| 212.0 (96.2) |
| 280.0 (127.0) |
| 340.0 (154.2) |

**(e) Add** metric equivalents in (kg/m)

| Pounds per Linear Foot (kg/m) |
|---|
| 0.20 (0.30) |
| 0.25 (0.37) |
| 0.35 (0.52) |
| 0.55 (0.82) |
| 0.80 (1.19) |
| 1.10 (1.64) |
| 1.50 (2.23) |
| 2.00 (2.98) |

**Subsection 602.50 (a) Change** the name of section (a) to read as follows

(a) Structural Steel – Per Pound (Kilogram)

**Section 603,** Second paragraph, **Revise** the first sentence by adding the following:

"Effective Lettings after January 01, 2007," All contractors or subcontractors…

**Subsection 604.02 Revise** entire subsection as follows:

**604.02-Materials.** Materials used in this construction shall meet the requirements of the following sections or Subsections of Division III, Materials, of these Specifications.

| Material | Section or Subsection |
|---|---|
| **Water** | **918.01** |
| **Hydraulic cement[1]** | **901.01** |
| **Fine Aggregate, (all Classes of concrete)** | **903.01** |
| **Coarse Aggregate** | |
| **For Class A Concrete: Size No. 57** | **903.03** |
| **For Class D Concrete: Size No. 57** | **903.03** |
| **For Class L Concrete** | **903.19** |
| **Fly Ash** | **918.31** |
| **Ground Granulated Blast Furnace Slag** | **918.32** |
| **Cement Concrete Curing Materials** | **913** |
| **Air-Entraining Admixtures** | **918.09** |
| **Steel Bar Reinforcement** | **907.01** |
| **Welded Steel Wire Fabric** | **907.03** |
| **Waterstops** | **918.11** |
| **Joint Filler, Preformed Type** | **905.01** |
| **Structural Steel** | **908.01** |

[1]Type I, Type I-SM or Type I cement with either fly ash and/or ground granulated blast furnace slag as a partial cement replacement shall be used unless otherwise specified or permitted. When Type I cement with either fly ash and/or ground granulated blast furnace slag as a partial cement replacement is used, the requirements of **Subsection 604.03** shall apply.

| | |
|---|---|
| **Applied Texture Finish** | **918.30** |
| **Steel Castings** | **908.05** |
| **Elastomeric Bearing Pads** | **908.12** |
| **Bronze Bearing Plates, Plain** | **908.09** |
| **Bronze Bearing Plates, Self-Lubricating** | **908.10** |
| **Paints** | **910** |
| **Chemical Additives for Concrete** | **918.09** |
| **Gray Iron Castings** | **908.07** |
| **Permanent Steel Bridge Deck Forms** | **908.03** |
| **Precast Prestressed Bridge Deck Panels** | **918.29** |
| **Precast Concrete Box Culverts** | **914.08** |

Fly ash or ground granulated blast furnace slag of different classes or sources used as partial replacement for Portland cement in concrete mixes will not be permitted. FlyAsh or Ground Granulated Blast Furnace Slag shall only be permitted as a partial cement replacement in Type I Portland Cement. A maximum of 20% fly ash shall be permitted as a partial hydraulic cement replacement in Type I-SM cement only in Class A concrete.

Concrete with fly ash as a partial cement replacement shall not be produced until the concrete supplier furnishes the following information to the Engineer:

1. Copies of the results of all tests performed by the fly ash producer within the previous 30 days, on shipments to the concrete supplier showing:

   Fineness (percent retained on the No. 325(45µm) sieve)
   LOI (loss on ignition)
   Specific gravity
   Soundness (autoclave expansion)
   Moisture content
   Pozzuolanic activity, 7 day cement

2. A notarized certification from the fly ash producer stating that the fly ash meets the Departments specifications.

Concrete with ground granulated blast furnace slag as a partial cement replacement shall not be produced until the concrete supplier furnishes the following information to the Engineer:

1. Copies of the results of all tests performed by the ground granulated blast furnace slag producer within the previous 30 days on shipments to the concrete supplier showing:

   Fineness (percent retained on the No. 325(45µm) sieve.
   Air content of slag mortar
   Individual sample slag activity index (percent)
   Specific gravity
   Sulfide sulfur(s) (percent)
   Sulfate ion reported as $SO_3$ (percent)
   Total alkalies ($Na_2O$+0.658$K_2O$)
   Compressive strength (28 day)

2. A notarized certification from the ground granulated blast furnace slag producer stating that the slag meets the Departments specifications.

Unless otherwise indicated on the plans, the Contractor may substitute precast reinforced box sections meeting the requirements of Subsection 914.08, AASHTO specifications for all fill heights for cast in place concrete box sections. The Contractor is only required to notify the project engineer and the Division of Structures that he intends to utilize sections fabricated to the appropriate AASHTO Materials Specifications or the other pre-approved sections contained in the Division of Structures Standard Drawings for Precast Boxes. Should he elect to construct precast boxes of a different design, the Contractor shall submit shop drawings of the proposed precast box section and design calculations to the Structures Division for approval prior to construction. As a minimum, the shop drawings shall include a plan and elevation view of the box culvert showing all precast sections, a typical precast box section showing dimensions and reinforcing, and notes and details required for construction. After securing the necessary approval, the Contractor shall furnish the Structures Division a permanent, 100 µm(4 mil) mylar reproducible of the design for their file. The Contractor will be paid for the precast box based on the price bid for the quantity of the items in the cast in place structure it replaces. The precast reinforced box sections shall be manufactured in accordance with Departmental procedures

**Subsection 604.03 Remove and Replace** entire subsection with the following:

**604.03-Classification Proportioning and Quality Assurance of Concrete.**

(a) Classification and Proportioning and Quality Assurance

| Min. 28 Day Comp.Strength PSI (MPa) | Min. lbs. (kg) Cement per C.Y. (C.M..) | Maximum Water/Cem. lb/lb (kg/kg) | Air Content % (Design± production tolerance) | Slump in. (mm) |
|---|---|---|---|---|
| | CLASS A CONCRETE | | | |
| 3,000 (20.7) | 564 (335) | 0.45 | 6 ± 2 | 3 ± 1[1] (75 ± 25) |
| | CLASS D CONCRETE[2&3] | | | |
| 4,000 (27.6) | 620 (368) | 0.40 | 7[3] | 8 max[4] (200 max.) |
| | CLASS L CONCRETE[5&3] | | | |
| 4,000 (27.6) | 620 (368) | 0.40 | 7[3] | 8 max[4] (200 max.) |
| | CLASS S (SEAL) CONCRETE[6] | | | |
| 3,000 (20.7) | 682 (405) | 0.47 | 6 ± 2 | 6±2 (150 ± 50) |

The proportioning of the concrete shall be based on a predetermined minimum cement content, and the water-cement ratio shall not exceed the maximum shown in the above table. Below this limit, the quantity of water shall be adjusted to meet the slump requirements. The fine aggregate shall not exceed 44% by volume calculation of the total aggregate with the exception of slip formed Class A concrete incorporated into parapets and median barriers. For slip formed parapet and median barriers exclusively, the percentages of fine and coarse aggregate in an approved concrete mix design may be adjusted ± 2%, such that the maximum percent by volume of fine aggregate does not exceed 46%. Mixture adjustments shall be documented in the field book and daily concrete report. Adjusted mix shall comply with all performance criteria specified in **Section 604**.

---

[1] For slip forming, the slump shall range from 0 to 3 inches.

[2] Class D concrete shall be used in all bridge decks except box and slab type structures unless otherwise noted on the plans.

[3] Class D and Class L concrete shall be designed at 7% air content, acceptance range for pumping and other methods of placement is 5.5-8.5%. Sampling will be at the truck chute.

[4] Water reducing admixtures are acceptable, however, the maximum water/cement ratio shall not be exceeded in order to achieve the required slump.

[5] The unit weight of air dried Class L Concrete (lightweight concrete) shall not exceed 115 lbs./c.f. (185 kgs/0.1 $m^2$) as determined by ASTM C 567.

[6] The Use of Fly Ash as a cement replacement will be allowed in Class S (Seal) concrete.

Chemical Admixtures shall be included in the concrete mixture as specified in the following table based on the ambient air temperature and expected weather conditions.

| Class of Concrete | Temperature less than 85°F (30°C) and falling | Temperature 85°F (30°C ) or greater and rising |
|---|---|---|
| **A** | Type A or F | Type D or G or A and B |
| **D** | Type A or F | Type A or F and B or G |
| **L** | Type F | Type F and B or G |
| **S** | Type D or G or A and B | Type D or G or A and B |

If a Type A, F, or G water reducer is used, then the allowable slump shall be maximum of 8 in. (200 mm).

Admixtures to be incorporated into the concrete shall all be from the same manufacturer, shall be compatible, and shall be incorporated into the concrete in accordance with the manufacturer's recommendations.

The fine aggregate in all Class L Concrete shall be natural sand conforming to the requirements of **Subsection 903.01.**

Fine aggregate manufactured from limestone or other polishing aggregates will not be permitted in concrete to be used as a riding surface in traffic lanes.

The Contractor shall submit the proposed concrete design to the Engineer for approval. The design shall be determined using saturated surface dry aggregate weights and shall be determined by the use of trial batches meeting the requirements of these specifications. The concrete design shall be prepared by a TDOT certified Class 3 concrete technician or approved independent testing laboratory under the direction of a registered civil Engineer licensed by the STATE OF TENNESSEE. The concrete plant technician or the civil Engineer shall certify that the information contained on the design is correct and is the result of information gained from the trial batches. The concrete design shall produce an average compressive strength to indicate that the specified 28 day strength can be obtained in the field. All strength determinations shall be made on equipment meeting the requirements of and in the manner prescribed by AASHTO T 22. It is the contractor's responsibility to provide concrete of the design strength specified in all applicable special provisions, plans, and/or standard specifications. Trial batches for design shall be built no more than 90 days prior to the design submittal. All cost of concrete design, preparation and submittal shall be the responsibility of the Contractor.

The proposed concrete design submittal shall contain as a minimum, the following:

Source of all aggregates
Brand and type of cement
Source and class of fly ash (if used)
Source and grade of ground granulated blast furnace slag (if used)
Specific gravity of cement

Specific gravity of the fly ash (if used)
Specific gravity of the ground granulated blast furnace slag (if used)
Admixtures (if used)
Gradations of aggregates
Specific gravity of aggregates (saturated surface dry)
Air content (if air entrainment is used)
Percentage of fine aggregate of the total aggregate (by volume)
Slump
Weight per c.y. ($m^3$)
Yield
Temperature of plastic concrete
Water/cement ratio lb/lb (kg/kg)
7 day compressive strength [minimum of 3 x 6-in. x12in. (150mm x 300mm) cylinders]
14 day compressive strength (minimum of 3-6 in.x 12 in. (150 mm x 300 mm) cylinders
28 day compressive strength (minimum of 3-6 in.x 12 in. (150mm x 300mm) cylinders
Weight of each material required to produce a c.y. ($m^3$) of concrete

In lieu of the above mix design submittal, the Contractor may submit for approval an existing design approved by the Department within the current calendar year. The approval of this concrete design submittal will not relieve the Contractor of the responsibility of providing concrete meeting the requirements of these specifications. A temporary mix design may be issued if the 7 day compressive strengths exceed the required 28 day strengths.

Any request for a change in source of materials or admixtures from the original mix design must be made in writing to the Regional Materials and Tests Engineer explaining the necessity for the change and must be accompanied by a new mix design in accordance with the above provisions. The Contractor shall place no concrete until the new design is approved.

Concrete with fly ash or ground granulated blast furnace slag as a partial cement replacement will not be used in concrete when high early strength is specified. When the Contractor elects to replace a portion of hydraulic cement with fly ash or ground granulated blast furnace slag, the following requirements must be verified prior to producing any concrete:

1. Fly ash or ground granulated blast furnace slag shall be stored in silos separate from each other and separate from the hydraulic cement.
2. The fly ash or ground granulated blast furnace slag is to be added to the concrete by methods and equipment approved by the Engineer, capable of uniformly distributing the materials throughout the mix.
3. The fly ash or ground granulated blast furnace slag may be weighed cumulatively in the weigh hopper with the cement, provided the cement is added first. The temperature of the fly ash or the ground granulated blast furnace slag is not to exceed 160° F(71° C) at the time of introduction to the mix.

Design of Portland cement concrete with Type I cement modified by the addition of fly ash and/or ground granulated blast furnace slag. The following table indicates the maximum cement replacement rates(by weight) and minimum substitution ratios(by weight) for the type of modifier specified:

| **Modifier** | **Cement Replacement Rate** (Maximum)% (by weight) | **Minimum Modifier Cement Substitution Ratio** (by weight) |
|---|---|---|
| **Ground Granulated Blast Furnace Slag** (grade 100 or 120) | 35.0 | 1:1 |
| **Class F Fly Ash** | 20.0 | 1:1 |
| **Class C Fly Ash** | 25.0 | 1:1 |

Ternary cementitious mixtures (mixtures with Portland cement, ground granulated blast furnace slag, and fly ash) will be allowed for Class A Concrete provided that the minimum Portland cement content is 50%. The maximum amount of fly ash substitution in a ternary cementitious mixture will be 20%. Type I-SM cement will be allowed with ternary cementitious mixtures. When a Type I-SM cement is used, no additional slag shall be used as a partial replacement for the hydraulic cement.

(b) Quality Control and Acceptance of Concrete

It shall be the responsibility of the Contractor to determine and measure the batch quantities of all ingredients (including all water and any specified or approved admixtures) for all concrete produced for the project and to mix, deliver and place the concrete so that the concrete meets the requirements of these specifications. The minimum size of a batch shall be 2.5 c.y. (2.0 m3). The Contractor shall have a TDOT Class 2 or higher certified technician at the concrete plant during all batching operations with the primary responsibility of process control, which includes all sampling, testing and inspection of the aggregate and concrete.

The Contractor shall have a TDOT or ACI certified Class 1 or higher technician for all sampling, testing and inspection for process control of the concrete at the placement site. A technician shall be present at each placement site during all concrete placement. The technician at both the plant and job site shall be authorized to promptly correct any deficiencies in quality control within approved design parameters. All necessary equipment required for process control shall be furnished by the Contractor and shall be at the plant and at the placement site at all times during concrete and placement.

Process control shall include, but not be limited to, the following test and inspections:

1. Test to determine aggregate gradations (AASHTO T 27 with AASHTO T 11 when required).
2. Frequent inspections of the stockpile to ascertain that stockpiles are being maintained in an uncontaminated and un-segregated manner. A current aggregate quality report shall be kept at the plant.
3. Calibration of weighing systems, water meters and admixture dispensing systems prior to starting production.
4. Assurance of accurate weighing of the aggregates and cement, the proper metering of water and admixtures and the quality of water.

5. Assurance that mixing equipment is in proper working condition and the proper mixing speeds and revolutions are controlled as required by the specifications and the Materials and Tests Circular Letter File book.
6. Adjustment of mix proportions due to moisture content of both coarse and fine aggregates (moisture determination to be in accordance with AASHTO T 255).
7. Slump (AASHTO T 119) and Air Test (AASHTO T 152 - AASHTO T 196 required for concrete containing light weight aggregate).
8. Yield test (AASHTO T 121) (When yield varies more than ±2% from that shown on the design. All batching operations shall cease until the problem has been identified and corrected or a new concrete design has been obtained.
9. Quality control cylinders and early break cylinders (7-14 day, etc) for compression tests in accordance with AASHTO T 22.
10. Tests for concrete and ambient air temperatures.
11. A report furnished daily to the Engineer showing all pertinent information (Date, Contract and Project, Item number(s), batch weights, moisture corrections, admixtures, slump, air content, temperatures, etc.). A sample daily report will be given to the Contractor as an example.
12. A concrete delivery ticket must accompany each load to the placement site. The ticket shall at a minimum include the following:

    Date
    Contract number
    County
    Class of concrete
    Concrete design number
    Number of cubic yards
    Load number
    Truck number
    Maximum water allowed by design
    Total water added at the plant
    Maximum water allowed to be added on the project
    Actual water added on project
    Number of revolutions at mixing speed at plant
    Number of revolutions at mixing speed at project
    Time loaded
    Time discharged
    Actual and target batch weights of each component including each aggregate, chemical admixture, and cementitious material used.

The Contractor shall develop for approval of the Engineer and maintain at the plant written procedures for sampling, testing and inspection of the concrete. The Contractor shall keep a record of all tests and inspections performed at the plant site and placement site and this documentation, together with a certification by the Contractor that the concrete incorporated in the work meets the requirements of the specifications, shall be delivered to the Engineer upon completion of the project for inclusion in the project records. Records shall be kept current and shall be made available to the Engineer for review at any time.

It shall be the responsibility of the Contractor to properly make, cure and transport all early break cylinders (7-14 day, etc.) in accordance with AASHTO T 23 and delivered to the Regional laboratory or other established satellite laboratories for tests.

The Department or their representative shall be responsible for performing all acceptance tests. A TDOT Level 1 Certified or ACI Certified Technician shall sample, test air content and slump, and prepare 28 day cylinders for acceptance. The Department shall also be responsible for properly curing and transporting all acceptance cylinders in accordance with AASHTO T 23.

All independent assurance sampling and testing shall be performed by the Department. All sampling and testing for acceptance and independent assurance shall be at the frequencies established in TDOT Procedures. The time and location for obtaining all acceptance and assurance samples will be determined by the Department.

It shall be the responsibility of the Contractor to provide cylinder molds, a wheelbarrow, and provide a level site to perform testing and for initial curing. The Contractor shall also provide a secure storage shed/building for temporary storage of concrete acceptance cylinders in accordance with **Subsection 722.09** of these Specifications.

An approved concrete design is required for non-critical items involving small quantities of concrete but these non-critical items may be accepted at a reduced testing frequency in accordance with TDOT Procedures. This is to be used for sidewalks, curbs and gutters, building foundations, slope paving, ditch paving, guardrail anchorages, small culvert headwalls 30 in. (750 mm) diameter or less, fence posts, catch basins, manhole bases and inlets, small sign bases and steel strain pole footings.

A qualified plant technician shall be at the ready-mix plant during all batching operations. A field technician is not required to be at the placement site during all small quantity placing operations but is required to perform one complete set of tests during the life of the project. A delivery ticket must accompany each load delivered to the job site.

Pre-approved, pre-packaged concrete mixtures may be used for the applications listed above provided the quantity does not exceed 2 c.y.(1.5 $m^3$) per day. No design will be required.

Batch weights shall be corrected to compensate for any surface moisture on the aggregate at the time of use. The Contractor may elect to withhold some of the water from the mix at the plant. If a portion of the water is withheld at the plant, additional water may be added at the work site provided the design water/cement ratio of the mix is not exceeded. Water added at the placement site for Class D and Class L concrete shall not exceed one (1) gallon per cubic yard. The total amount of water in the mix shall not exceed the maximum in the approved mix design. Any additional slump shall be achieved using a water reducing admixture. When the addition of water to the mix is made in the field, 30 additional revolutions at mixing speed are required.

(c) <u>High Early Strength</u>

When high early strength concrete is required, in the plans for structural or pavement repairs, or other type work, the use of Type I or Type III cement will be optional with the Contractor. If Type I cement is used, a minimum cement content of 714 lbs/c.y. (424 kgs/$m^3$) will be required. If Type III cement is used, a minimum cement content of 620 lbs./c.y.(368 kgs/$m^3$) will be required. High early strength concrete, meeting these requirements, may be substituted at the option of the Contractor for Class A concrete when approved in writing by the Engineer.

When the Contractor elects to use high early strength concrete, the source and gradation of fine and coarse aggregates shall be the same as that specified for the concrete for which the high

early strength concrete is substituted. No additional compensation will be made if the Contractor elects to substitute high early strength concrete for Class A concrete. The unit price for the class of concrete for which the substitution is made shall be full compensation for the concrete.

**Subsection 604.04 Page 404, Last paragraph, last sentence**

The fogger will be designed to provide a maximum VMD (volume mean diameter) of 15 (microns), and a throw distance of 60 ft. (18m).

**Subsection 604.08 (4)** Third sentence, **Change** "35mm" to, "#36"

**Subsection 604.08 page 412** Fifth paragraph, third sentence, **Change** the word "Uncoated" to "Coated"

**Section 604,** All sections, after **Subsection 604.11** referencing 604 Subsections are off by one subsection. Therefore **change** them by one, see the example below.

Example: **Change "Subsection 614.12(b)"** to **"Subsection 604.11(b)"**

**"Subsection 604.23"** to **"Subsection 604.22"**

**Subsection 604.13 Revise** entire subsection to the following:

The requirements for mixing concrete shall be as prescribed in **Subsection 501.10** for major structures. However, when the concrete is mixed and transported in truck mixers, the time elapsing from when the water is added to the mix until the concrete is deposited in place at the site of the work shall not exceed 90 minutes. When the ambient air temperature exceeds 90° F(32° C), the elapsed time above shall be reduced to 60 minutes for concrete placed in bridge decks. Retempering concrete by adding water or by other means will not be permitted; however, a portion of the mixing water or chemical admixtures may be withheld from transit mixers and added at the work site if all requirements of the approved mix design are met. Water added at the placement site for Class D and Class L concrete shall not exceed one (1) gallon per cubic yard. The total amount of water in the mix shall not exceed the maximum in the approved mix design. Any additional slump shall be achieved using a water reducing admixture. In the event water or chemical admixtures are added at the placement site, the concrete shall be mixed a minimum of 30 revolutions at mixing speed after additions are made. Concrete that is not within the specified slump limits, air content limits, temperature limits or time limits at time of placement shall not be used.

For items of construction specified in **Subsection 604.11(b)**, concrete mixing may be performed by mobile volumetric measuring and mixing equipment as prescribed in **Subsection 604.04** of these Specifications.

When concrete placed in the items of construction specified in **Subsection 604.11(b)** does not exceed 25 c.y.(20 $m^3$) per day, it may be accepted on the basis of field testing for air, slump, and occasional strength tests with only random plant inspections as deemed necessary by the Engineer for control.

When this basis of acceptance is used, the ready-mix plant furnishing the concrete shall have been inspected and approved for use as provided in **Subsection 604.04**. In addition, the delivery ticket accompanying each load of concrete shall show the class of concrete, the quantity of

cement, aggregates, water, and additives used in the batch, and the time of batching. Materials used in the concrete shall be tested and approved.

**Subsection 604.15 Delete** the seventh paragraph, "If the acceptance cylinders…"

**Subsection 604.16 (a) Delete** the twelfth paragraph of this section, "If data collected during…"

**Subsection 604.16 page 420** Second and third paragraph, **Replace** with the following:

In hot weather mitigation it will be necessary to apply a certified dry fog with a maximum VMD of 15 (microns) with a throw distance of 60 (ft.) above the concrete surface during the placement and finishing operations. The contractor shall furnish a certification to the project supervisor verifying the VMD.

In addition, immediately before the concrete is placed, the forms and reinforcing steel shall be cooled to 90° F (32° C) or less by using a fine spray of water, leaving no puddles or pockets of water. Trucks shall be sprinkled or kept in the shade when not being unloaded so as to contribute to reducing the temperature of the concrete.

**Subsection 604.16 (d)** Last sentence, **Change "**$m^3$" to "$8m^3$"

**Subsection 604.16 (e)** Second paragraph, second sentence, **change** "8 m" to "6 m",

**Subsection 604.19. Add** the following as the last sentence**:**

"Refer also to Article 107.02 regarding restrictions on loading during bridge construction"

**Subsection 604.21 (d) Remove and Replace** entire subsection with the following:

(d)Applied Texture Finish.

Surface preparation prior to the textured finish shall include a Class 1 Ordinary Surface Finish in accordance with Subsection 604.22(a). The concrete shall be in place a minimum of 28 days to allow for ample cure time and weathering of curing compounds prior to application of the textured finish. All surfaces shall be pressure washed just prior to application. Surfaces to be coated shall be free from efflorescence, flaking, coating, rust, dirt, oil and other foreign substances. Coatings shall be applied only to surfaces that are free of surface moisture as determined by sight and touch. Surfaces that are not to receive a Coated Finish are to be shielded and masked. Cracks over 1/8 in.(3 mm) wide are to be veed out and filled with an approved product from the TDOT QPL 13-Section B.5.Structural Materials and Components. The surface preparation shall be approved by the Engineer immediately prior to the beginning of the work.

The textured finish shall be applied in the number of coats as recommended by the manufacturer and as posted on the Departments Qualified Products List to achieve a total application rate of one (1) gallon per 45 (±5) s.f. (0.9 ± 0.1 liter per $m^2$). If a two coat system is used, the base coat shall be similar in color to mountain gray, **Federal Specification No. 36440,** when the final coat is White, **Federal Specification No. 37886.** When the final coat is similar in color to mountain gray, **Federal Specification No. 36440** a base coat of white, **Federal Specification No. 37886** shall be used**.** The contractor/subcontractor shall give advance notice to the Engineer of the date(s) and time(s) the texture coating is to be applied. The textured finish shall be applied with rollers or brushes so as to provide a consistent and uniform coverage. As an alternative, the Contractor may elect to spray the textured finish if he furnishes a containment system meeting the approval of the Engineer. Regardless of the method of application, drippings

and/or overspray from the texturing process shall be prohibited or otherwise contained in a manner that will not contaminate the environment.

The contractor/subcontractor shall submit to the Engineer certification of the following:

Brand name,
Production batch or lot number,
Qualified Products List Evaluation Number
Manufacturers recommended rate of application,
Materials Safety Data Sheet,
Materials Data Sheet,
Shipping date.
A color sample shall be submitted to the Engineer for approval.

**Subsection 604.21** Third paragraph, sentence next to last, **Change** "**Federal Color Standard 594b",** to "**Federal Color Standard 595b"**

**Subsection 604.27,** Revise the first sentence under the Pavement Roughness Index Table to the following:

"In addition, all areas of pavement roughness index using a 0.1 in. (2.5 mm) blanking band represented by high points having deviations in excess of 0.4 in (10 mm) for any 25 ft. (7.6 m) section per each wheel path shall be corrected."

**604.28-Loading and Opening to Traffic. Add** the following as the last sentence:

"Refer also to Article 107.02 regarding restrictions on loading during bridge construction"

**Subsection 604.31-Basis of Payment. Revise** entire subsection to the following**:**

**604.31-Basis of Payment.** The accepted quantities will be paid for at the respective contract unit price per c.y.($m^3$) for Class A Concrete, Class D Concrete, Class L Concrete and Class S Concrete; per lb.(kg) for Steel Bar Reinforcement and Epoxy Coated Reinforcing Steel; and per s.y.($m^2$) for Scarifying bridge deck surface and Applied Texture Finish; complete in place.

The concrete fillet above fabricated bridge girders will be paid as bridge deck concrete with the quantities based on the fillet required for a conventional deck forming system. Increases in the aforementioned fillet depth to solely accommodate the Contractor's chosen deck forming system (e.g. precast deck panels) will not to be measured and paid for directly. All costs of this increase will be included in other items bid.

The accepted quantities of leveling concrete shall be paid for at 40% of the price bid for the concrete that is to go into the footing.

Any deduction in monies due to the Contractor for failure to comply with the surface rideability requirements set forth in **Subsection 604.28** shall be make on a lump sum basis.

When field conditions result in the construction of a different type of box culvert or box bridge from that established on the Plans (box type to slab type or vice versa) the respective bid price per c.y.($m^2$) for Class A concrete shall be increased by 15% for constructing a slab type in lieu of box type and decreased by 13% for constructing box type in lieu of slab type. No adjustment of Steel Bar Reinforcement unit bid price is to be made for the change in box culvert or box bridge type.

Where concrete does not meet the specified strength but is allowed to be included in the permanent construction as set out in Subsection 604.20, Defective Concrete, or tardy acceptance cylinders and/or cores fail to meet the strengths specified in Subsection 604.15, the following equation shall be used to determine percent payment of contract bid price.

PP = 100-(3*Ds)
PP = Percent Payment
Ds = Percent Below Specified Strength
Ds = [(Specified Strength-Actual Strength)/Specified Strength]*100

Defective concrete greater than 25 percent below specified strength may remain in place at no cost to the Department if approved by the Department of Structures or the contractor may remove and replace.

*Payment to be based on unit price of item as bid, i.e., volume [c.y.($m^3$)], length [ft.(m)], each, or other designated bid units. Payment of the above listed percentages includes cost of incidental items such as reinforcing steel when included in the price bid for the Item.

**Subsection 606.04 (c)** First sentence, **Change** "3(1)" to "1(3)"

**Subsection 606.21** Second sentence, **Change** "o1ne" to "one"

**Subsection 607.02-Materials. Remove and Replace** entire subsection with the following:

**607.02-Materials.** Materials used in this work shall meet the following requirements:

| Material | Subsection |
|---|---|
| **Concrete Pipe, Reinforced** | **914.02** |
| **Corrugated Metal Pipe Culverts, Pipe Arches and Underdrains** | **915.02** |
| **Joint Mortar** | **905.02** |
| **Rubber Gaskets** | **905.03** |
| **Polyvinyl Chloride Pipe (PVC)** | **914.09** |
| **High Density Polyethylene Plastic Pipe** | **914.10** |

Where Pipe Culverts (Cross Drains & Median Drains) are specified they shall be in accordance with the following:

(a) Pipe Culverts (Cross Drains & Median Drains) 15 through 36 in. (375 through 900 mm) shall be one of the following:

(1) Class III, IV, or V Concrete pipe meeting the requirements of either **Subsection 914.02** or AASHTO M 86.
(2) Metal pipe meeting the requirements of **Subsection 915.02**.
(3) High Density Polyethylene pipe meeting the requirements of **Subsection 914.10**.

(4) Polyvinyl Chloride pipe meeting the requirements of **Subsection 914.09**.

(b) Pipe Culverts (Cross Drains & Median Drains) larger than 36 in. through 48 in. (900 through 1200 mm) shall be one of the following:

(1) Class III, IV, or V Concrete pipe meeting the requirements of either **Subsection 914.02**.
(2) Metal pipe meeting the requirements of **Subsection 915.02**.
**(3)** High Density Polyethylene pipe meeting the requirements of **Subsection 914.10**.

(c) Pipe Culverts (Cross Drains & Median Drains) larger than 48 in. (1200 mm) shall be one of the following:

(1) Class III, IV, or V Concrete pipe meeting the requirements of Subsection 914.02.
(2) Metal pipe meeting the requirements of **Subsection 915.02**.

Where Pipe Culverts (Side Drains) are specified they shall be in accordance with the following:

(a) Pipe Culverts(Side Drains) 15 through 36 in.(375 through 900 mm) shall be one of the following:

1. Class III, IV, or V Concrete pipe meeting the requirements of either Subsection 914.02 or AASHTO M 86.
2. Metal pipe meeting the requirements of Subsection 915.02.
3. High Density Polyethylene pipe meeting the requirements of Subsection 914.10.
4. PVC pipe meeting the requirements of **Subsection 914.09**

(b) Pipe Culverts(Side Drains) larger than 36 in.(900 mm) shall be one of the following:

(1) Class III, IV, or V Concrete pipe meeting the requirements of **Subsection 914.02**.
(2) Metal pipe meeting the requirements of **Subsection 915.02**.

Where Pipe Culverts (Storm Drains) are specified they shall be in accordance with the following:

(a) Pipe Culverts (Storm Drains) 15 through 36 in. (375 through 900 mm) shall be one of the following:
(1) Class III, IV, or V Concrete pipe meeting the requirements of either **Subsection 914.02** or AASHTO M 86.
(2) High Density Polyethylene pipe meeting the requirements of **Subsection 914.10.**
(3) PVC pipe meeting the requirements of **Subsection 914.09**.

(b) Pipe Culverts (Storm Drains) larger than 36 in. through 48 in. (900 through 1200 mm) shall be one of the following:
   (1) Class III, IV, or V Concrete pipe meeting the requirements of either **Subsection 914.02**.
   (2) High Density Polyethylene pipe meeting the requirements of **Subsection 914.10**.

(c) Pipe Culverts (Storm Drains) larger than 48 in. (1200 mm) shall be Class III, IV, or V Concrete pipe meeting the requirements of **Subsection 914.02**.

Where Slope Drains are specified, they shall be in accordance with one of the following:

(a) Metal pipe meeting the requirements of **Subsection 915.02.**
(b) High Density Polyethylene pipe meeting the requirements of **Subsection 914.10**.
(c) Polyvinyl Chloride pipe meeting the requirements of **Subsection 914.09**.

Materials for special end connections to other pipes or structures, required to complete the work as indicated on the Plans or directed by the Engineer shall conform to the requirements of **Section 914** and **Section 915** of the Standard Specifications, unless otherwise specified.

Reinforced concrete pipe shall be flat base, round, or oval, as shown on the Plans.

The sizes of pipe shall be identified by the nominal inside diameter. The pipe shall be of the sizes and classes or gauges stipulated in the Contract, shown on the Plans, or established by the Engineer.

Steel and aluminum pipe are considered as optional for corrugated metal pipe, pipe arches, and underdrains by the Department. The Contractor may use either option he prefers, however, in no case shall different metals or corrugations be mixed in a single line of pipe.

When paved or coated corrugated metal pipe and pipe arches are specified, either aluminum coating or bituminous coating may be used. The aluminum or bituminous coated pipe shall conform to the requirements of AASHTO M 274 or AASHTO M 190 respectively.

When precoated corrugated metal pipe and pipe arches are specified, polymer coating shall be used in accordance with **Subsection 915.03.** Coupling bands and all hardware except nuts, bolts and washers shall be of the same material and coating as the pipe.

When corrugated metal pipe arches are specified as "size equivalent round" the dimensions shall be as shown in the Plans.

**Subsection 607.07-Joining Pipe. Remove and Replace** entire subsection with the following:

**607.07-Joining Pipe.** Rigid pipe may be of bell and spigot or tongue and groove design, unless one type is specified. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

Joints for rigid pipe shall be made with: (a) portland cement mortar; (b) rubber gaskets; or (c) other types of joints recommended by the pipe manufacturer and approved by the Engineer may be permitted.

For mortar joints, the pipe ends shall be thoroughly cleaned and wetted with water before the joint is made. Stiff mortar shall then be placed in the lower half of the bell or groove of the pipe section already laid and on the upper half of the spigot or tongue of the section to be laid. The 2 pipe sections shall then be tightly joined with their inner surfaces flush and even. The inside of

the joint shall then be finished smooth and any surplus material removed from the pipe. The completed mortar joints shall be protected against rapid drying by suitable covering material.

Rubber ring gaskets shall be installed so as to form a flexible watertight seal. When other type joints are permitted, they shall be installed or constructed in accordance with the recommendations of the manufacturer.

Metal pipe shall be firmly joined by approved coupling bands.

High Density Polyethylene and Polyvinyl Chloride pipe shall meet the performance requirement for soiltightness, unless watertightness is specified. Joints shall be installed so that the connection of pipe sections, for a continuous line, will be free from irregularities in the flow line.

Pipe shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and relaid or replaced.

**Subsection 607.09-Backfilling. Remove** and **replace** entire subsection with the following:

**607.09-Backfilling.** After the pipe is installed, the trench shall be backfilled in accordance with the provisions of Section 204 and the standard drawings. All pipes shall undergo visual inspection during and after installation to insure conformance to these specifications. Final visual inspections for all pipes shall be conducted no sooner than 30 days after completion of installation and final fill. Final visual inspections shall be conducted from the inlet and outlet ends of all pipe with sufficient hand held lighting to observe any defects. In addition to visual inspection, the following test shall be performed not less than 30 days following completion of pipe installation and final fill placement. All post installation inspections and test shall be observed by Department personnel.

High Density Polyethylene Pipe (HDPE Pipe) , Polyvinyl Chloride Pipe (PVC), and Corrugated Metal Pipe (CMP): The contractor shall be responsible for conducting a deflection test, (mandrel, laser, or manual), on at least 10 percent of the total number of pipe runs representing a minimum 10 percent of the total project footage including a minimum of one run of each pipe size. The Engineer shall randomly select installations to be tested to determine whether the internal diameter of the barrel has been reduced more than 5 percent. If any installation is determined to have deflected more than 5 percent, all pipe installations shall be evaluated for deflection. Documentation of station, pipe size, and deflection results shall be provided to the Engineer.

Reinforced Concrete Pipe (RCP): All RCP shall be visually inspected for deflection, alignment, cracking, and joint construction during and after installation. Any installations where visual inspections detect poor construction techniques shall be further evaluated as directed by the Engineer.

All Pipes with deflections greater than 5 percent of the nominal pipe diameter, undue misalignment, or poor joint construction shall be replaced by the Contractor at his expense. Any excavation or additional work including, but not limited to, base stone or asphalt removal and replacement, required to replace a pipe installation due to poor construction techniques shall be at the Contractor's expense. As visual and deflection test dictate, the Engineer may request additional inspections at the contractors expense.

**Subsection 607.12-Method of Measurement. Remove and Replace** entire subsection with the following:

**607.12-Method of Measurement.** Concrete pipe culverts and concrete storm sewers of the different classes, shapes, and sizes specified, will be measured by the linear foot(meter) of pipe installed and accepted. The quantity of pipe cut off, not to exceed 2 ft.(600 mm), will be paid for at the contract bid price for pipe in place.

Corrugated metal pipe, and corrugated metal structural plate pipe will be measured by the linear foot (meter) of pipe installed and accepted. Measurements will be made as follows:

(a) Metal pipe and metal structural plate pipe, with square and vertical ends or with skewed and vertical ends will be measured, in place, end to end of the metal on the centerline of the structure.
(b) Metal pipe and metal structural plate pipe, with square ends beveled, and with ends skewed and beveled, except arch pipe, will be measured, in place, by averaging the end to end distances at the top and bottom of the pipe, measured parallel to the centerline of the structure.
(c) Metal arch pipe and metal structural plate arch pipe with square ends beveled, and with ends skewed and beveled, will be measured, in place, end to end of the metal along the invert of the structure.

High Density Polyethylene pipe will be measured by the linear foot(meter) of pipe installed and accepted. The quantity of pipe cut off, not to exceed 2 ft.(600 mm), will be paid for at the contract bid price for pipe in place.

Polyvinyl Chloride pipe will be measured by the linear foot(meter) of pipe installed and accepted. The quantity of pipe cut off, not to exceed 2 ft.(600 mm), will be paid for at the contract bid price for pipe in place.

Slope Drains will be measured in the same manner as specified for corrugated metal pipe.

Pipe Culverts(Side Drains) of the different sizes specified will be measured by the linear foot(meter) along the centerline of the installed pipe, except that no measurement for payment will be made in excess of the ordered length of the pipe. Pipe Culverts (Side Drains) will be ordered in increments of 2 ft.(600 mm).

Unless otherwise indicated on the Plans, no measurement of structure excavation will be made; and the costs involved shall be included in the unit prices bid for other items of construction. When the Plans provide for direct payment for structure excavation, measurement and payment will be in accordance with **Section 204**.

No payment will be made for labor and materials used in making branch connections. The length of pipe in the branch connection will be measured and included in the quantity of pipe installed in the branch line.

Strutting of corrugated metal pipe and corrugated metal structural plate pipe will not be paid for separately, but the costs thereof shall be included in the unit price bid per linear foot(meter) of pipe.

**Subsection 607.13-Basis of Payment**. **Revise** to include bedding and back fill as shown below:

The accepted quantities of pipe culverts and storm sewers, measured as provided for above, will be paid for at the contract unit price per linear foot(meter) for each type, class, shape, and size constructed, complete in place, including placing and compacting bedding and backfill, which price shall be full compensation for labor and materials used in making joints, and

connections to other structures; for strutting, when required, and for completing all incidentals necessary to complete the item.

**Subsection 614.04** First sentence of the second paragraph. Shall read as follows:

The precast concrete deck units shall be cast in a Precast/Prestressed Concrete Institute, Catergory B-3 certified precast plant under plant control conditions, and in accordance with the TDOT procedure for the Manufacture and Acceptance of pre-cast concrete drainage structures, noise wall panels, and retaining wall panels.

The precast concrete deck units shall be cast in a certified precast plant under plant control conditions, and in accordance with the TDOT procedure for the Manufacture and Acceptance of pre-cast concrete drainage structures, noise wall panels, and retaining wall panels.

**Subsection 615.01**, Replace the second paragraph, first sentence with the following:

"The fabrication of these items shall be accomplished in plants that have been certified by the Precast/Prestressed Concrete Institute, Plant Certified Inspector (PCI)."

**Subsection 615.02**, Replace the third paragraph, first sentence with the following:

"The fabrication of precast/prestressed concrete members shall be in a Precast/Prestressed Concrete Institute category B-3 certified plant and have at each fabrication site a technician skilled in the approved pre-stressing method."

**Subsection 615.05**, Replace the second paragraph with the following:

"The panels shall be fabricated in a plant certified by the Precast/Prestressed Concrete Institute (PCI) category B-3."

**Subsection 615.07** First paragraph, fourth sentence, **Change** "4 months" to "6 months"

**Subsection 616.05 Revise the last paragraph to the following:**

"Tendons shall be placed in rigid ducts after concrete placement is completed. Ducts shall be as specified on plans and in conformance with Subsection 616.07."

**Subsection 619.14** Add as the second paragraph

PMC Variable Depth shall be measured by the cubic yard complete in place. The number of cubic yards will be determined by deducting the theoretical volume of Bridge Deck Overlay (PMC) from the total volume of PMC required to obtain the finished grade shown on the Plans or established by the Engineer.

**Subsection 621.01 Add** "and temporary shoring" after "temporary structures" in the first sentence.

**Subsection 621.02 Add** the following as the last paragraph:

Temporary shoring shall be used to retain the earth during grading operations and bridge construction to maintain traffic. Temporary shoring shall be installed at the locations shown on the plans or as directed by the engineer. Payment for this item will not be made when used for the installation of drainage structures, utilities, to meet OSHA regulations, or for the convenience of the contractor, unless these locations are specifically shown on the plans. The contractor shall design the temporary shoring for the specific locations and in-situ soil types. The submittal shall be in accordance with **Subsection 105.02**, shall be stamped by a Professional Engineer, and shall include detailed drawings, design calculations, and shoring material requirements. Temporary shoring may be sheet piling, piling/lagging walls, tie back walls, etc…

**Subsection 621.03 Add** the following as the last paragraph:

Temporary shoring will be measured and paid for by the square foot (square meter) of exposed vertical face area. The bottom of shoring for payment will be where the exposed face intersects the existing or specified grade. The top of shoring for payment will be the actual shoring top, but not more than one (1) foot above where the back of shoring intersects the existing or specified grade.

**Subsection 621.04 Add** the following as the last paragraph:

Payment for temporary shoring shall be full compensation for all designs, submittals, labor, tools, equipment, materials, and all other incidentals for proper installation and removal of the shoring.

**Subsection 623.02 B. 2.** First sentence, **Add** after "grade 50" "50S, HPS50W,"

**Subsection 623.02 C. 2.** Last part of the paragraph, **Add** after "Category I" "Simple Steel Bridges", SBR-1B.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 02-06-10) March 1, 2006
(Rev. 05-05-10)
(Rev. 12-13-10)

## Supplemental Specifications - Section 700

## of the

## Standard Specifications for Road and Bridge Construction

**701.13-Method of Measurement. Add** the following as the second paragraph:

Handicap Ramps will be measured by the ft.² (m²) complete in place as specified by standard drawings. The area shall be obtained by surface measurements. Where standard widths are constructed, the measurements shall not exceed the standard widths shown on the Plans, unless approved in writing by the Engineer.

**Subsection 701.14-Basis of Payment. Revise** paragraph to include Handicap ramps as follows:

The accepted quantities of Concrete Sidewalk of each thickness, Handicap Ramps, and Concrete Driveway will be paid for at the contract unit price per ft.² ($m^2$) for the respective items, complete in place. The accepted quantities of Concrete Median Pavement will be paid for at the contract unit price per yd³. ($m^3$), complete in place.

**Subsection 705.06:** Delete the second and third paragraph, and add the following as the second, third, and fourth paragraph. Revise the bulleted section as shown below.

All post holes, dug or drilled, shall be of such size as will permit proper setting of the posts, and allow sufficient room for backfilling and tamping.

When solid rock is encountered while drilling post holes.

- Within 18 in. (460mm) of the ground surface, an oversized or elongated hole shall be drilled 24 in. (610mm) into the rock. The post shall be set at the roadside edge of the hole and the hole should be backfilled with the cutting spoils. If using wooden posts the oversized hole shall be a single hole 23 in. (580mm) in diameter or three overlapping holes 10 in. (250mm) in diameter to a length of 23 inches. For steel posts, the oversized hole shall be a single hole, 20 in. (530mm) in diameter or three overlapping holes 8 in. (203mm) in diameter to a length of 20 inches.
- Below 18 in. (460mm) of the ground surface hole shall be drilled 12 in. (300mm) into the rock or to the specified depth in Plans. The holes shall be 8 in. diameter for steel posts, and 12 in. diameter for wood posts.
- When installing end terminals using tubes, posts 1 and 2 will be installed to full depth or a minimum of 36 in. into the solid rock. The holes around the steel tube shall be backfilled with the cutting spoils.

- See approved shop drawings for additional information concerning post depth, and size of holes.

To validate proper installation of posts, each guardrail contractor/installer doing work for the Department shall have a minimum of 5 line posts and 5 terminal posts per Region per year pulled by the Department for verification of length. The Regional Construction and Materials and Tests offices may select any post for verification, but at a minimum, must select posts from five different runs of rail. If the posts are found to be in accordance with the plans and specifications, they may be re-installed if they were not damaged during the pulling process. If the post length is found to be deficient, the contractor/installer shall be required to remove the entire run of guardrail or end terminal and replace it properly at his expense.

**Subsection 705.10**: Add to the end of the section

When no contract unit price has been established for drilling or boring in solid rock, for posts, while placing Single Guardrail, payment for each hole shall be made at a rate equal to 2.0 times the contract unit price for Single Guardrail.

While drilling or boring into solid rock for posts placed in conjunction with Guardrail at Bridge Ends, Parapets, Piers, Concrete Endposts, and other similar edifice, payment shall be made at a rate equal to 1.25 times the contract unit price per hole.

When no unit price has been established for drilling or boring into solid rock for End Terminals posts, payment shall be made at a rate equal to 2.0 times the contract unit price for single guardrail per hole.

Unless posts are driven to refusal in solid rock, prior to drilling or boring, no additional payment will be made for drilling or boring for the placement of posts.

**Subsection 709.01, Revise** entire subsection to the following:

**709.01-Description.** Riprap shall consist of furnishing and setting or placing, rubble stones, crushed stone, sacked sand-cement, machined riprap, and embedded riprap. Slope Pavement shall consist of the construction of a reinforced concrete mat on prepared slopes. The riprap and slope pavement shall be constructed within reasonably close conformity to the lines, grades, and cross sections, and at the locations indicated on the Plans or as directed by the Engineer, and in conformity with the requirements and provisions of these Specifications.

**Subsection 709.02, Revise** entire subsection to the following:

**709.02-Materials.** Materials used in the construction of riprap and slope pavement, in addition to meeting the general requirements of these Specifications, shall conform to the following:

(a) Rubble-stone Riprap shall consist of stone or broken Class "A" or paving concrete meeting the requirements of **Subsection 918.10**. In addition, at least 80% of the stone shall have a minimum dimension of 10 in.(250 mm). The remainder shall be 2 to 4 in.(50 to 100 mm), and shall be approximately rectangular and/or trapezoidal in shape. Broken Class "A" or paving concrete shall be free of steel and wire fabric reinforcement. Sand for rubble-stone riprap(grouted) shall meet the requirements of **Subsection 903.01** or **903.02**. Cement for rubble-stone riprap(grouted) shall meet the requirements of **Subsection 901.01**.

((b)Sand for sacked sand-cement riprap shall be manufactured or natural sand and shall meet the quality requirements of **Subsection 903.01** or **903.02**. Cement for sacked sand-cement shall meet the requirements of **Subsection 901.01**. Sacks shall be of either cotton or jute, standard grade of cloth, which will hold the sand-cement mixture without leakage during handling and tamping. They shall be strong and shall be sized to hold approximately 1 c.f.(0.03 $mm^3$).

(c) Reinforced concrete slope pavement shall be composed of Class A concrete meeting the requirements of **Subsection 604.03** and steel reinforcement meeting the requirements of **Subsection 907.01** or **907.03**, whichever is specified. Preformed expansion joint filler shall meet the requirements of **Subsection 905.01**.

(d) Concrete curing materials shall meet the requirements of Sec**tion 913**.

(e) Machined Riprap shall be clean shot rock essentially free of sand, dust or organic materials and shall be the size designated for the class specified. The stone shall be uniformly distributed throughout the size range. The thickness of the stone layer shall be that designated for the specified class herein unless otherwise noted on the Plans. Sensitive areas of the project as indicated on project plans, project permits, and/or designated by the Engineer requiring washed and/or clean rock will be provide by the contractor at no additional cost to the project. Washed and/or clean rock must be approved by Engineer prior to placement in environmentally sensitive areas.

When rock or stone is used as riprap, the material when subjected to five alternations of the sodium sulfate soundness test (**AASHTO T 104**), shall not have a weighted percentage of loss of more than 12. The material shall be approved by the Engineer before use.

**Subsection 709.08:** Second paragraph, **Change** "sawed for a depth of 1 ft." to "1 in."

**Subsection 709.09, Revise** entire subsection to the following:

**709.09-Machined Riprap.** The Contractor shall exercise care in the preparation of the riprap subgrade to insure that no reduction in the design waterway occurs. No riprap is to be placed until the final subgrade elevation has been verified by the Engineer. When deemed necessary by the Engineer, the riprap shall be rolled down with metal tracked equipment to provide a more dense stone mass with final contours in reasonable conformance to the plans. Placement of the super-structure shall not proceed until the final elevation of the riprap has been accepted by the Engineer.

Upon completion of the work, visual inspection shall reveal that approximately 50% of the surface area consists of stones no smaller than 1/2 of the maximum size specified.

The material shall be dumped and placed by the use of appropriate power equipment in a manner that will produce a surface uniform in appearance. Hand work may be required to correct irregularities.

The Contractor shall exercise care in the preparation of the site referring to erosion control in accordance with the provisions in Subsection 209 and channel excavation in accordance with the provision of Subsections 203.02(c). When required by project plans, permits, or as directed by the engineer, embedded riprap in streams, conveyances, diversions, or other sensitive areas shall be properly tamped into the subsurface or otherwise blended into the substrate. Care is to be taken so that water flows over the embedded riprap and that flow is not lost below and/or within

the rock. If clean rock is required by the project plans, permit, or directed by the engineer, the rock shall meet the provisions of Subsection 709.02 for clean rock.

**Subsection 712.01**: Add to the end of paragraph 1.

This work shall include both installing additional devices as necessary in construction work zones.

**Subsection 712.04: Remove entire subsection text and replace with the following:**

**General.** At the Pre-construction Conference the Contractor shall designate a responsible person who will be assigned to the project to supervise traffic control.

Signs shall be erected in a workmanlike manner such that all supports are plumb, sign panels generally perpendicular to the travelway and legends horizontal so that they effectively convey the intended message. Advanced warning signs shall not be displayed more than 48 hours before physical construction begins. Signs may be erected up to 1 week before needed, if the sign face is fully covered, in a manner approved by the Engineer. The sheeting of the sign shall be free of any damage that would reduce the reflectivity. The use of overlay plates on signs is prohibited. Signs shall be mounted on stationary or portable supports dependent on the type work being performed. Sign supports shall be driven a minimum of 3.5 ft. (1 m) into soil or 1 ft. (300 mm) into solid rock. Where soil and solid rock are both encountered, the depth of the sign support in the ground shall be:

$d1 + 3.33d2 = 1$, where
$(d1 + 3.5d2 = 42)$
$d1$ = depth in m (in.) of support in soil
$d2$ = depth in m (in.) of support in solid rock

Stationary sign supports may be spliced, provided the splice is a minimum of 18 in.(450 mm). In addition, the stubs for the splice shall be driven as required above and shall not extend above 18 in.(450 mm) from ground level. The splice shall be fastened with four bolts, 2 placed at each end of the splice. In general, work being performed at spot locations and of short duration will necessitate the use of portable supports properly weighted for stability.

During periods of non-use, warning signs and other devices shall be removed from the work area, covered or otherwise positioned so they do not convey their message to the traveling public and do not present a safety hazard to drivers. If covered, the covering material shall be maintained in a neat and workmanlike manner during its use. The method of covering the sign face shall not deface or damage the sheeting of the sign.

Barricades and other devices that require lighting shall be lighted, as designated by plans details or as directed by the Engineer, with the use of flashing or steady burning lights. The Contractor will be responsible for procuring and bearing the expense of a continuous power source.

Flaggers with proper attire and paddle shall be provided when necessary to safely handle traffic through the construction zone. Flaggers will be considered a general requirement of traffic control and no direct payment will be made for such.

All Uniformed Law Enforcement Officers working on TDOT projects shall have training from a Peace Officer Standards and Training (POST) certified police training academy in the State of Tennessee.

All Uniformed Law Enforcement Officers working within TDOT work zones shall have an additional 4 hours of FHWA approved work zone training by December 31, 2010. Record of this training shall be submitted to the Project Engineer.

The Flashing Arrow Board(s) shall be installed at locations shown on the Plans or as directed by the Engineer and shall comply with all requirements of the **"Manual on Uniform Traffic Control Devices for Highways and Streets"(MUTCD)**. The Contractor shall take all necessary precautions to insure that the Flashing Arrow Board(s) perform as described herein. Any Flashing Arrow Board that exhibits any type of malfunction including improper dimming shall be corrected or replaced immediately.

The Flashing Arrow Board shall be capable of displaying the following configurations:

1. Right Arrow - 10 lamps flashing in unison forming an arrow
2. Left Arrow - 10 lamps flashing in unison forming an arrow
3. Double Arrow - 5 lamps in each arrow head and 3 lamps in a common shaft all flashing in unison
4. Four Point Caution - 4 outermost corner lamps flashing in unison

The Flashing Arrow Board(s) shall be used in the single arrow mode for lane closure only and shall be situated and aligned so that the flashing arrow is clearly visible and legible. The single arrow mode display shall have 10 lamps flashing in unison. The sequential arrow configuration, chevron arrow configuration, and horizontal bar configuration will not be allowed. The flash rate shall not be less than 25 flashes per minute or more than 40 flashes per minute. Minimum lamp "on-time" shall be 50% of the cycle.

The Flashing Arrow Board(s) shall be mounted so as to provide a minimum of 7 ft.(2.1 m) between the bottom of the panel and the roadway.

Portable signs may be used when the duration of the work is less than three (3) days or as allowed by other conditions in the proposal. All portable signs and sign mounting devices utilized in work shall be **NCHRP 350** compliant. When not being used, portable signs must be removed from the clear zone. Turning signs sideways or backwards is explicitly prohibited while the signs are in the clear zone. Portable interim signs shall be mounted a minimum of one (1) foot above the level of the pavement edge and shall be mounted at the height recommended by the manufacturer’s crashworthy testing requirements.

All regulatory sign blanks shall be rigid.

The Contractor shall make every effort to eliminate the use of interim signs as soon as the Work allows for the installation of permanent signs.

Existing street name signs shall be maintained at street intersections.

Any sign(s) or portions of a sign(s) that are not applicable to the traffic control plan shall be covered so as not to be visible to traffic or shall be removed from the roadway when not in use.

The Contractor shall not remove any existing signs and supports without prior approval from the Engineer. All existing signs and supports that are to be removed shall be stored and protected if this material will be required later in the work.

Interim guide, warning, or regulatory signs required to direct traffic shall be furnished, installed, reused, and maintained by the Contractor in accordance with the **MUTCD**. The bottom of all interim signs shall be mounted at least seven (7 ft.) feet above the level of the pavement edge when the signs are used for long-term stationary operations as defined by Section 6G.02 of the **MUTCD**.

Existing guide and exit directional signs on the Project shall be maintained until conditions require a change in location or legend content. When change is required, the signs shall be in accordance with the Traffic Control Plan. When an existing guide and exit directional signs sign is in conflict with work to be performed, the Contractor shall remove the conflicting sign and reset it in a new, non-conflicting location that has been approved by the engineer.

When it is not possible to utilize existing signs, either in place or relocated, the Contractor shall furnish, erect, maintain, modify, relocate, and remove new interim guide and exit directional signs in accordance with the Plans or as directed by the engineer.

The installation of new permanent guide and exit directional signs and the permanent modification or resetting of existing guide and exit directional signs, when included in the contract, shall be accomplished as soon as practical to minimize the use of interim guide and exit directional signs.

**Worker Visibility and Safety.** All workers within the right-of-way of a project who are exposed to either vehicular traffic or to construction equipment in the work area shall wear high-visibility safety apparel. High-visibility apparel shall be considered personal protective clothing that meets performance Class 2 or Class 3 of the ANSI/ISEA 107-2004 publication. Class 3 apparel shall be required for night work.

**Portable Barrier Rail.** All portable barrier rail will be placed as far away from the travel lanes as possible while serving the intended purpose. All portable barrier rail will be moved or removed as directed by the engineer. There shall be no additional payment for removing barrier that is no longer required.

**Lane Closures.** The length of a lane closure should be held to the minimum length required to accomplish the Work. The advanced warning signs for the project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

Drums shall be used in all transition tapers for lane closures on multi-lane roads

**Night Work Lighting.** When night work is required by Contract documents or plans, the Contractor shall supply sufficient lighting according to the following Specification.

The following information regarding the lighting plan must be submitted to the project supervisor:

- Descriptions and sketches of the layout of lighting devices including spacing, luminary height, lateral placement and anticipated illuminance provided.
- Photometric & physical specifications of all lighting equipment.
- Detailed description of all lighting to be used on construction equipment.
- Methods to be employed to reduce glare.
- Contractor’s frequency and procedure for checking illumination levels.

In addition to their standard protective equipment, the following information regarding construction personnel and equipment shall be followed as a minimum:

1. Traffic Control Persons, all equipment operators and all other workers shall wear high-visibility apparel that meets performance Class 2 or Class 3 of the ANSI/ISEA 107-2004 publication. Class 3 apparel shall be required for night work.
2. They shall also have a minimum of 12 $in^2$ of reflective material added to their hard hats which is visible from all sides.
3. Traffic Control Persons must also be equipped with a flashlight complete with semi -transparent red cone.
4. All traffic control persons shall be equipped with radios or cell phones so that they have communication with each other.
5. All workers shall receive specific training on night work operations.
6. All vehicles in the work area must operate rotating or flashing incandescent amber lights visible in 360 degrees around the vehicle.
7. All work vehicles including trucks must have red and white reflective tape applied to all sides such that it defines the outline of the vehicle.

The following equipment will be outfitted with non glare balloon style lights or equivalent. The lights will be required on each piece of equipment in operation.

| **Equipment Type** | **Illuminance Requirement** |
|---|---|
| Paver, Milling Machine, Material Transfer Devices | 1- 4000 watt assembly or 2 - 2000 watts assemblies |
| Grader, Roller, Rumble Strip Machine, Shoulder Machine | 1 – 400 watt assembly |
| Paint truck | 1- 400 watt assembly or nonglare 300 watt floodlight assembly |
| Guardrail driver, stationary Operation | 1- 4000 watt assembly or 2 - 2000 watts assemblies or equipment light plant |
| Trail Vehicle | 1-4000 watt assembly or 2 - 2000 watts assemblies |

(A trail vehicle will be required to follow the last piece of equipment in a mobile operation(i.e. finish roller, pavement marking, etc.) depicting the beginning of the working area. In addition, portable lighting of at least 400 watts shall be available for the density testing inspector. The illuminance requirement for other vehicles not listed will be determined by the Engineer. A 400 watt metal halide lamp or equal approved by the Engineer may be substituted for a 2000 or 400 watt balloon light assembly.)

All luminaries shall be located and directed in such a way to minimize glare to both motorists and work vehicles. If glare is noted from any travel path, the contractor must adjust the lighting to reduce the glare to an acceptable level to the satisfaction of the Engineer.

The contractor shall replace non-functioning lamps immediately. The luminary aiming shall be checked daily. The luminaries shall be cleaned regularly.

**Specification Compliance**. The Contractor will be notified for failure to comply with this specification or plans. The safe passage of pedestrians and traffic through and around the temporary traffic control zone, while minimizing confusion and disruption to traffic flow, shall have priority over all other Contractor activities. Continued failure of the Contractor to comply

with the requirements of the Traffic Control Standard Specification or Special Provisions will result in non-refundable deductions of monies from the Contract for non-performance of Work that the deficiency is allowed to remain, not as penalty, but as liquidated damages.

Failure of the Contractor to comply with this Specification or take immediate correction actions required within forty-eight (48) hours of written notice shall be reason for the engineer suspending all other work on the Project, except erosion prevention and sediment control and traffic control, applying non-refundable deductions of monies from the Contract at a rate of twenty-five hundred dollars ($2,500) per calendar day per notice and/or withholding payment of monies due to the Contractor for any work on the Project until traffic control deficiencies are corrected. These other actions shall be in addition to the deductions for non-performance of traffic control.

**Subsection 712.05**: Remove entire subsection text and replace with the following:

**Pavement Marking Removal.** Conflicting pavement markings must be removed to prevent confusion to vehicle operators. Pavement marking removal shall be accomplished by the Contractor in a manner acceptable to the Engineer.

Final surface pavement markings shall be removed by sand blasting, water blasting, or acceptable grinding methods that will cause the least possible damage to the pavement. Intermediate surface pavement markings shall be removed by sand blasting or water blasting, or other approved methods that will cause the least possible damage to the pavement. The following methods listed below are considered as acceptable for intermediate surface pavement markings: Sand blasting using air or water, High pressure water, steam or superheated water, or Mechanical devices such as grinders, sanders, scrapers, scarifiers, and wire brushes.

The Contractor at his expense shall repair any damage to the pavement or surface caused by pavement marking removal by methods and materials acceptable to the engineer. The end result of the removal shall not cause a condition that appears to be a line that conflicts with the current markings.

Traffic shifts that are done on the final surface shall be accomplished using interim traffic marking tape unless otherwise specified in the plans.

Removal of an existing pavement marking by painting over with black paint or asphalt will not be an acceptable method.

When the method of removal causes sand or other material to be accumulated on the pavement, the residue shall be removed as the work progresses.

**Subsection 712-07 Maintenance. Revise** entire subsection to the following**:**

**712.07-Maintenance.** The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all signs, barricades, temporary impact attenuators and all other traffic control devices to meet the “acceptable” category as described in *Quality Guidelines for Temporary Traffic control Devices and Features* published by ATSSA. Such maintenance will be considered a part of the original installation cost. Failure to maintain all traffic control devices in such a manner as to provide continuous safety to the public will be cause for suspension of construction operations until proper traffic control is re-established.

**Subsection 712.09:** Insert the following after the sixth paragraph condition (2).

Additional relocations of barrier rail that will be relocated due to safety of work zone or traffic, as established in the traffic control plans or as directed by the engineer laterally up to 10 ft., shall be paid at ten percent (10%) of the interconnected portable barrier bid amount unless a separate item is in the proposal.

**Subsection 712.10:** Delete the first paragraph and replace with the following

The lump sum payment for Traffic Control shall include Temporary Workzone Lighting and all equipment, labor, materials and shall included full compensation for furnishing flaggers, traffic cones and removing conflicting and incorrect pavement markings, as required, until project completion.

**Subsection 712.10**: Insert the following after the second paragraph

Payment for Portable Energy Absorbing Terminals will be made at the contract price per Portable Energy Absorbing terminal, complete in place, with total payment based on the maximum number of portable energy absorbing terminals in place at one time as specified in **Subsection 712.09**.

**Subsection 714.02 Revise** entire subsection to the following:

**714.02-Materials and Submittal Data Requirements.** Materials used in this construction shall conform to the requirements of **Section 917** and to the following Sections or Subsections, unless otherwise stipulated:

| **Section or Material** | **Subsection** |
|---|---|
| **Gray Iron Castings** | **908.07** |
| **Portland Cement Concrete, Class** | **604** |
| **Steel Bar Reinforcement for Concrete Structures** | **907.01** |
| **Welded Steel Wire Fabric** | **907.03** |
| **Crushed Stone Grading D** | **903.05** |
| **Cement Concrete Curing Materials** | **913** |
| **Aluminum Paint** | **910.04** |
| **Conduit** | **917.05 or 917.07** |

Within 30 days after the issuance of the work order, the Contractor shall submit to the Engineer, four (4) collated sets of the manufacturer's descriptive literature and technical data which fully describes the types of lighting equipment he proposes to use. Descriptive literature shall include the manufacturer, models, etc. and be adequate to determine if the equipment or material meets the requirements of the Plans and these specifications. These sets of submittal data shall include a list of the materials submitted along with descriptive material for, but not limited to, the following items when applicable:

1. Complete photometric data of luminaires as published by the manufacturer with independent testing laboratory results.
2. Computer printouts showing illumination levels throughout each interchange area where high mast luminaires are to be installed.
3. General details of light standards, breakaway bases and bracket arms.
4. Highmast tower details with a set of design computation for each height including access hole, base, anchorage, head frame, and lowering device. Details are to include specification references for materials and location, type, size and extent of welds.
5. Dimension sheets and performance data on all related equipment.

The Engineer shall retain one copy and forward one copy to the Regional Materials and Test Division, one copy to the local entity (city or county engineer), and one copy to the Design Division for their review.

The submittal sets shall also include detailed scale drawings of any non-standard or special equipment and of any proposed deviation from the Plans. Any deviation from plans or specifications shall require approval from the Design Division. A letter requesting deviations or alternate materials must be included in the submittal for Design Devision approval. If requested to do so, the Contractor shall submit for approval sample articles of any materials proposed for use. The Department will not be liable for any materials purchased, labor performed, or delay to the work prior to such approval.

In addition to the above, each submittal shall include a notarized letter certifying that all lighting system materials listed in the submittal are in conformance with the Plans and Specifications. The Contractor shall also submit to the Engineer a statement from the Maintaining Agency that the system is acceptable to the Agency.

**Subsection 716.02 Delete "Adhesive 918.26"** from the table.

**Subsection 716.03 Revise** entire subsection to the following:

**716.03-Thermoplastic Pavement Marking.**

(a) General.

The material shall be applied to the pavement by the screed extrusion method or the ribbon dispenser method. The screed extrusion device shall have one side of the shaping die open with the other 3 sides being contained by, or being part of, suitable equipment for heating and controlling the flow of material. Ribbon dispensers shall be heated, suspended above the road surface, and shall apply the material to the width and thickness specified.

The equipment shall be constructed to provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the shaping die shall be so constructed as to prevent accumulation and clogging. All parts of the equipment which come in contact with the material shall be so constructed as to be easily accessible for cleaning and maintenance. The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die, maintain the material at the plastic temperature with heat transfer oil or electrical element controlled heat. Direct fire heat transfer will not be allowed.

The equipment shall be so constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide a method of applying "skip" lines. The use of pans, aprons, or similar appliances which the die overruns will not be permitted under this Specification. The equipment shall be calibrated, and checked periodically by marking over a metal plate. The equipment will be so constructed as to provide for varying widths to produce varying widths of traffic markings.

Glass spheres applied to the surface of the completed stripe shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instantaneously upon the installed line. The glass sphere dispenser shall be capable of applying glass spheres to the surface of the completed stripe by a double drop application for initial traffic striping and marking. The bead dispenser for the first

bead drop shall be attached to the striping machine in such a manner that the beads are dispensed closely behind with the thermoplastic material. The second bead dispenser bead shall be attached to the striping machine in such a manner that the beads are dispensed immediately after the first bead drop application. Glass spheres dispensers shall be equipped with an automatic cut-off control that is synchronized with the cut-off of the thermoplastic material and applies the glass spheres in a manner such that the spheres appear uniform on the entire traffic stripes and markings surface with, 50 to 60% embedment.

Special kettle(s) shall be provided for melting and heating the thermoplastic material. The kettle(s) must be equipped with automatic thermostatic control devices so that heating can be done by controlled heat transfer rather than by direct flame, so as to provide positive temperature control and prevent over-heating of the material.

Applicators shall be mobile and maneuverable to the extent the straight line can be followed and normal curves can be made in a true arc.

The applicator equipment to be used on roadway installations shall consist of either hand equipment or truck mounted units depending on the type of marking required.

The hand equipment shall have sufficient capacity to hold 150 lbs (70 kgs) of molten material and shall be sufficiently maneuverable to install crosswalks, lane, edge, and center lines, arrows and legends. The truck mounted unit for lane, edge and center lines shall consist of a mobile self contained unit carrying its own material capable of operating at a minimum speed of 5 mph (8 kph) continuously during an 8 hour period while installing striping.

Hand equipment used for stop bars, cross walks, legends, directional arrows and other specialty markings shall use the same thermoplastic formulation as described above with the exception of placing the marking at a minimum thickness of 0.090 in. (3mm) and a single drop of AASHTO M-247-09, Type 1 bead at the rate of 8 to 10 pounds per 100 square feet {3.6 to 4.5 kg per 9.3 m2} of stripe.

As an alternate, the Contractor may apply preformed thermoplastic marking material for stop bars, cross walks, legends or directional arrows. The preformed thermoplastic material shall have a minimum thickness of 0.090 in. (3 mm) and fused to the pavement by the heat of a torch.

(b) Application.

The pavement temperature shall be a minimum of 50° F (10° C) and rising before application begins. Application shall be suspended at any time the pavement temperature falls below 50° F (10° C). All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the striping.

To insure optimum adhesion of thermoplastic applied on all Portland cement concrete pavements, the Contractor shall apply a binder-sealer material as recommended by the thermoplastic manufacturer. To insure optimum adhesion, the thermoplastic material shall be installed in a melted state at a temperature of 400 to 450° F (205 to 230° C). The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall bond itself to the old line in such a manner that no splitting or separation takes place.

Longitudinal lines shall be off-set at least 2 in. (50 mm) from longitudinal joints of Portland Cement Concrete pavements.

Unless specified on the plans, a minimum average film thickness of 0.100 in. (2.54 mm) for lane and edge lines shall be maintained on all markings. This is to be computed on the basis of the amount of material used each day. The film thickness shall be uniform in appearance throughout its application. The glass sphere top coating must be applied by means of a pressure type spray gun designed specifically for this purpose, and which will embed the spheres into the line surface to at least one-half their diameter.

Placement of Drop on Glass Beads AASHTO M-247-09, Type 1 and AASHTO M-247-09, Type 4 shall each be placed on the thermoplastic stripe at a rate of 8 to 10 pounds per 100 square feet {3.6 to 4.5 kg per 9.3 m2} of stripe.

The AASHTO M-247-09, Type 4 glass beads shall be placed immediately after the first bead drop application of AASHTO M-247-09, Type 1 beads.

"Regardless of the application methods and procedures, or pavement types, the Contractor will be responsible for replacing any and all pavement markings that fail to comply with these specifications or fail to adhere to the pavement for one year after installation at the Contractor's own expense."

**Contractor's Responsibility for Notification.**

Notify the Engineer prior to the placement of the thermoplastic materials. Furnish the Engineer with the manufacturer's name and batch numbers of the thermoplastic materials and glass spheres to be used. Ensure that the approved batch numbers appear on the thermoplastic materials and glass spheres packages.

When thermoplastic is used on the final surface, the Contractor shall have the option of using reflectorized paint installed to permanent standards at the end of each day's work and then installing the permanent marking after the paving operation is completed. Short, unmarked sections will not be allowed.

**Protection of Newly Applied Traffic Stripes and Markings.**

Do not allow traffic onto or permit vehicles to cross newly applied pavement markings until they are sufficiently dry. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause, at no additional cost to the Department.

**Subsection 716.04 Replace the first paragraph with the following:**

**716.04-Raised Reflective Pavement Markers.** Markers shall be bonded to the pavement with an epoxy listed on the Departments QPL and approved by the marker manufacturer or a hot bituminous adhesive conforming to the requirements as described below. Markers manufactured with a self adhesive backing will not be allowed. Markers shall be spaced as shown on the plans but shall not be installed over joints in rigid type pavements.

**Subsection 716.06: Replace** with the following

The application of preformed plastic pavement markings shall be made on clean dry surfaces free of dirt and foreign matter. The pavement temperature shall be 60° F (15° C) or over. Should plastic require activators for the adhesive or various special coatings for different

pavement surfaces, the bidder shall include the cost of the activator or special coatings in the unit price of plastic bid upon.

The vendor will furnish with each package of reflectorized pavement marking materials complete instructions and/or specifications for the application of pavement marking materials to pavement surface. The reflectorized pavement marking materials are to be installed according to the vendor's specifications. Any adhesion used in the installation shall be as specified by the manufacturer. An adhesion-promoting primer shall be required when recommended by the pavement marking manufacturer.

Guides to mark the lateral location of pavement markings shall be established as shown on the plans or as directed by the Engineer. The Contractor shall establish the pavement marking guides and the Engineer will verify the location of the guides. Markings shall be placed in proper alignment with the guides. The deviation rate in alignment shall not exceed 1 inch per 200 feet of roadway. The maximum deviation shall not exceed 2 inches nor shall any deviation be abrupt.

Markings placed that are not in alignment or sequence, as shown on the plans or as stated in this specification, shall be removed and replaced by the Contractor at the Contractor's expense. Removal shall be in accordance with **Subsection 712.05,** Pavement Marking Removal. Guides placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway in the opinion of the Engineer.

When markings are specified in the contract for newly paved asphalt concrete surfaces, they shall be placed immediately after final rolling of the mat. A rubber tired roller cart with a minimum weight of 200 pounds or a truck operated at no more than 3 m.p.h. shall be used to assure proper adhesion when the markings are in place. Steel wheel rollers may not be used for this purpose.

Subsection 722.09Concrete Cylinder Storage. Revise entire subsection to the following:

**722.09 Concrete Cylinder Storage-**The Contractor shall provide a storage shed/building for temporary storage of concrete acceptance cylinders. The storage facility shall be of sufficient size and construction to protect the concrete cylinders from the elements and damage. The storage facility location shall be approved by the Engineer and access to the storage shed/building shall be under the control of Department personnel. The storage shed shall have a concrete curing box or water curing tank with a heating/circulating system of sufficient size to properly cure all acceptance cylinders before transferring for final storage and testing. The curing box or curing tank and heater/circulator shall comply with AASHTO M-201, and proper curing of the cylinders shall be in accordance with AASHTO T-23.

**SECTION 740-GEOTEXTILES. Revise** heading to the following:

**GEOTEXTILES AND GEOSYNTHETICS**

**Subsection 740.01-Description. Revise** subsection to include Geosynthetics as follows:

This work shall consist of the placement of Geotextiles and Geosynthetics in accordance with these Specifications and/or Standard Drawings, at the locations and in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

**Subsection 740.02-Materials. Revise** subsection to include Geosynthetics as follows:

Materials used in this construction shall meet the requirements of **Subsection 918.27** for the Type Geotextile or Geosynthetic called for in the plans.

The contractor shall furnish a certified laboratory test report from an approved testing laboratory with each shipment of materials. Laboratory test reports shall include the actual numerical test data obtained. All rolls shall be clearly labeled as being part of the same production run from which the test date was derived. Fabric shall be protected to prevent damage during transportation, storage, and installation. Geotextile and geosynthetic rolls shall be covered during storage to protect against UV degradation and shall be stored with rolls elevated up off of the ground. Fabric that is torn, punctured, or otherwise damaged shall not be installed.

**Subsection 740.03-General.** Revise subsection to include Geosynthetics as follows:

Geotextile and Geosynthetic fabric shall be placed as specified on the Plans for the specific application. The surface on which the Geotextile or Geosynthetic fabric is to be placed shall be compacted, as directed by the Engineer, and prepared as smooth as possible and free from debris, obstructions and depressions which could result in gaps, tears, or punctures in the fabric during cover operations. The Geotextile or Geosynthetic shall be installed in such a manner that placement of cover material will not excessively stretch nor tear the Geotextile or Geosynthetic. After fabric is placed, the initial lift of cover material shall be installed within five (5) calendar days. Under no circumstances shall any equipment operate directly on the Geotextile or Geosynthetic fabric. Cover material shall be placed such that at least the minimum initial lift thickness, as specified by the Engineer, is between the Geotextile or Geosynthetic and equipment tires or tracks at all times. Turning of equipment/vehicles shall not be allowed on the first lift above the Geotextile or Geosynthetic.

**Subsection 740.04-Method of Measurement. Revise** subsection to include Geosynthetics as follows:

Geotextiles or Geosynthetics of the type specified shall be measured by the $yd^2$ ($m^2$), complete in place. No measurement for payment will be made for overlaps, splices, sewing joints, etc.

**Subsection 740.05-Basis of Payment. Revise** subsection to include Geosynthetics as follows:

The accepted quantities of Geotextiles or Geosynthetics of the type specified, measured as provided for above, will be paid for at the contract unit price per $yd^2$.($m^2$) complete in place, which price shall be full compensation for labor, equipment, materials, tools and all incidentals necessary to complete the work. Fabric that is damaged during or after placement shall be replaced or repaired, as directed by the Engineer, at the expense of the Contractor.

**STATE OF TENNESSEE**

(Rev. 05-05-10) March 1, 2006

## Roadside Development

**803.02-Sod.** New sod shall consist of live, dense, well-rooted growth of permanent grasses, free from Johnson grass, nut-grass, and other undesirable grasses or weeds, well-suited for the intended purpose and for the soil in which it is to be planted. Installed sod which does not meet these requirements shall be corrected as directed by the Engineer at the Contractors expense.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 09-01-09)
(Rev. 02-06-10)
(Rev. 12-13-10)
(Rev. 02-13-12)
(Rev. 01-07-13)

March 1, 2006

**Supplemental Specifications - Section 900**

**of the**

**Standard Specifications for Road and Bridge Construction**

**March 1, 2006**

**Subsection 903.03 Coarse Aggregate for Concrete, Revise** the fourth paragraph to the following:

Coarse aggregate for prestressed concrete shall be Size No. 57 or Size No. 67, **Subsection 903.22,** as may be specified or directed. Coarse aggregates for precast concrete shall include any size fractions of **Subsection 903.22**, as may be specified or directed.

**Subsection 903.12 (b) - Replace** with the following:

**(b) Aggregate for Micro-Surface.** A minimum of 50% of ~~The~~ aggregate shall be crushed slag, crushed granite or crushed stone (crushed stone as specified for the types listed for Grading D in **Subsection 903.11(c)**) meeting the gradation limits below and the physical properties of ASTM D 692 except the percent of fractured pieces shall be 100. The aggregate shall have a minimum sand equivalent (AASHTO T 176) of 65. Blends of more than one aggregate source shall be mixed by means of pug mill only. Blending aggregates with a front end loader will not be permitted. The aggregate shall be proportioned to produce a uniform gradation meeting the following requirements:

**GRADATION LIMITS FOR AGGREGATE**
**BASED ON WASH GRADATION**

| Sieve | Design Master Range (Total Percent Passing) | Mixture Control Tolerances |
|---|---|---|
| 3/8 in.(9.5 mm) | 100 | |
| No. 4(4.75 mm) | 70-**98** | ±6.0 |
| No. 8(2.36 mm) | 45-70 | ±5.0 |
| No. 16(1.18 mm) | 28-50 | ±5.0 |
| No. 30(600 µm) | 19-34 | ±4.0 |
| No. 50(300 µm) | 12-25 | ±4.0 |
| No. 100(150 µm) | 7-18 | ±2.0 |

| | | |
|---|---|---|
| No. 200(75 µm) | 4-15 | ±2.0 |

**Subsection 904.03 Emulsified Asphalts. Replace** Entire subsection with the following:

**904.03 - Emulsified Asphalts**.

Emulsified asphalts shall meet the following test requirements:

| | Test Method | CAE-P | | CSS-1 | | CSS-1H | | SS-1H | | TST-1P | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | QC | Compliance | QC | Compliance | QC | Compliance | QC | Compliance | QC | Compliance |
| Saybolt-Furol Viscosity @ 77F, seconds | AASHTO T59 | 10-50 | 10-50 | 20-100 | 20-100 | 20-100 | 20-100 | 20-100 | 20-100 | 10-75 | 10-75 |
| Saybolt-Furol Viscosity @ 122F, seconds | AASHTO T59 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Storage Stability Test, 24-h, % | AASHTO T59 | n/a | 1 Max | n/a | 1 Max | n/a | 1 Max | n/a | 1 Max | n/a | n/a |
| 5-day Settlement, % | AASHTO T59 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Particle Charge | AASHTO T59 | n/a | Positive | n/a | Positive | n/a | Positive | n/a | n/a | n/a | n/a |
| Sieve Test, % | AASHTO T59 | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max | 0.1 Max |
| Residue by | AASHTO T59 | Distillation | Distillation | Distillation | Distillation | Distillation | Distillation | Distillation | Distillation | Distillation1 | Distillation1 |
| Residue, % | AASHTO T59 | n/a | n/a | 57 Min | 57 Min | 57 Min | 57 Min | 57 Min | 57 Min | 55-60 | 55-60 |
| Demulsibility, % | AASHTO T59 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Distillate, % | AASHTO T59 | 55 Max | 55 Max | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Oil Test, % | AASHTO T59 | n/a | 12.0 Max | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Stone Coating | AASHTO T59 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Cement Mix | AASHTO T59 | n/a | n/a | n/a | 2.0 Max | n/a | 2.0 Max | n/a | 2.0 Max | n/a | n/a |
| Float Test, seconds | AASHTO T50 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Solubility in Trichlorethylene, % | AASHTO T44 | 97.5 Min | n/a | 97.5 Min | n/a | 97.5 Min | n/a | 97.5 Min | n/a | 97.5 Min | n/a |
| Penetration | AASHTO T49 | n/a | 300 Min | n/a | 100-250 | n/a | 40-90 | n/a | 40-90 | n/a | 75-150 |
| Elastic Recovery, %3 | AASHTO T301 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 25 Min |
| Ductility @ 77F, cm | AASHTO T51 | n/a | 40 Min | n/a | 40 Min | n/a | 40 Min | n/a | 40 Min | n/a | n/a |
| Ductility @ 40F, cm | AASHTO T51 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 10-35 |
| R&B Softening Point, ˚F | AASHTO T53 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Original G*/sinδ @ 82°C | AASHTO T315 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | | | | | | | | | | | |
| 1 - Distill at 400°F | | | | | | | | | | | |
| 2 - Distill at 350°F | | | | | | | | | | | |
| 3 - Straight-sided mold, 20-cm elongation, 5 min hold, 25°C | | | | | | | | | | | |

Emulsified asphalts used on TDOT projects shall only be from Certified Emulsified Asphalt Suppliers that have an approved Quality Control Plan in accordance with TDOT Standard Operating Procedures.

All emulsified asphalts shall be homogeneous, and shall adhere firmly to the surface of the mineral aggregate. Failure of the emulsified asphalt to perform satisfactorily on the job shall be deemed cause for rejection, notwithstanding its ability to pass laboratory tests.

The test requirement for settlement may be waived when the emulsified asphalt (special tack coat excepted) is used in less than 5 days' time; or the Engineer may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.

The AE-3 shall be of such stability that it will remain constant and uniform while being mixed with dry or approximately dry aggregate, and shall thoroughly and uniformly coat the entire surface of each fragment while being manipulated and incorporated into the work. The emulsified asphalt after being incorporated into the work shall show no signs of re-emulsifying.

Solubility in trichloroethylene will be required for information only every 3 months in the supplier’s quality control program.

When approved by the Engineer, cationic emulsions may be substituted for anionic emulsions.

Latex, polymer, and other emulsifiers shall be styrene butadiene rubber (SBR) or natural latex, and shall be milled into the asphalt cement and shall show no separation after mixing. When modified emulsions are utilized in microsurface mixtures, the blended mixture when combined with aggregate and mineral filler shall have the following characteristics:

1. Be capable of filling up to 1/2 in.(13 mm) wheel ruts in one pass.
2. Be capable of field regulation of the setting time.
3. Be suitable for nighttime placement.

The latex shall be combined with the asphalt emulsion at the emulsion mill to produce a homogeneous mixture. Latex modified emulsions upon standing undisturbed for a period of 24 hours shall show no color striations, but shall be a uniform color throughout.

**Subsection 908.03-Permanent Steel Bridge Deck Forms; Delete** ASTM A446 and A525, and **Replace** with A653

**Subsection 908.03(C)** First paragraph. Change to read as follows:

All high strength bolts, nuts and washers shall be certified to have met the specified tests identified in their individual ASTM Specification designations, both as individual components, and as assemblies (Bolts, Nuts, and Washers).

**Subsection 908.07-Gray Iron Castings. Revise**entire subsection to the following:

**908.07-Gray Iron Castings.** All castings shall be of the type specified and shall be within reasonably close conformity with the dimensions shown on the Plans. The castings shall conform to AASHTO M105, with the additional requirements herein, and unless otherwise specified all castings shall be Class 30.

Test bars for tension testing shall be cast in accordance with AASHTO M 105, Table 2, Test Bar B.

All castings shall be cleaned of sand and scale by sand blasting or other effective methods so as to present a smooth, clean, and uniform surface.

Gray iron castings shall have the date of manufacture cast into each unit.

Manhole castings shall have the lid and lid seat of the rim machined to form a true bearing.

All castings shall weigh at least 95% of the theoretical weight shown on the Plans.

**Subsection 910.02-Revise entire Subsection to the following:**

**910.02-Quick Dry Traffic Marking Paint (White and Yellow).** These specifications cover quick dry white and yellow traffic paint, also referred to as pigmented binder, for use in marking traffic lanes or barrier lines on bituminous and concrete highways.

(a) General Requirements. The pigmented binder shall be properly formulated so as to be suitable for application by spray equipment when heated to 130°F(55°C) maximum and applied on bituminous or portland cement concrete pavements.

(b) Drop on Glass Beads. The glass beads drop-on type, shall meet the requirements of AASHTO M 247 Type I.

General: All beads used for Pavement Markings shall be clear, transparent, colorless glass, smooth and spherically shaped, free of milkiness, pits, or excessive air bubbles and conform to the following specific requirements.

Glass Beads shall not contain more than 200 ppm of lead, 200 ppm of antimony, or 200 ppm of arsenic. The contractor shall certify and ensure that all glass beads meet all federal requirements. The contractor shall provide certification that all glass beads contain no more than 200 parts per million of arsenic or lead as determined by a certified independent (third party) laboratory, in accordance with Environmental Protection Agency testing methods 3052, 6010B, or 6010C. The contractor shall provide an independent certified test report showing compliance with these requirements.

Silica content of the glass beads shall be no less than 60%.

Color and Clarity: Beads shall be colorless, clear and free from carbon residues.

Roundness: Minimum true spheres overall shall be 80% when tested in accordance with ASTM-D-1155, for larger beads use visual inspection.

Index of Refraction: Minimum of 1.50, when tested by the liquid emersion method @ 77°F

Air Inclusions: Maximum of 3% overall

(b) Paint.

Characteristic requirements.

1. Pigment content shall be between 58% and 65% by weight. Pigment for white paint shall contain 0.99 lbs/gal.(120 grams/l) of 94% titanium dioxide. Pigment for yellow paint shall be lead free and contain 0.22 lbs/gal.(26 grams/l) minimum of 94% titanium dioxide.
2. Total non-volatile shall not be less than 76% by weight.
3. Vehicle non-volatile shall not be less than 41% by weight. Vehicle shall be Rohm and Haas E-2706, DOW DT211NA or an approved equal.
4. Minimum weight shall not be less than 13.3 lbs./gal.(1,600 grams/l).
5. The paint viscosity shall be between 78 and 95 Kreb units when tested at 77±° F(25±1°C) in accordance with ASTM D 562.
6. Drying Time:
   FIELD -The paint shall dry to a no-tracking condition in 3 minutes when applied at 15 ±1 mil(380 ±25 μm.) wet film thickness with a bead application rate of 6 lbs./gal.(0.7 kgs/l) of

glass spheres per gallon(liter) of binder, when the pavement temperature is between 40 and 120° F(4 and 49 C°) and the relative humidity is not exceeding 80%. The pigmented binder shall be applied with specialized equipment so as to have the binder at a temperature of 100 to 130° F(35 to 55° C) at the spray gun. The no-tracking condition shall be determined by passing over the line as applied above in a simulated passing maneuver with a passenger car travelling 35 mph(56 kph.). A line showing no visual deposition when viewed from a distance of 50 ft.(15 m) shall be considered as conforming to this drying requirement.

LAB - The pigmented binder without glass spheres, shall dry to no-pick-up condition in 10 minutes or less when tested in accordance with ASTM D 711.

7. The paint shall meet the current EPA VOC requirements or 150 grams/l whichever is lower.
8. The ph of the paint shall be a minimum of 9.6.

Qualitative Requirements.

The finished paint shall meet the following quality requirements:

1. Condition in container: The paint received shall show no livering, skinning, mold growth, corrosion of the container, or hard settling of the pigment. Any settling shall be readily dispersed when stirred by hand with no persistent foaming.
2. Color: The color for white after drying shall be flat white, free from tint, furnishing good opacity and visibility under both daylight and artificial light. For yellow, the color shall closely match chip 33538 of Federal Standard 595B.
3. Flexibility: The paint shall show no cracking or flaking when tested on a ½ in.(13 mm) mandrel in accordance with Federal Specification TT-P-1952B.
4. Dry Opacity: The minimum contrast ratio shall be 0.95 when drawn with a 0.005 Bird Applicator.
5. Daylight Reflectance: The daylight directional reflectance of the white paint shall be not less than 85% and not less than 50% for yellow(relative to manganese oxide) when measured in accordance with Federal Test Method No. 1416.
6. Bleeding: The paint shall have a minimum bleeding ratio of 0.97 when tested in accordance with Federal Specification TT-P-1952B.
7. Scrub Resistance: The paint shall pass 300 cycles when tested in accordance with ASTM D 2484.
8. Freeze-Thaw Stability: The paint shall show no change in consistency greater than 10% when tested in accordance with Federal Specification TT-P-1952B.
9. Storage Stability: When stored at 77± °(25 ±2°C) in a 3/4- filled can for a period of 30 days, the paint shall be in a homogeneous state with no skinning, curdling, hard settling or caking that cannot be readily remixed.

(e) Inspection, Testing, Packaging, and Marking.

All paint furnished under this specification shall be proportioned in accordance with the characteristic requirements set forth herein. Compounding shall be from ingredients or component materials that have been found to conform with the detail specifications as set forth herein by reference or otherwise. After manufacture, a 0.5 pt.(l) sample along with certified

laboratory analysis for each batch shall be sent to the Division of Materials and Tests. A qt.(l) sample and a manufacturer's certification that the glass beads meet the requirements of ASSHTO M 247 for the type beads, shall be sent to the Division of Materials and Tests for each batch or lot of glass beads shipped for use on Tennessee projects.

Each shipment of paint and beads shall be accompanied by a detailed analysis for that particular batch and certification that all ingredients meet the requirements set forth in this specification.

The Department reserves the right to perform in-plant sampling of ingredients and finished product during manufacturing operations and to sample the packaged product when it is received by the Department. Acceptance of the product may be withheld until analysis of samples has been completed.

All paint shall be shipped in new containers that can be properly sealed.

All containers shall be plainly marked or labeled to show the following information: Description of paint, color, net gal.(liters), name of manufacturer, batch number and date of manufacture(month and year).

**Subsection 914.09 Polyvinyl Chloride Pipe (PVC). Revise** entire subsection to the following:

**914.09-Polyvinyl Chloride Pipe(PVC) .** Pressurized pipe accepted under this Specification shall conform to the requirements of ASTM D 1785. Pipe Culverts accepted under this Specification shall conform to the requirements of ASTM D 1784.

**Subsection 914.10-High Density Polyethylene Plastic Pipe. Revsie** entire subsection to the following:

**914.10, High Density Polyethylene Plastic Pipe.** Pipe Culverts accepted under this specification shall conform to the requirements of AASHTO M 294, Type S. Slope Drains accepted under this specification shall conform to the requirements of AASHTO M 294, Type C or Type S.

**Subsection 916.02 (a)** Aluminum flat Sheet; **Revise** as shown below:

(a). Aluminum flat sheet (sign blanks) and plates (permanent and temporary) shall meet ASTM B 209, Alloy 6061 T6 or 5052-H38. Recycled aluminum flat sheet (sign blanks) meeting ASTM B209, Alloy 6061 T6, or 5052-H38 may be used for temporary signing only. Composite material sign blanks (temporary signing only) shall be selected from the Department's QPL. The sign blanks shall be flat and shall contain no visible lateral bow.

**Subsection 918.08: Replace entire section,** with the following:

**918.08-Preformed plastic pavement Marking Materials.** The marking material shall be prefabricated plastic consisting of white or yellow pigmented plastic with reflective glass spheres uniformly distributed throughout the entire cross sectional area and shall be capable of being affixed to bituminous or Portland cement concrete pavement by either a pressure sensitive pre-coated adhesive or liquid contact cement. The material shall be provided complete in a form that will facilitate rapid application and protection during shipment and storage. Solvents, adhesives and necessary equipment for proper application for life shall be in accordance with manufacturer's instructions. The material shall be manufactured and packaged in such a manner to permit storage at normal shelf temperatures for periods of up to one year after purchase. Contact cements, where used, shall have a shelf life of 6 months. The

material shall mold itself to pavement contours, breaks, faults, and the like by action of traffic at normal pavement temperatures. The material shall have resealing characteristics so that it will fuse with itself and with previously applied marking materials of the same composition under normal conditions of use.

Prefabricated legends and symbols must conform to the applicable shapes and sizes as outlined in the Manual on Uniform Traffic Control Devices for Streets and Highways. These pavement markings shall be on the Department's QPL.

**Materials:** The marking material shall be a 60 mil (1.50 mm) retroreflective pliant polymer conforming to the following requirements. The retroreflective pliant polymer pavement marking film shall consist of a mixture of high quality polymeric materials and pigments with 1.50 minimum refractive index glass spheres uniformly distributed throughout its cross sectional area, and with a reflective layer of beads bonded to the top surface. Composition shall be as follows:

| Material | Min. % by Weight |
|---|---|
| Resins & Plasticizers | 20 |
| Pigments | 30 |
| Graded Glass Beads | 33 |

This material shall be capable of adhering to asphaltic or Portland cement concrete, by means of a pressure sensitive, pre-coated adhesive, or by a liquid contact cement applied at the time of installation.

**Tensile Strength.** The film shall have a minimum tensile strength of 40 psi (275 kPa) of cross section when tested according to ASTM D 638. A sample 6 x 1 x 0.06 in.(150 x 25 x 1.5 mm) shall be tested at a temperature between 70° and 80° F(21 to 27° C) using a jaw speed of ¼ in.(6 mm) per minute.

**Elongation.** The film shall have a minimum elongation of 75% when tested according to ASTM D 638.

**Plastic Pull Test.** A test specimen made the same size as described under "Tensile Strength" above shall support a dead weight of 4 lbs. (1.8 kgs.) for not less than 5 minutes at a temperature between 70 and 80° F (21 to 27° C).

**Pigmentation.** The pigments shall be selected and blended to provide a marking film that is white or yellow conforming to standard highway colors through the expected life of the film.

**Pigments.** Sufficient titanium dioxide pigment meeting Federal Specification TT-P-442 shall be used in white markings to insure a dense opaque marking. Pigments shall include titanium dioxide for white plastic and C. P. medium chrome yellow for yellow plastic.

Sufficient medium chrome yellow pigment meeting Federal Specification TT-P-346b, Type 111, shall be used to insure a durable finished color that complies with

Highway Yellow Color Tolerance Chart and matches Chip 33538 of Federal Standard 595. The yellow plastic shall have a minimum of 18% pigment as chrome yellow.

**Glass Beads**. The glass beads shall be, colorless and have a minimum index of refraction of 1.50 when tested using the liquid oil immersion method. The size and quality of the beads will be such that performance requirements for the retroreflective pliant polymer film shall be met.

Glass beads shall not contain more than 200 ppm of lead, 200 ppm of antimony, or 200 ppm of arsenic. The contractor shall certify and ensure that all glass beads meet all federal requirements. The contractor shall provide certification that all glass beads contain no more than 200 parts per million of arsenic or lead as determined by a certified independent (third party) laboratory, in accordance with Environmental Protection Agency testing methods 3052, 6010B, or 6010C. The contractor shall provide an independent certified test report showing compliance with these requirements.

The film shall have a glass bead retention quality such that when a 2 x 6 in. (50 x 150 mm) sample is bent over a 1/2 in. (13 mm) diameter mandrel, with the 2 in. (50 mm) dimension perpendicular to the mandrel axis, microscopic examination of the area on the mandrel shall show no more than 10% of the beads with entrapment by the binder of less than 40%.

**Skid Resistance.** The surface of the retroreflective pliant polymer shall provide a minimum skid resistance value of 35 BPN when tested according to ASTM E 303.

Color: ***The color of the*** *white* ***thermoplastic material shall be pure white and conform to Federal standard 595-17778. The color of the*** *yellow* ***thermoplastic material shall conform to Federal Standard 595-33538 and meet the following chromaticity specifications.***

**X** and **Y** coordinates shall fall in an area bordered by these coordinates:

| | | | | |
|---|---|---|---|---|
| X | **0.470** | **0.510** | **0.490** | **0.537** |
| **Y** | 0.455 | 0.489 | 0.432 | 0.462 |

**Reflectance.** The white and yellow markings shall have the following minimum initial retroreflectance values as measured in accordance with the testing procedures of ASTM D 4061. The photometric quantity to be measured shall be specific luminance (SL) and shall be expressed as millicandelas per square foot per footcandle.

| | **White** | | **Yellow** | |
|---|---|---|---|---|
| **Entrance Angle** | 86.0 | 86.5 | 86.0 | 86.5 |
| **Observation Angle** | 0.2 | 1.0 | 0.2 | 1.0 |
| **Specific Luminance** | 500 | 300 | 400 | 175 |

**Thickness.** The retroreflective pliant polymer film without adhesive shall be supplied in a standard thickness of 60 mils (1.5 mm).

**Performance.** The retroreflective pliant polymer, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The pliant polymer shall provide a cushioned resilient substrate that reduces bead crushing and loss. The film shall be weather resistant, and through normal traffic wear shall show no appreciable fading, lifting or shrinkage throughout the useful life of the marking. It shall also show no significant tearing, roll back or other signs of poor adhesion.

**Subsection 918.09 B 3 Chemical Additives, Add** the following as **Subsection B-3:**

3 Warm Mix Asphalt (WMA) additives. Organic wax or foaming additives may be added to bituminous plant mix to reduce placement temperatures in accordance with subsection 407.11. WMA additives should be introduced into the mixture at a constant rate satisfactory to produce mix temperatures as per subsection 407.11. If the proportions of the additive change during the course of mix production, these changes shall be noted and recorded. The manner in which the additive is introduced into the mixture shall be approved by the Department. The Department will maintain a list of qualified WMA additives. No product shall be used unless it appears on this list.

**Subsection 918.18-Mulch Material, Add** the following as the last sentence:

"An approved tackifier from the QPL shall be used to hold mulch in place."

**Subsection 918.23; Remove and Replace** entire subsection with the following:

**918.23- Thermoplastic Pavement Marking Material.** This material shall conform to AASHTO M-249 with the following changes. The material requirements are as follows.

**Composition:** The retroreflective pavement marking material shall be an Alkyd / Maleic based thermoplastic material consisting of homogeneously mixed pigments, filler, resins and glass beads. The pigment, beads, and filler shall be uniformly dispersed in the resin. The material shall be manufactured from virgin material using no reprocessed components.
The material shall be free from all skins, dirt, and foreign objects and shall comply with requirements from the following table.

**TABLE 1**

| Component | White | Yellow |
|---|---|---|
| % Binder Content | 19.0 min | 19.0 min |
| % $TiO_2$ Pigment, | 10.0 min | N/A |
| % Intermix Glass Beads | 35 min | 35 min |
| % Calcium Carbonate \ Fillers | 36 max* | 46 max* |

*The amount of Calcium Carbonate and inert fillers shall be as opted by the manufacturer, providing all other specifications are met.

The Titanium Dioxide shall be Rutile Type II in accordance with ASTM D 476 with a minimum purity of 93%.

Use white thermoplastic which does not contain anatase titanium dioxide pigment.

The total silica content used in the formulation of the thermoplastic shall be the premixed beads. Uniformly disperse the pigment, beads and filler in the binder.

The Alkyd / Maleic binder shall consist of a mixture of synthetic resins and high boiling point plasticizers one of, which shall be solid at room temperature. At least one-half of the binder composition shall be 100% Maleic modified glycerol ester of resin and shall be no less than 15% of the entire material formulation. The binder shall contain no petroleum, hydrocarbon resins, tall oil resins or rosins.

The thermoplastic material shall be free of contaminates and shall be dry blended or hot mixed from 100% virgin stock using no reprocessed materials.

The Thermoplastic material shall be formulated such that when it is on the roadway surface at any natural temperature it exists in a hard, solid state with cold ductility that permits normal movement with the road surface without chipping, or cracking.

The thermoplastic shall not deteriorate or discolor when held at the application temperature for periods of time up to 4 hours or upon repeated reheating (a minimum of 4 times).

The color, viscosity, and chemical properties versus temperature characteristics of the thermoplastic material shall remain constant for up to 4 hours at the application temperature and shall be the same from batch to batch.

The thermoplastic material shall be readily applicable at temperatures between 400°F and 440°F from the approved equipment to produce lines and symbols of the specified thickness above the pavement surface.

**Physical Requirements: After 4 hours @ 425°F**

The thermoplastic material after heating for 4 hours ± 5 minutes at 218 ± 2°C (425 ± 3°F) and cooled to 25 ± 2°C (77 ± 3°F) shall meet the physical requirements set forth in AASHTO M-249 with the following changes.

The material shall be tested in accordance with AASHTO T-250 and or with the appropriate method in Federal Test Method Standard #141 or ASTM Designation.

**Safety** – No toxic fumes.

**Bond Strength** – (ASTM-D4796), 180 p.s.i. min.

**Specific Gravity –** Not to exceed 2.30

**Yellowness Index –** The white thermoplastic shall not exceed a yellowness index of 0.15.

**Glass Beads**

**General:** All beads used for Thermoplastic Pavement Markings shall be clear, transparent, colorless glass, smooth and spherically shaped, free of milkiness, pits, or excessive air bubbles and conform to the following specific requirements.

Glass Beads shall not contain more than 200 ppm of lead, 200 ppm of antimony, or 200 ppm of arsenic. The contractor shall certify and ensure that all glass beads meet all federal requirements. The contractor shall provide certification that all glass beads contain no more than 200 parts per million of arsenic or lead as determined by a certified independent (third party) laboratory, in accordance with Environmental Protection Agency testing methods 3052, 6010B, or 6010C. The contractor shall provide an independent certified test report showing compliance with these requirements.

Silica content of the glass beads shall be no less than 60%.

Color and Clarity: Beads shall be colorless, clear and free from carbon residues.

Roundness: Minimum true spheres overall shall be 80% when tested in accordance with ASTM-D-1155, for larger beads use visual inspection.

Index of Refraction: Minimum of 1.50, when tested by the liquid emersion method @ 77°F

Air Inclusions: Maximum of 3% overall

**Intermix Glass Beads**

Glass Beads used for intermix shall be premixed into the thermoplastic mixture and shall consist of 35% of the overall thermoplastic formulation. Intermix beads shall be uncoated and defined by two distinct gradations and meet the following requirements.

Type 1 Intermix glass beads shall comprise 50% minimum of the 35% of the overall thermoplastic formulation ( Intermix Glass Beads ) and shall conform to AASHTO M-247-09, Type 1 with the exception of minimum true spheres overall shall be 80% as stated above, when tested in accordance with ASTM D-1155.

Type 3 Intermix glass beads shall comprise 50% minimum of 35% of the overall thermoplastic formulation ( Intermix Glass Beads ) and shall conform to AASHTO M-247-09, Type 3 with the exception of minimum true spheres overall shall be 80% as stated above, when tested in accordance with ASTM D-1155.

**Specification for Double Drop System**

The double drop system shall be capable of applying glass beads at the specified application rates. Beads shall be applied across the entire line width assuring uniform application and embedment of the beads to 50 to 60% of the bead diameter.

Type 1 drop on beads shall be dual coated for moisture resistance and adhesion , Also meet the requirements of AASHTO M-247-09 Type 1 with the exception that the beads shall be 80% round overall.

Type 4 drop on beads shall be dual coated for moisture resistance and adhesion , Also shall meet the requirements of AASHTO M-247-09 Type 4 with the exception that the beads shall be 80% round overall.

**918.26-Raised Reflective Pavement Markers with Adhesive. Remove** "**with Adhesive**" from the subsection title.

**Subsection 918.27-Geotextile. Add** "and Geosynthetics" to subsection title. **Replace** entire subsection with the following:

Geotextile and Geosynthetic materials and their types shall be on the Departments Qualified Products List. Geotextile and Geosynthetic material used shall meet the material requirements of the Standard Drawing.

The contractor shall furnish a certified laboratory test report from an approved testing laboratory and a certified letter stating the product is the same as on the Department's Qualified Products List with each shipment of materials. Laboratory test reports shall include the actual numerical test data obtained. All rolls shall be clearly labeled as being part of the same production run from which the test date was derived. Fabric shall be protected to prevent damage during transportation, storage, and installation. Geotextile and Geosynthetic rolls shall be covered during storage to protect against UV degradation and shall be stored with rolls elevated up off of the ground. Fabric that is torn, punctured, or otherwise damaged shall not be installed.

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006

# SPECIAL PROVISION

# REGARDING

# UNBALANCED BIDS

The Department will review all unit prices submitted by the apparently lowest responsible bidder and will decide whether any of the unit prices are excessively above or below a reasonable cost analysis value determined by the Engineer.

In the event any unit prices are determined to be unbalanced and contrary to the interest of the Department, the right is reserved to reject such bid at the discretion of the Department or to award the Contract and limit progress payments on units of work performed on any excessively priced items to costs that are satisfactorily documented by the Contractor plus 20 percent, until 85 percent of the Contract has been completed. Upon completion of 85 percent of the Contract, the Contractor will be reimbursed in accordance with **Subsection 109.06** of the Standard Specifications for the accepted quantities of work performed on the excessively priced items.

**S T A T E** **OF** **T E N N E S S E E**

October 1, 2006

REV: February 5, 2007

## SPECIAL PROVISION

## REGARDING

## EMPLOYING AND CONTRACTING WITH ILLEGAL IMMIGRANTS

The State shall endeavor to do business only with those contractors and subcontractors that are in compliance with the Federal Immigration and Nationality Act. This policy shall apply to all State Contractors including subcontractors. This policy statement is issued to establish implementation guidance to procuring state agencies and contractors reflecting the requirements of Governor's Executive Order #41, An Order Regarding Compliance with Federal and State Laws Related to Employing and Contracting with Illegal Immigrants, and the requirements of Public Acts of 2006, Chapter Number 878 of the State of Tennessee (codified at *Tennessee Code Annotated*, Title 12, Chapter 4, Part 1).

1. The Contractor hereby attests, certifies, warrants, and assures that the Contractor shall not knowingly utilize the services of an illegal immigrant in the performance of this Contract and shall not knowingly utilize the services of any subcontractor who will utilize the services of an illegal immigrant in the performance of this Contract. The Contractor shall reaffirm this attestation, in writing, by submitting to the State a completed and signed copy of the "Attestation form" provided by the Department, semi-annually during the period of this Contract.

2. Prior to the use of any subcontractor in the performance of this Contract, and semi-annually thereafter, during the period of this Contract, the Contractor shall obtain and retain a current, written attestation that the subcontractor shall not knowingly utilize the services of an illegal immigrant to perform work relative to this Contract and shall not knowingly utilize the services of any subcontractor who will utilize the services of an illegal immigrant to perform work relative to this Contract.

3. The Contractor shall maintain records for its employees used in the performance of this Contract. Said records shall include a completed federal Department of Homeland Security Form I-9, *Employment Eligibility Verification*, for each employee and shall be subject to review and random inspection at any reasonable time upon reasonable notice by the State.

4. The Contractor understands and agrees that failure to comply with this section will be subject to the sanctions of Public Chapter 878 of 2006 for acts or omissions occurring after its effective date. This law requires the Commissioner of Finance and Administration to prohibit a contractor from contracting with, or submitting an offer, proposal, or bid to contract with the State of Tennessee to supply goods or services for a period of one year after a contractor is discovered to have knowingly used the services of illegal immigrants during the performance of this contract.

For the Purposes of this policy, “illegal immigrant” shall be defined as a non-citizen who has entered the United State of America without federal government permission or stayed in this country beyond the period allowed by a federal government-issued visa authorizing the non-citizen to enter the country for specific purposes and a particular time period.

Compliance and non-compliance procedures will be as specified in the Tennessee Department of Finance and Administration’s Policy on “Ensuring Compliance with Federal Immigration Laws by State Contractors and Subcontractors”.

**S T A T E** **O F** **T E N N E S S E E**

(Revised 02-25-05) March 1, 2006(Revised 10-19-12)

## SPECIAL PROVISION

## REGARDING

## SECTION 105 – CONTROL OF WORK

## CRITICAL PATH METHOD (CPM) SCHEDULE

The Contractor shall develop a schedule of activities for this project, in accordance with Subsection 105.06 of the Standard Specifications and to achieve the required completion date as specified in the contract, using the Critical Path Method (CPM). The CPM schedule shall be provided to the Engineer at the pre-construction conference.

Once the work begins, the Contractor shall furnish the Engineer with an updated schedule at 30-day intervals thereafter for the duration of the project. Cost of developing and maintaining this schedule shall be included in the cost of other items of construction.

If the Contractor fails to deliver an updated schedule as required, the Engineer may withhold payment of estimated earnings until the updated schedule is received.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 6-19-95)
(Rev. 6-1-04)
(Rev. 06-20-2011)

March 1, 2006

# SPECIAL PROVISION

# REGARDING

# BUY AMERICA REQUIREMENTS

All manufacturing processes for iron and steel products, and coatings applied thereon, used in this project shall occur in the United States except that if the proposal has bid items for furnishing domestic and foreign iron and steel, the bidder will have the option of (1) submitting a bid for furnishing domestic iron and steel, or (2) submitting a bid for furnishing domestic iron and steel and a bid for furnishing foreign iron and steel. If option (2) is chosen the bid will be tabulated on the basis of (a) the total bid price using the bid price for furnishing domestic iron and steel and, (b) the total bid price using the bid price for furnishing foreign iron and steel.

For the total bid based on furnishing foreign iron and steel to be considered for award, the lowest total bid based on furnishing domestic iron and steel must exceed the lowest total bid based on furnishing foreign iron and steel by more than 25 percent. The 25 percent differential applies to the total bid for the entire project, not just the bid prices for the steel or iron products.

Iron and steel products are defined as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed from iron and steel made in the United States. Iron products are included, however, pig iron and processed, pelletized, and reduced iron ore may be purchased outside the United States.

Manufacturing begins with initial melting and continues through the coating stage. Any process which modifies chemical content, physical size or shape, or the final finish is considered a manufacturing process. Coatings include epoxy, galvanizing, painting or any other surface protection that enhances the value and/or durability of a material.

The contractor shall provide a certification to the Engineer with each shipment of iron and steel products to the project site that the manufacturing processes for the iron and steel products occurred in the United States. No steel shall be placed until the contractor ensures the requirements of this Special Provision are met.

The above requirements do not prevent a minimal use of foreign materials, if the cost of such materials used does not exceed 0.1 percent of the total contract cost or $2,500.00, whichever is greater. If steel not meeting the requirements of this Special Provision is used, the contractor

shall provide a written statement to the Department prior to its use indicating where the steel will be incorporated in the work, the value of the steel, the percentage of the contract amount, and the appropriate invoices shall be submitted as documentation.

The contractor shall be responsible for all cost associated with any steel that is permanently incorporated into the project that does not meet the requirements of this Special Provision without prior written approval from the Department, up to and including removal and replacement.

**STATE OF TENNESSEE**
**DEPARTMENT OF TRANSPORTATION**
**BUREAU OF ENGINEERING**
SUITE 700, JAMES K. POLK BUILDING
505 DEADERICK STREET
NASHVILLE, TENNESSEE 37243-1402
(615) 741-0791

JOHN C. SCHROER
COMMISSIONER

BILL HASLAM
GOVERNOR

# MEMORANDUM

**TO:** Regional Construction Supervisors
Regional Project Supervisors
Regional Materials and Tests
Headquarters Materials and Tests

**FROM:** Brian Egan, Construction Division Director

**DATE:** January 14, 2013

**SUBJECT:** **Buy America Requirements and SP106A**

---

Over the last few years we have placed a great deal of emphasis on assuring that all iron and steel products used on TDOT projects with federal funds meet the Buy America Requirements of SP106A. While the Federal Regulations have not changed (23 CFR 635.410), the Federal Highway Administration (FHWA) has issued the attached Memorandum (December 21, 2012 by Mr. John R. Baxter) to provide some "Clarification of Manufactured Products under Buy America".

Please note specifically the following three (3) excerpts in the Memorandum as you interpret and apply the requirements of SP106A:

1) *"Thus, in order for a manufactured product to be considered subject to Buy America, the product must be manufactured predominantly of steel or iron. The FHWA deems a product to be manufactured predominantly of steel or iron if the product consists of at least 90% steel or iron content when it is delivered to the job site for installation",* and,

2) *"Examples of products that are subject to Buy America coverage include, but are not limited to, the following:*

- *steel or iron products used in pavements, bridges, tunnels or other structures, which include, but are not limited to, the following: fabricated structural steel, reinforcing steel, piling, high strength bolts, anchor bolts, dowel bars, permanently incorporated sheet piling, bridge bearings, cable wire/strand, prestressing / post-tensioning wire, motor/machinery brakes and other equipment for moveable structures;*
- *guardrail, guardrail posts, end sections, terminals, cable guardrail;*

- *steel fencing material, fence posts;*
- *steel or iron pipe, conduit, grates, manhole covers, risers;*
- *mast arms, poles, standards, trusses, or supporting structural members for signs, luminaires, or traffic control systems; and*
- *steel or iron components of precast concrete products, such as reinforcing steel, wire mesh and pre-stressing or post-tensioning strands or cables.*", and,

3) "*The miscellaneous steel or iron components, subcomponents and hardware necessary to encase, assemble and construct the above components (or manufactured products that are not predominantly steel or iron) are not subject to Buy America coverage. Examples include, but are not limited to, cabinets, covers, shelves, clamps, fittings, sleeves, washers, bolts, nuts, screws, tie wire, spacers, chairs, lifting hooks, faucets, door hinges, etc.* "

Utilities are required to meet the requirements of Buy America.

Also, as allowable in SP106A, a small amount of foreign materials may be used in the project with prior approval and proper supporting documentation. The maximum amount of foreign materials, subject to meeting the Buy America Requirements, allowed is $2,500 or 0.1 percent (%) of the total contract amount (awarded contract amount), whichever is greater. The cost includes the total cost of iron and steel plus the cost of transportation to the project site, as evidenced by delivery receipt, but does not include labor costs involved in final assembly.

For additional information on the Buy America Requirements, please visit the following FHWA website:

http://www.fhwa.dot.gov/construction/cqit/buyam.cfm
http://www.fhwa.dot.gov/construction/contracts/buyam_qa.cfm

cc: Mr. Paul Degges
Mr. Greg Duncan
Mr. Gerald Varney, FHWA
Mr. Kent Starwalt, TRBA

U.S. Department of Transportation
Federal Highway Administration

# Memorandum

Subject: **ACTION**: Clarification of Manufactured Products under Buy America

Date: DEC 21 2012

From: Mr. John R. Baxter
Associate Administrator for Infrastructure

In Reply Refer To: HIPA-30

To: Division Administrators
Directors of Field Services

This memo clarifies the Federal Highway Administration's (FHWA) position regarding application of Buy America requirements to manufactured products. Our current Buy America policy is based upon the statutory provisions in the Surface Transportation Assistance Act of 1982, as implemented with a November 25, 1983, final rule.

In the preamble to the 1983 final rule (48 FR 53099), after soliciting and considering public comments, the FHWA found that it was in the public interest to waive application of Buy America to manufactured products other than steel and iron manufactured products. As the Federal-aid Highway Program evolved and technology improved, the FHWA clarified the applicability of the standing waiver for manufactured products in a December 12, 1997, memo. In this 1997 memo, the FHWA clarified that, while Buy America does not apply to manufactured products, Buy America does apply to components of "predominately steel products."

With enactment of the American Recovery and Reinvestment Act (ARRA), the FHWA formed National Review Teams (NRT) (now known as Project Management Improvement Teams) to conduct reviews and make recommendations on how to improve the delivery of ARRA funded projects. One NRT review recommended that a State's Buy America certification be clarified to ensure that all covered steel and iron meets FHWA Buy America requirements. In working to address this finding, questions have arisen regarding the scope of the application of the 1983 public interest waiver for manufactured products. For example, it has been suggested that nuts, bolts, washers, and other miscellaneous steel or iron parts used in common off-the-shelf products such as toilets and the filaments in light bulbs must be Buy America compliant. Given these questions, the FHWA is concerned that such a reading of Buy America is inconsistent with the previous 1983 waiver decision and is not cost-effective to administer. Accordingly, it has become necessary to clarify the applicability of the waiver for manufactured products.

The FHWA continues to support the Buy America waiver for manufactured products in the 1983 final rule, as clarified by the 1997 memo. In particular, the waiver was intended to apply to all manufactured products except for steel and iron manufactured products. For example, the 1983 rule specified that traffic controllers are covered by the waiver since these products have many different components that are difficult to trace. Over time, however, some States have subjected signal heads and other traffic control equipment to Buy America and have sought project specific waivers. In reexamining the extent of the 1983 waiver in light of the NRT finding, we believe that the scope of the waiver was intended to encompass miscellaneous steel or iron components and subcomponents that are commonly available as off-the-shelf products such as faucets, door hardware, and light bulbs.

Thus, in order for a manufactured product to be considered subject to Buy America, the product must be manufactured predominantly of steel or iron. The FHWA deems a product to be manufactured predominantly of steel or iron if the product consists of at least 90% steel or iron content when it is delivered to the job site for installation. For purposes of applying Buy America and determining whether a product is a steel or iron manufactured product, the job site includes the sites where any precast concrete products are manufactured.

Examples of products that are subject to Buy America coverage include, but are not limited to, the following:

- steel or iron products used in pavements, bridges, tunnels or other structures, which include, but are not limited to, the following: fabricated structural steel, reinforcing steel, piling, high strength bolts, anchor bolts, dowel bars, permanently incorporated sheet piling, bridge bearings, cable wire/strand, prestressing / post-tensioning wire, motor/machinery brakes and other equipment for moveable structures;
- guardrail, guardrail posts, end sections, terminals, cable guardrail;
- steel fencing material, fence posts;
- steel or iron pipe, conduit, grates, manhole covers, risers;
- mast arms, poles, standards, trusses, or supporting structural members for signs, luminaires, or traffic control systems; and
- steel or iron components of precast concrete products, such as reinforcing steel, wire mesh and pre-stressing or post-tensioning strands or cables.

The miscellaneous steel or iron components, subcomponents and hardware necessary to encase, assemble and construct the above components (or manufactured products that are not predominantly steel or iron) are not subject to Buy America coverage. Examples include, but are not limited to, cabinets, covers, shelves, clamps, fittings, sleeves, washers, bolts, nuts, screws, tie wire, spacers, chairs, lifting hooks, faucets, door hinges, etc.

If you have any questions, please contact either Mr. Gerald Yakowenko at 202-366-1562 or Mr. Edwin Okonkwo at 202-366-1558.

**S T A T E** **O F** **T E N N E S S E E**

Rev. 04-03-2006
Rev. 11-22-2011
Rev. 02-13-2012

March 1, 2006

## SPECIAL PROVISION

## REGARDING

## WATER QUALITY AND STORM WATER PERMITS

**Scope**

The conditions of this Special Provision apply to all construction on this project pursuant to the following:

1. Section 404 of the Federal Clean Water Act (33 U.S.C. §1344), and all implementing regulations, including without limitation regulations of the U.S. Army Corps of Engineers governing permits for discharges of dredged or fill material into waters of the United States in 33 CFR Part 323; and
2. The Tennessee Water Quality Control Act (T.C.A. §69-3-101, et seq.) and all implementing regulations, including without limitation the Rules of the Tennessee Department of Environment and Conservation governing NPDES permits in Chapter 1200-4-10, and Aquatic Resource Alteration permits in Chapter 1200-4-7; and
3. Section 26a of the TVA Act of 1933 as amended (49 Stat. 1079, 16 U. S. C. sec. 831y1.) and all implementing regulations, including without limitation the regulations of the Tennessee Valley Authority governing construction in the Tennessee River System in 18 C.F.R., Part 1304; and
4. The Tennessee Wildlife Resources Agency Reelfoot Lake Watershed Management permit program (T.C.A. section 70-5-1,), and all implementing regulations, including without limitation regulations authorizing any activity, practice, or project which has or is likely to have the effect of diverting surface or subsurface water from the Lake or have the effect of draining or otherwise removing water from Reelfoot Lake; and
5. Coast Guard Bridge Permit (USCG) (Section 9 of the Rivers and Harbors Appropriation Act of 1899) and all implementing regulations, including but not without limitation for projects which impact streams deemed navigable by the U.S. Coast Guard.

**Responsibility**

It is understood and agreed that the Contractor assumes all responsibilities of the permittee as indicated in the permit that relates to protection of the "waters of the United States" and/or "waters of the State of Tennessee."

It is also understood and agreed that the Contractor shall be responsible for obtaining any additional permits required by the Contractor’s method of construction, including without limitation haul roads, temporary channels or temporary ditches, or off-site waste and/or borrow areas.

It is also understood that the Contractor shall be responsible for implementing the provisions of the Water Quality (including, but not limited to, TDEC ARAP, USACE 404, TVA Section 26a, Coast Guard, TWRA) and Storm Water [including, but not limited to, National Pollution Discharge Elimination System (NPDES), Statewide Stormwater Management Plan (SSWMP)] Permits and requirements that pertain to construction activities.

The Contractor by signing this contract is indicating that the Contractor has reviewed a copy of the permit provisions, including NPDES Permit provisions at http://www.tdot.state.tn.us/construction/permits/npdes.pdf, the site specific SWPPP, the contract plans, Standard Specifications and contract Special Provisions and finds the permit requirements and erosion prevention and sediment control (EPSC) procedures to be reasonable, workable, and binding.

It is also understood that the Contractor shall not be released from the project site responsibilities under the NPDES permit provisions until the Notice of Termination (NOT) is submitted to TDEC by the TDOT Regional Construction Supervisor. The NOT is a certification that the construction project site is permanently stabilized and that all construction related discharges have ceased. This means that the use of EPSC measures to alleviate concerns of surface erosion and transport of sediment to surface water conveyances or to waters of the state is no longer necessary. Furthermore, it means that permanent controls, hard surfaces and/or vegetation, employed at the site are deemed adequate to prevent erosion and sediment transport and no other potential sources of construction-related pollution are on the project.

It is also understood that the Contractor shall not be released from any warranty provided for EPSC plantings, including sod and trees. If the entire project is complete as outlined in **Subsection 105.15** of the **Standard Specifications,** the Contractor shall be required to supply a performance bond as outlined in **Subsection 802.15** of the **Standard Specifications** to cover any warranty for EPSC plantings.

**NPDES Permit Required Action**

The Contractor (or their representative) shall accompany the EPSC inspector (TDOT personnel or TDOT hired consultant) on all EPSC inspections of the entire construction project including permitted locations and potentially impacted streams as well as attend all QA/QC Project Assessments.

EPSC Inspections shall be conducted as required in the most current TN Construction General Permit.

EPSC inspections shall be performed on the schedule established in the TN Construction General Permit until the site is permanently stabilized to determine if the permit requirements are being met. Where sites or portion(s) of construction sites have been temporarily stabilized, or runoff is unlikely due to winter conditions (e.g. site covered with snow or ice), such inspection only has to be conducted once per month until thawing or precipitation results in runoff or construction activity resumes. Written notification of the intent to change the inspection frequency and the justification for such request must be submitted to the TDOT Project Supervisor and the TDEC Central Office before proceeding.

An individual representing the Contractor, who holds a current TDEC "*Fundamentals of Erosion Prevention and Sediment Control Level I*" certification shall accompany the EPSC inspector on all required EPSC inspections. The Contractors project supervisor(s) shall also hold a current TDEC "*Fundamentals of Erosion Prevention and Sediment Control Level I*"

certification. Proof of required personnel training for the individual(s) shall be provided to the TDOT Project Supervisor prior to beginning of construction.

The TDOT EPSC inspector shall document all deficiencies on the required TDOT EPSC Inspection Report form (provided in the SWPPP). The Contractor (or their representative) shall sign the TDOT EPSC Inspection Report form and any supporting documentation indicating that he is in agreement with the report, recommendations and repair schedule as stated within the documentation.

Additionally, the Contractor shall make necessary maintenance and repairs relative to deficiencies in these permit conditions or requirements within twenty-four (24) hours after an inspection identifies the maintenance or repair need, and/or when directed to do so by the TDOT Project Supervisor, unless conditions make a particular activity impracticable. Any such conditions that make immediate repairs impracticable shall be documented and provided to the TDOT Project Supervisor, via the inspection report, and be accompanied by an expected repair schedule based on forecasted weather conditions.

The Contractor further agrees that he will execute two (2) copies of the Notice of Intent (NOI) form of the permit (provided by the Department), indicating his acceptance of the stipulations contained therein. The Contractor further agrees, that should he fail to execute said copies and return them to the TDOT Construction Division within ten (10) calendar days after submittal of the contract proposal to him, that the Department may at its discretion cancel the award with the Contractor forfeiting his bid bond.

Further, the Contractor agrees to review the site specific Stormwater Pollution Prevention Plan (SWPPP) that will be made available prior to or at the pre-construction conference, for any additional EPSC requirements. The Contractor shall sign and submit two copies of the SWPPP signature page (provided by the Department within the site specific SWPPP). The Contractor may submit for review and approval changes/revisions to the SWPPP to better prevent erosion and sediment transport at any time after contract execution. Rejection of any submittals does not relieve the contractor of any liability for appropriate Best Management Practices (BMPs).

If at any time during this contract, the requirements for the Water Quality Permits and/or the Storm Water Permits for Construction Related Activities are changed/revised/updated, the Contractor shall be notified in writing by the Department of such requirements. The Contractor shall comply with the new requirements within thirty (30) days of the Department notification.

If at any time the Contractor becomes aware that sedimentation is occurring or has occurred in streams impacted by the specified project, the Contractor shall immediately notify the TDOT Project Supervisor to evaluate the EPSC measures employed. A determination of the cause for sedimentation will be made by the Department. The Contractor shall immediately repair or replace defective EPSC measures, and install, as applicable, additional or other EPSC measures with the goal of eliminating future sedimentation. Once a remediation plan is provided by the Department, the Contractor shall, within twenty-four (24) hours after notification, begin the remediation as required. Based on the cause of sedimentation, the Department will determine if the cost of remediation will be performed at the Contractor's expense.

**Failure to Comply**

In the event a Notice of Violation (NOV) or Order pursuant to the Tennessee Water Quality Control Act or the Federal Clean Water Act is issued on this project, any and all fines will be the sole responsibility of the Contractor as outlined in **Subsection 107.01** of the **Standard Specifications for Road and Bridge Construction.**

Failure of the Contractor to comply with this Special Provision or take immediate corrective actions required within twenty-four (24) hours (unless documented conditions make a particular maintenance or repair activity impracticable immediately) shall be reason for the TDOT Project Supervisor to suspend all other work on the Project, except erosion prevention and sediment control (EPSC) and traffic control, applying non-refundable deductions of monies from the Contract per calendar day from monies due to the Contractor for any EPSC work on the Project. This deduction can be made for each location, as determined by the TDOT Project Supervisor, for each calendar day that the deficiency is allowed to remain and charged as item description *"Failure to Comply with Permit Deduction"*. A deduction shall be made from monies due the Contractor, not as a penalty, but as liquidated damages, as indicated in **Subsection 108.07** of the **Standard Specifications for Road and Bridge Construction March 1, 2006**, as amended.

If the Contractor does not make necessary corrections/adjustments in a timely manner as required above, the Department will implement the provisions of **Subsection 209.07 and Subsection 109.08** of the **Standard Specifications for Road and Bridge Construction** that provides for the Department making repairs and recovering the costs thereof from the Contractor.

The Department will not participate in any payment or reimbursement for fines and will not authorize time extensions due to delays in project progress for work stoppage, to remedy the violations stated within the NOV, required by the TDOT Project Supervisor as stated in **Subsection 105.01** of the **Standard Specifications for Road and Bridge Construction**.

**STATE** **OF** **TENNESSEE**
February 6, 2010 March 1, 2006

## CONTRACTOR EMPLOYEE SAFETY AND HEALTH PROGRAM (EFFECTIVE THE MARCH 19, 2010 LETTING)

At the preconstruction meeting, the Contractor shall submit to the Project Supervisor written certification of an Employee Safety and Health Program (ESHP) developed by a safety professional with a minimum of 30 hours OSHA Construction Training. The certification letter shall include the following:

1. Certification that the ESHP meets or exceeds all Federal, State, and local safety and health standards.
2. Qualifications of safety professional responsible for developing and maintaining the ESHP.
3. Chief Safety Personnel- Management-level personnel responsible for managing and implementing the ESHP for the company. Include the name and 24/7contact information.
4. On-Site Safety Personnel - Supervisory-level personnel responsible for implementing and monitoring the ESHP. Include 24/7 contact information.
5. Traffic Control Coordinator. Include the name and 24/7 contact information.
6. Prime contractor shall insure all sub-contractors have a safety program. The Prime Contractor is responsible for work site safety. The Prime contractor is responsible for conducting all operations so as to protect the workers engaged in duties connected with the work.

The ESHP is a living document and shall be updated as needed. The Contractor shall maintain an original copy at the company's headquarters and shall provide to the Department upon request. Certification of an ESHP will be required before any work can begin.

The ESHP shall at a minimum include the following:

1. **Description.** Describe in detail how the ESHP is implemented and monitored. Provide guidelines for protecting personnel from hazards associated with project operations and activities. Establish the policies and procedures for safety practices that are necessary for the work to be in compliance with the requirements of TOSHA, the MUTCD and other State and Federal regulatory agencies with jurisdiction, rules, regulations, standards, or guidelines in effect at the time the work is in progress.

2. **Certification, Responsibility, and Identification of Personnel.** Identify the safety professional responsible for developing the ESHP and provide that person's qualifications

for developing the ESHP. Qualifications should include but not limited to: education, training, certifications, and experience in developing this type of ESHP.

a. Provide a certification, executed by the safety professional that developed the ESHP, stating that the safety program complies with the rules, regulations, standards, and guidelines in effect at the time the work is in progress, of TOSHA, the MUTCD and other applicable Federal, State, and local regulatory agencies having jurisdiction.

b. Identify the Chief Safety Personnel and designate the On-Site Safety Personnel at supervisory-level responsible for implementing and monitoring the ESHP and having the authority to take prompt corrective measures to eliminate hazards, including the authority to stop work. Include documentation of training provided to the On-Site Safety Personnel.

c. For work that requires a competent person as defined by TOSHA, ensure that the On-Site Safety Personnel is capable of identifying existing and predictable hazards and has the authority to take prompt corrective measures to eliminate the hazards, including the authority to stop work. Include documentation of the qualifications of such competent persons identified, including certifications received.

d. For work that requires flagging, all flaggers will have proof they have completed an approved Flagging Course.

3. **Elements of the Program.** Include information and procedures for the following elements:

a. **Chain of Command.** Include the responsibilities of the management, supervisors, safety personnel, and employees.

b. **Traffic Control Coordinator.** Include the name and 24/7 contact information. Ensure that the traffic control coordinator meets the requirements specified in the MUTCD and holds a Work Zone Safety Supervisor certificate (ATSSA, NHI, UT).

c. **Chief Safety Personnel.** The Chief Safety Personnel shall have a minimum of 10 hours OSHA Construction training and the authority to make immediate decisions concerning safety and health, including the authority to stop work. Include the name and 24/7contact information. Ensure that the Chief Safety Officer meets the requirements specified in TOSHA.

d. **On-site Safety Personnel.** The On-Site Safety Personnel shall have a minimum of 10 hours OSHA Construction training and the authority to make immediate decisions concerning safety and health. Include the name and 24/7contact information. Ensure that the On-Site Safety Personnel meets the requirements specified in TOSHA.

e. **Emergency Procedures.** Provide guidelines for handling emergencies, including emergency action plans for incidents involving a worker's death or serious injury, property damage, fires, explosions, and severe weather. Include the 24/7 emergency

contact information of the Contractor's personnel responsible for handling emergencies.

f. **Local Emergency Telephone Numbers.** Include police, fire, and medical numbers. This item will be in the project specific copy to be kept at each worksite.

g. **Training Topics.** Include regulatory and jobsite safety meetings.

h. **Contractor's Safety Rules.** Include employee safety, housekeeping procedures and personal protective equipment requirements.

i. **Employee Disciplinary Policy as related to safety issues.** Documentation shall be maintained at the contractor’s headquarters.

j. **Work-Site Safety Checklists.** Include project safety-planning, emergency plans and procedures, documentation, and protective materials and equipment. Define procedures for routine work site inspections and correcting hazards reported by employees.

k. **Personnel Injuries.** Record all work-site accidents including cause and correction and provide to the department upon request.

l. **Hazard Communication Program.** Provide the following:

1. The location of and instructions for understanding the Manufactures Safety Data Sheet (MSDS). Ensure that the location and instruction are available to anyone within the project Limits.
2. The person responsible for the hazard communication program and the method of informing personnel of the hazardous communication program. Attendance sheets of hazard communication meetings shall be maintained.
3. Provide employees a procedure for reporting and recording safety and health concerns to the On-Site Safety Personnel and the Chief Safety Personnel who have the authority to make immediate corrections.
4. When performing work that generates airborne crystalline silica or lead, include engineering and work practice controls to limit exposure levels to, at, or below the permissible exposure limit according to TOSHA. Ensure that the program includes employee training and respiratory protection measures according to TOSHA and control of the area when the permissible exposure limit is exceeded. Provide a trained and competent person, according to TOSHA, within the Project Limits at all times when performing work that produces airborne crystalline silica or lead.

m. **Additional Requirements.** Provide additional procedures for Project specific topics including but not limited to:

1. Compressed gas cylinders.
2. Confined spaces.

3. Cranes.
4. Electrical.
5. Equipment operators.
6. Fall protection.
7. Hand and power tools.
8. Hearing conservation.
9. Highway safety. See supplement specification 700SS
10. Lead.
11. Lock out/tag out.
12. Materials handling, storage, use, and disposal.
13. Night work.
14. Personal protective equipment.
15. Project entry and exit.
16. Respiratory protection.
17. Sanitation.
18. Signs, signals, and barricades.
19. Subcontractors.
20. Trenching.
21. Flagging.

The Contractor is responsible for implementing, monitoring, updating, and revising the ESHP. If an incident occurs that requires hospitalization, or TOSHA Citation to be submitted, notification of the incident shall be sent to the Project Supervisor and forwarded to the Regional Safety Coordinator.

On-call guardrail, sweeping, on-call striping/retracing, litter removal, tree services, mowing, and work performed at Welcome Centers and Rest Stops, will be considered Maintenance Contracts. The Maintenance Contractor, while performing the above listed projects, will have a Safety and Health Program, a Work Zone Traffic Control Supervisor and a Safety Manager. . Certification of an ESHP will be required before any work can begin. The certification letter shall include the following items and names (with 24/7 contact numbers) for:

- Safety and Health Program developed by a safety professional with a minimum of 30 hours OSHA Construction Training. This plan will cover the unique and specific hazards posed by the intended work including a Hazard Communication Program as defined as above.
- Traffic Control and Safety Supervisor to ensure that the traffic control meets the requirements specified in the MUTCD and holds a Work Zone Safety Supervisor certificate (ATSSA, NHI, UT); also have a minimum of 10 hours OSHA Construction training. This employee must have the authority to make immediate decisions concerning safety and health, including the authority to stop work.

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006
Project No.: STP-M-7900(29)
& 79946-2455-54
County: Shelby

# SPECIAL PROVISION

# REGARDING

# "SPECIALTY ITEMS"

In accordance with the provisions of Subsection 108.01, *Standard Specifications for Road and Bridge Construction*, 2006, all construction items included in the following described work are hereby designated as "Specialty Items":

Items 105-01 – Construction Stakes, Lines and Grades

Items 209 – EPSC Items

Items 604 – Texture Finish

Items 705 – Guardrail, Anchors, etc.

Items 712 – Traffic Control Items

Items 713 – Signing Items

Items 716 – Pavement Marking Items

Items 730 – Traffic Control Items

Items 797 – Utility Items

Items 801 – Seeding

Items 802 – Landscaping Items

Items 803 – Sodding

Items 805 – Erosion Control

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 12-18-95) March 1, 2006
(Rev. 6-6-97)
(Rev. 2-1-02)

## SPECIAL PROVISION

## REGARDING

## EMBANKMENT (COMPACTED IN PLACE)

Description: This work shall consist of constructing roadway embankments in accordance with the Standard Specifications except as modified herein. All work shall be performed in reasonably close conformity with the lines and grades shown on the plans or as directed by the Engineer and shall include roadway excavation, the furnishing of borrow material, the preparation of the area upon which embankments are to be placed, the placing and compacting of approved material within roadway areas, removal and replacement of unsuitable material, clearing and grubbing of borrow sites, and transporting borrow material.

Materials. Materials used in the construction of embankments shall meet the requirements of Section 205 of the Standard Specifications unless otherwise specified on the plans.

Construction Requirements. Roadway excavation and embankment construction shall be performed in accordance with Section 203 and Section 205 respectively of the Standard Specifications except as modified herein.

The Contractor shall perform all excavation indicated or described in the plans or directed by the Engineer. All suitable material obtained from the roadway excavation, bridge excavation, channel excavation or other excavation may be used in the formation of embankments. All additional material required for completion of the embankments shall be furnished by the Contractor from locations approved by the Engineer.

Unsuitable material encountered in the roadway excavation will be removed and disposed of in accordance with the Standard Specifications except that the unsuitable material will be measured and paid for under Item No. 203-10, Embankment (Compacted in Place). No other material shall be removed from the project without the written consent of the Engineer except as provided for in the Plans and Specifications.

Topsoil shall be stripped and stockpiled in accordance with Subsection 203.06 of the Standard Specifications. The Engineer may at his discretion measure and pay for topsoil prior to placing and spreading, however, such payment shall not exceed 50% of the estimated volume of the stockpile.

Method of Measurement. Embankment (Compacted in Place) will be measured by the cubic yard complete in place. Final volume of Embankment (Compacted in Place) will be computed using the average end area method and shall be based on original cross-sections taken after removal of topsoil and unsuitable material from the embankment areas and after placement of rock or other select material paid for under other items. Final cross sections will be taken on the completed embankment prior to placement of topsoil, mineral aggregate or other material which is paid separately. Boundaries of the embankment shall be the neat lines established by the slope stakes and the elevations shown on the plans or established by the Engineer. No measurement for payment will be made beyond these boundaries except as specified herein.

The centerlines, baselines or other lines shown on the Plans or established by the Engineer shall be used as reference lines for measurement of embankments. Cross-sections shall be taken from these reference lines at intervals not to exceed 50 feet.

The volume of embankment displaced by box culverts, box bridges, span bridges, pipe(s) with cumulative diameter(s) of 60" or greater and retaining walls including all structural backfill required for the structures will be deducted from the embankment quantity. Materials placed in the embankment area including but not limited to rock pads, sinkhole treatment and rock caps on subgrade which are paid for under other items will not be measured as part of the embankment.

Roadway excavation will not be measured on this project, but shall be a responsibility to be assumed by the Contractor in connection with the pay item(s) specified herein.

Basis of Payment. The amount of completed and accepted work, measured as provided for above, shall be paid for at the contract unit price bid for Embankment (Compacted in Place), which price shall be full compensation for furnishing all materials, placing and forming of embankments, all roadway excavation shown on the plans, clearing and grubbing of borrow pits, and all equipment, tools, labor, and incidentals necessary to complete the work.

Roadway excavation will not be paid for directly. The contract unit price for Embankment (Compacted in Place) shall be full compensation for all roadway excavation performed in accordance with the Plans and Specifications.

No additional payment will be made for undercutting at locations where the plans indicate undercutting is required. However, if the Engineer directs undercutting at locations not indicated on the plans, the unsuitable material removed will be measured by the cubic yard in its original location and paid for at 1.5 times the contract unit price bid for Embankment (Compacted in Place). Material used to replace unsuitable material will be measured and paid for under the appropriate contract item.

**S T A T E** **O F** **T E N N E S S E E**

Effective 04-04-2011 March 1, 2006

# SPECIAL PROVISION

# REGARDING

# ASPHALT PAVEMENT SAFETY EDGE

The contractor shall attach a device to the screed of the paver such that material is confined at the end gate and extrudes the asphalt material in such a way that results in a consolidated wedge-shape pavement edge of approximately 25 to 30 degrees as it leaves the paver (measured from a line parallel to the pavement surface). The device shall maintain contact to the graded material adjacent to the pavement and must be adjustable to allow for transition to cross roads, driveways and obstructions without requiring the paver to be stopped routinely. The device shall constrain the asphalt head and increase the density of the extruded profile. To achieve desired results, rolling is not required on the wedge. The desired pavement edge angle is 30 degrees but angles as steep as 38 degrees are acceptable after the mat has been rolled for compaction.

The contractor shall use the TransTech Shoulder Wedge Maker, the Advant-Edge Edger or Ramp Champ, Carlson's Safety Edge Endgate or an equivalent device that produces the same wedge consolidation results. If the contractor uses a similar device, he must provide proof that his device has been used on previous projects with acceptable results (proof shall consist of, at a minimum, approval and endorsement of another State D.O.T. or FHWA Division). Short sections of handwork will be allowed when necessary for transitions and turnouts or otherwise authorized by the engineer. Conventional single plate strike off devices will not be allowed.

No direct payment will be made for the Safety Edge and all cost of furnishing and/or operation of this device will be included in other items.

Contact information for these wedge shape compaction devices is as follows:

1. **TransTech Systems, Inc.**
   1594 State Street
   Schenectady, NY 12304
   1-800-724-6306
   http:/www.transtechsys.com

2. **Advant-Edge Paving Equipment LLC**
   P.O. Box 9163
   Niskayuna, NY 12309-0163
   Ph. 518-280-6090
   http://www.advantedgepaving.com

3. **Carlson Paving Products, Inc.**
   18425 50th Ave E, Tacoma WA 98446
   Phone (253) 875-8000 | Toll Free 1-800-216-2108 | General Fax# (253) 846-2703
   http://www.carlsonpavingproducts.com

**S T A T E** **O F** **T E N N E S S E E**

Date: 08-08-08 March 1, 2006
(Rev. 12-03-10)
(Rev. 08-06-12)

# SPECIAL PROVISION
# REGARDING
# RETAINING WALLS

## General Description

This Special Provision covers the design, submittal of working drawings, materials, construction, measurement, and payment for earth retaining walls. The scope of work for retaining wall construction includes, but is not limited to, the following as required:

1. All grading necessary for wall construction,
2. Undercutting and backfilling of weak surficial zones, and or ground improvement as required by plans
3. Compaction of wall foundations
4. General and local dewatering as required for proper execution of the work
5. Construction of leveling pads
6. Formwork, placement of reinforcing steel, placement and curing of concrete
7. Texture coating or architectural treatment
8. Placement of drainage materials
9. Installation of piling
10. Placement of soil reinforcing devices
11. Placement and compaction of backfill
12. Preparation and erection of wall units
13. Construction of any required reinforced concrete appurtenances such as caps, copings, or end sections

All items included in the construction of the retaining wall shall conform to this Special Provision, the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction*, henceforth referred to as the Standard Specifications, American Society for Testing Materials Standards (ASTM), Federal Highway Administration (FHWA) Technical Publications, and the current *AASHTO LRFD Bridge Design Specifications* with interims, henceforth referred to as the AASHTO LRFD. The architectural treatment and/or texture finish of the walls shall be in accordance with the contract plans.

## Design Criteria

The design of all types of earth retaining walls shall be in accordance with this Special Provision and the following Specifications as required:

1. AASHTO *LRFD Bridge Design Specifications* with interims
2. Publication no. FHWA-NHI-10-024, *Mechanically Stabilized Earth Walls and Reinforced Soil Slopes*
3. (FHWA Report No. FHWA-SA-99-018, 1999)*Geotechnical Engineering Circular No. 4, Ground Anchors and Anchored Systems*

The soil properties and specific design values shall be shown on the contract plans.

## Submittal Requirements for Contractor/Supplier Prepared Design Plans

The Contractor shall utilize the information contained on the Retaining Wall Conceptual drawing as well as information shown elsewhere in the plans to prepare his bid for the wall during the project bidding process and to prepare wall design plans during the construction of the project. The final design shall be submitted subsequent to contract award and a minimum of sixty (60) days prior to wall construction and shall include detailed design computations and all details, dimensions, quantities and cross sections necessary to construct the wall. Acceptable wall types will be identified on the concept drawing. Specific wall systems will typically be selected from the Department's Qualified Products List (QPL) in effect at time of bid letting. In certain circumstances, TDOT may elect to provide a complete, detailed wall design in the contract plans. The Contractor shall not bid for nor shall the Contractor submit plans for wall types and/or specific wall systems not listed as an Acceptable Wall Type on the Retaining Wall Conceptual Drawing and related drawings or the specific wall design if provided for in the contract plans.

The plans shall be prepared to include but not be limited to the following items:

1. A plan and elevation sheet or sheets for each wall containing the following:

    a. An elevation view of the wall showing grades at the top of the wall, every 50 feet along the wall and at all horizontal and vertical break points. Elevations at the top of leveling pads and footings, the distance along the face of the wall to all steps in the footings, and leveling pads, the designation as to the type of panel or module, the length, size and number of tiebacks, nails, mesh or strips and all the distances along the face of the wall to where changes in length of the reinforcing elements occur and the location of the original and final ground line should be shown. The Contractor shall be responsible for field verifying original ground elevations.

b. A plan view of the wall shall indicate the offset from the construction centerline to the face of the wall at all changes in horizontal alignment, the limit of the widest module, tiebacks, nails, mesh or strip and the centerline of any drainage pipe which is behind or passes under or through the wall.
c. Any general or special notes, standard or special drawings, or other unique provisions required for construction of the wall.
d. All horizontal and vertical curve data affecting wall construction.
e. Cross sections showing limits of construction and in fill sections, limits and extent of select granular backfill material placed above original ground.
f. Limits and extent of reinforced soil volume
g. Limits and extent of any ground improvements as require by the contract plans.

2. Details

a. All structural details including reinforcing bar bending details. Bar bending details shall be in accordance with CRSI standards.
b. All details for foundations and leveling pads, including details for steps in the footings or leveling pads, as well as allowable and actual maximum bearing pressures.
c. All modules and facing elements shall be detailed. The details shall show all dimensions necessary to construct the elements, all reinforcing steel in the element, and the location of reinforcement element attachment devices embedded in the facing.
d. All details for construction of the wall around drainage facilities, overhead sign footings and abutment piles shall be clearly shown.
e. All details for connections to traffic barriers, coping, parapets, noise walls and attached lighting shall be shown.
f. All details for drainage behind wall or reinforced soil volume.
g. If vehicular impact protection is required due to the wall system not satisfying the minimal design requirements of Section 5.0, details of the barrier wall and end terminals shall be shown on the Contractor/Supplier Design plans for the proposed wall.

3. Detailed design computations which clearly demonstrate compliance with design requirements provided in this specification.

4. Limits of design responsibility, if any.

5. Each design submittal shall include a detailed list of quantities for each wall unit. The quantities shall include but not be limited to: concrete cast in-place, pre-cast concrete, select backfill material, backfill material, reinforcing steel, geomembrane/geogrid reinforcement, modular blocks, structural steel, pre-stressing steel, etc… If known, all materials sources shall be identified so acceptance and verification sampling and testing can be conducted. All

quantities listed are for informational purposes only. All retaining walls shall only be paid for under the respective retaining wall bid item measured as described herein.

6. The plans shall be signed, stamped and dated by a qualified registered Professional Engineer licensed in the State of Tennessee.

7. Submittals and Approval

   Four sets of design drawings and detail design computations shall be submitted to the Structures Division. The computations shall include a detailed explanation of any symbols and computer programs used in the design of walls. All designs and construction details will be checked by the Structures Division and the Materials and Tests Division against the pre-approved design drawings and procedures for that particular system. (Structures Division will submit two of their four copies to the Division of Materials and Tests.) Each design drawing shall contain in the title block the project number, county, structure name, structure number, station and contract number. Design drawings shall be submitted in sets with the drawing numbers running consecutively in each set, and if more than five (5) sheets in a set, shall be appropriately bound. Approval of the detailed design and plans shall be made by the Structures Division and Materials and Tests Division. Notification to proceed shall be made by the Structures Division. After approval, the Contractor shall submit additional sets of the design drawings (full size and half size) as determined by the Structures Division for Departmental distribution. Also, an electronic copy of the design drawings and detail design computations shall be submitted to the Structures Division and the Materials and Tests Division upon completion of the project.

8. Other Submission Requirements

   As discussed in the previous sections, the Contractor shall bid for and, subsequently, (for the Contractor for which the project was awarded) prepare plans for and be prepared to construct the wall type(s) given on the Retaining Wall Conceptual Drawing or, under special circumstances, the specific wall type as provided by in the Contract Plans. The Contractor awarded the project may only under the circumstances discussed below request that a wall type, wall system, or associated construction for a wall (i.e., foundation improvement requirements, construction sequence requirements, etc.) be changed, altered, or eliminated from those requirements set forth in the plans.

   The Contractor may request the Department consider a change in the wall type, specific system, and associated construction through the submission of a Value Engineering Change Proposal (VECP) unless the contract prohibits submission of a VECP. Furthermore, any conditions of a VECP, such as a minimum cost savings required by the contract must be followed. The

Department's agreement to review a VECP for a retaining wall shall in no way imply subsequent acceptance of the VECP or any part thereof. Any costs associated with preparation and submittal of a VECP shall be borne by the Contractor and no construction scheduling changes or time delays shall be caused by the Contractor's submission of the VECP and the Department's review of the VECP. If the proposed change involves a wall system not on the Approved Wall System list, then the contractor must coordinate with the system supplier to gain approval of the system and shall be aware of the time considerations for this approval process.

The Contractor may request the Department consider a change in the wall type, specific system, and/or associated construction if the Contractor determines that project conditions exist that may substantially differ from those conditions upon which the decision to specify in the plans a particular wall type(s), wall system, or associated construction was made. An example of this would be where a soldier pile-lagging wall is specified as the only wall type due to right-of-constraints not allowing for a typical wall type to be built, then subsequently it is determined TDOT can acquire or has sufficient right-of-way available to make another wall type feasible

The request for consideration of changing of a wall type, system, or associated construction shall be made in writing and be submitted to the Construction Engineer. The Construction Engineer will distribute the request to the Regional Construction Engineer, Structures Division, Geotechnical Engineering Section, Design Division, and Right-of-Way Division, if applicable. The parties will review the request and provide recommended action (approval, rejection, alterations) to the Construction Engineer. If necessary, a plans revision will be made. Note that the Contractor's submission of a request does not imply acceptance by the Department and that the request process shall not be justification for a project schedule change or time extension. The Department reserves the right to require the Contractor to construct the wall as shown in the plans if a condition does not exist that renders the contract plan wall not constructible.

The Contractor must provide documentation in the request to demonstrate that the proposed change does not in any way cause additional cost to the wall and associated construction or to other aspects of the project. If the Contractor judges that a change involving wall construction must be made due to differing site conditions, the Contractor must follow procedures given in Sections 104.02 and 104.03 of TDOT Standard Specifications for Road and bridge Construction.

**Requirements for retaining wall protection provided by the retaining wall system**

When noted on the plans that a retaining wall is located in a hazard zone subject to vehicular impact, the Contractor shall be aware that retaining wall protection against vehicular collision for the wall may be required. If the retaining wall facing meets any one of the following criteria, an independent barrier wall shall be provided in front of the wall and included in the square foot cost of the wall:

1. Any retaining wall facing that is constructed of non-reinforced concrete (cast-in-place concrete gravity walls are exempt from this requirement and do not require protection.
2. Any dimension of a retaining wall facial panel that is less than 5’0” x 5’0” x 6” thick reinforced panel.
3. Any type of crib retaining walls.
4. A cast in place reinforced facing that has a thickness less than 6 inches

**Materials Approval**

The materials used in the construction of the earth retaining walls shall conform to this Special Provision and/or the Standard Specifications. Prior to delivery of any material used in the retaining wall construction, the materials must be accepted in conformance with the specifications associated with the wall type being constructed.

**Materials**

Unless other otherwise stated in specific retaining wall specifications, the materials used in the construction of earth retaining walls shall conform to the following specifications:

1. Concrete Class “A” shall be in accordance with Section 604 of the Standard Specifications.
2. Concrete Class “D” Shall be in accordance with Section 604 of the Standard Specifications.
3. Reinforcing steel shall conform to ASTM A 615, Grade 60.
4. The sources for all backfill material shall be approved in conformance with the Standard Specifications before the material is delivered to the job site. Any select backfill material must be approved or tested for compliance prior to construction.
5. Lifting hooks and threaded inserts shall be of the size indicated on the working drawings.
6. When required, imbedded items must be galvanized in accordance with AASHTO M 232 or ASTM A 153.
7. Acceptance of materials furnished for work will be in accordance with the TDOT “Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1) and certified test reports as specified in

Section 106 – Control of Materials supplemented by routine tests run by the Department as defined in the various applicable sections of the Standard Specifications.

8. Clearing and grubbing, removal of structures and obstructions, and excavation and undercutting shall be performed in accordance with the provisions of Sections 201, 202, and 203, respectively, of the Standard Specifications. Cost of these items, however, shall be included in the square foot price bid for retaining walls as shown in contract plans.
9. Reinforced Concrete Facing Panels - The panels shall be fabricated in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels."
10. Stone masonry shall be in accordance with Section 612 of the Standard Specifications.
11. The sources for all backfill material shall be approved in conformance with the specifications before the material is delivered to the job site. Any select backfill material must be approved or tested for compliance prior to construction.
12. All fabricated or precast retaining wall assemblies shall be selected from the TDOT's Qualified Products List.

All concrete, reinforcing steel, and backfill materials shall be tested at the specified frequencies in accordance with the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

## A. Cast-in-Place (CIP) Concrete Gravity Retaining Walls

### 1. Construction

The construction of the wall shall be in accordance with this Special Provision and the Standard Specifications.

## B. Cast-In-Place (CIP) Concrete Cantilever And Counterfort Retaining Walls

### 1. Construction

The construction of the wall shall be in accordance with this Special Provision and the Standard Specifications. If the use of piles is anticipated, the foundation information shown on the contract plans shall include the skin friction (Fs) and end bearing (Qb) values, or the location of the rock line. Based on this information, estimated pile lengths shall be shown on the contract plans for fifty (50) and one hundred (100) tons ultimate bearing capacity for Size 1 concrete friction piles. The contractor shall estimate point bearing steel pile refusal lengths based on the given rock line information.

Concrete friction piles shall be installed to provide a minimum factor of safety of 2.0 if a load test is used and a minimum factor of safety of 3.0 if a load test is not used. Pile types, load test procedures, and driving equipment shall be in accordance with the Standard Specifications and shall be approved by the

Engineer. The number and location of test piles and load tests shall be approved by the Engineer. Test pile lengths shall be ten (10) feet longer than the estimated pile lengths. Test piles shall be driven in accordance with the Standard Specifications, and shall be required at least every fifty (50) feet along the wall, unless otherwise approved by the Engineer. No pile shall be any farther than five hundred (500) feet from a load test, if a load test is used, unless otherwise approved by the Engineer. The length of production piles to be driven and the required bearing based on the driving equation shall be determined by the Engineer based on the required design bearing, the results of the test piles and load tests (if used), and applicable safety factors. Driven pile lengths and final bearings shall be approved by the Engineer.

Point Bearing Steel Piles shall be driven to refusal. Pile tips shall be used when indicated on the contract plans.

All reinforcing steel projecting from footing into the wall in the back face (fill side) shall be epoxy coated.

## C. Concrete Crib Walls

### 1. Materials

The following items are the construction materials requirements necessary for crib wall design fabrication. All materials shall be approved prior to use.

a. Pre-Cast Concrete Crib Units

The pre-cast crib units are to be made of Class D Portland cement concrete conforming to Section 604 of the Standard Specifications.

b. Crib Backfill

All backfill material shall be tested prior to use and at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

i. The crib backfill material shall consist of an AASHTO classified A-1-a, A-1-b, or A-3 soil with the additional requirement no more than ten percent by weight pass the #200 sieve.

ii. The unit weight of the crib fill should be a minimum 115 lb. per cubic foot.

iii. Filter protection (geotextile) may be required.

c. Backfill Behind the Crib Type Structure

All backfill material shall be tested prior to use and at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

i. If a filter blanket is placed behind the wall, native soil may be used as backfill behind the structure.

ii. Select fill, as defined in 4.2.1 of this document, can be used as backfill behind the structure. The backfill unit weight must be a

minimum of 115 pcf. An internal angle of friction can be assumed equal to 35 degrees.

**2. Fabrication of Precast Concrete Crib Units**

a. All pre-cast concrete shall be produced in an approved plant in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels".

Out-of-state producers shall provide documentation of material quality before the manufacture of any pre-cast products (i.e. aggregate quality reports, cement/steel mill test reports, etc.)

The fabricator shall provide two precast modular units to the Engineer for approval.

i. These approved precast modular units will serve as standard models. The finished exposed faces of the production precast modular units should be similar to the exposed faces of the model precast modular units.

ii. One of the model precast modular units should be kept at the production plant for relative comparison to future modular units. The other model should be kept on the construction site for comparison to the other delivered units.

b. To assure uniform unit production steel forms must be used.

c. The placement of reinforcing steel within the precast units should conform to the design placement shown in the shop drawings.

d. Final acceptability of the precast units shall be determined on the basis of compression tests, production defects and tolerances, and visual inspection. The manufacturer shall furnish all sampling and testing facilities.

e. Section 604 of the Standard Specifications states the units shall be steam or moist cured until developing the specified compressive strength set forth in the shop drawings. Any unit not developing the specified compressive strength shall be rejected.

f. The precast units should not be delivered before samples have attained the required compressive strength of 4,000 psi ($f'_c$).

g. Prior to shipment, the finished units are subject to visual inspection by the Engineer. Individual crib units may be rejected for any of the reasons listed below.

i. Variations in the exposed face texture relative to the approved model face texture.

ii. The length or height of the unit not satisfying the unit allowable tolerance limit of 3/16".

iii. Honeycombed or open texture units which are not properly repaired.

iv. Individual defects which could affect the structural integrity of the unit.

h. TDOT will verify products before shipment in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels". If products are manufactured out of state, TDOT may verify at the project site PRIOR to the placement of the units. The Contractor, or producer, shall notify the Regional Materials and Tests Division that products need to be verified.

i. Upon delivery, the exposed surface of the precast units shall be examined. If the exposed faces of any of the units are below the standards of the approved model on site, the units shall be replaced or properly repaired until conforming to the appearance, strength, and durability of the approved model.

j. The date of manufacture shall be clearly and permanently marked on one of the inside surfaces of each unit. Each shipment must be accompanied with a certification letter as stated in the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels

**3. Construction**

a. The Contractor should perform any soil improvement, such as undercutting and backfilling before foundation preparation.

b. Compact the top 12" of soil on which the structure will rest to at least 95% of the maximum laboratory dry density as specified in AASHTO T-99.

c. No Crib-type wall should be built upon frozen ground.

d. Following excavation for the crib wall system, the Contractor shall notify the Engineer for approval of the footing depth and character of the foundation material. No crib wall system work shall proceed until approval has been granted.

e. The correct batter of the wall shall not exceed ½" per 10 ft. of wall height.

f. The crib backfill should be placed and compacted to at least 95% of the maximum laboratory dry density (AASHTO T-99) in layers no thicker than 12".

g. Backfilling behind the crib system shall follow erection as closely as possible. The wall height should never be greater than three feet above the backfill.

h. Any underdrain shall be placed in accordance with the details of the working plans.

i. The Contractor shall furnish, install, operate, and maintain satisfactory dewatering systems as required to maintain the site in a dry and workable condition. These systems shall be continued as long as necessary. No separate measurement or payment will be made for dewatering.

## D. Bin Wall

### 1. Materials

a. Filler for horizontal joints between modular units shall be resin-bonded cork filler or closed cell foam, cross linked polyethylene polymer, conforming to test requirements of AASHTO M 153 or ASTM D 1752 (Type II) or equal. Filter fabric placed behind front vertical joints shall be at least 6" wide and conform to section 918.27 of the TDOT Standard Specifications).

b. Backfill: All select granular material shall be free from shale and organic or otherwise deleterious material and conform to the following gradation limits:

| Sieve Size | Percent Passing |
|---|---|
| 6 inch | 100 |
| 3 inch | 75-100 |
| No. 200 | 0-15 |

The Contractor, at his option, may produce the select granular material by processing the excavation from the project or from approved material from other sources. No direct payment will be made for producing the select granular material.

All backfill material shall be tested prior to use and at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

c. Bearing pads shall be rubber of size, and manufacture shown on shop drawings, with the following properties perpendicular to the pad thickness:

i. Compression- minimum ultimate strength 8000 psi
ii. Initial Cracking Strain- 40% of thickness
iii. Hardness (Shore A) – 75 +/- 5
iv. Tensile Strength- ASTM D 412, die "C", 1000 psi +/- 100 psi
v. Tear Strength- ASTM D 624, die "B" – 360 psi minimum

d. Acceptance of materials furnished for work will be in accordance with the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1) and certified test reports as specified in Section 106 – Control of Materials supplemented by routine tests run by the Department as defined in the various applicable sections of the Standard Specifications.

### 2. Construction

a. Bin Fabrication

i. All pre-cast concrete shall be produced in an approved plant in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels".

Out-of-state producers shall provide documentation of material quality before the manufacture of any pre-cast products (i.e. aggregate quality reports, cement/steel mill test reports, etc.)

Before proceeding with production, a model precast modular unit shall be provided by the fabricator for the Engineer's approval to establish a guide and standard for the type of finish to be furnished on the exposed face. This model shall be kept at the fabricator's plant to be used for comparison purposes during production. Formed surfaces other than the exposed face shall not require a special finish

ii. Forms: Forms for the units shall be constructed of steel with dimensional tolerances that will assure the production of uniform units. Finish for the front face of the wall shall be in accordance with the finish specified on the contract plans.

iii. Mixing and Placing Concrete: The concrete mix as designed shall be proportioned and mixed in a batch mixer to produce a homogeneous concrete. The transporting, placement, and compaction of concrete shall be by methods that will prevent segregation of the concrete materials and the displacement of the reinforcement steel from its proper position in the form. Concrete shall be carefully placed in the forms and vibrated sufficiently to produce a surface free from imperfections such as honeycomb, segregation or cracking. Clear form oil of the same manufacture shall be used throughout the casting operation.

iv. Reinforcing Steel: All reinforcing steel for the precast modules and other components shall be fabricated and placed in accordance with plans and Standard Specifications.

v. Testing and Inspection: Acceptability of the precast units at the casting yard shall be determined on the basis of compression tests and visual inspection during casting. The manufacturer shall furnish such facilities and assistance as is required to carry on the sampling and testing in an expeditious and satisfactory manner. The manufacturer shall document and provide all test data and certify in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels".

vi. Curing: The units shall be steam or moist cured as specified in Section 604 of the Standard Specifications for a sufficient length of time so that the concrete will develop the specified compressive

strength. Any panel which does not reach specified strength within 28 days shall be rejected.

vii. Compressive Strength: Compressive tests to determine the minimum strength requirements shall be made on cylinders. A minimum of six cylinders for determining when the units may be put into service will be made from each day's production and cured in accordance with AASHTO T 23 or ASTM C 31. The 28 day compressive strength shall be at least 5000 psi. Compressive strength tests shall be in accordance with AASHTO T 22 or ASTM C 39.

viii. Rejection: The quality of materials, the process of manufacture, and the finished units shall be subject to inspection by the Engineer prior to shipment. Precast units may be subject to rejection on account of failure to conform to the requirements set forth herein. Individual units may be rejected because of any of the following:

- Variations in the exposed face that substantially deviate from the approved model as to texture in accordance with precast concrete industry standards.
- Dimensions not conforming to the following tolerances:
  - Face of panel, length or height: plus/minus 3/16"
  - Deviation from square when measured on diagonal: 5/16" for modules up to 10' wide, 3/4" for larger units.
- Honeycombed or open texture not properly repaired.
- Defects which would affect the structural integrity of the unit.

ix. Shipment: The precast units shall not be shipped until they have achieved the required concrete strength (f'c) of 5000 psi. TDOT will verify products before shipment in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels". If products are manufactured out of state, TDOT may verify at the project site PRIOR to the placement of the units. The Contractor, or producer, shall notify the Regional Materials and Tests Division that products need to be verified

x. Repairs at Plant: Before shipment, surfaces of all precast units shall be examined. If the exposed face of a unit is below the standard of the approved model then it shall be properly repaired to conform to the balance of the work with respect to appearance, strength and durability.

xi. Handling and Storage: Handling devices, as required, shall be provided in each precast modular unit for the purpose of handling

and placing. Care shall be taken during storage, transporting, hoisting and handling of all units to prevent cracking or damage. Units damaged by improper storing, transporting or handling shall be replaced or repaired to the satisfaction of the Engineer.

xii. Marking: The date of manufacture and production lot number shall be clearly and permanently marked on the rear face of each unit.

b. Erection:

i. Foundation Preparation: The foundation for the bin wall shall be graded to the elevations and dimensions shown on the contract plans. Prior to wall construction, the top 12 inches of the foundation shall be compacted to at least 95% of the maximum laboratory dry density as determined by AASHTO T 99. Any foundation soils found to be unsuitable or incapable of sustaining the required compaction shall be removed and replaced. After the excavation for each location of the bin wall has been performed, the Contractor shall notify the Engineer. No concrete leveling footing shall be placed until the depth of excavation and the character of the foundation material has been approved by the Geotechnical Engineering Section of the Division of Materials and Tests and permission has been given to proceed by the Engineer.

ii. At each unit foundation level, either a precast or cast-in-place footing and/or leveling pad shall be provided as shown on the shop drawings. The footings shall be given a wood float finish and shall reach the required compressive strength of 3000 psi, before placement of wall modules. The completed footing surface shall be constructed in accordance with grades and cross slopes shown on the shop drawings. When tested with a 10’ straight edge, the surface shall not vary more than 1/8” in 10’. Any additional depth of footing required to level the top surface and bear on approved foundations shall be at the Contractor’s expense.

iii. The modular units shall be installed in accordance with the manufacturer’s recommendations. Special care shall be taken in setting the bottom course of units to true line and grade. Joint filler and neoprene pads, when required, shall be installed in the horizontal joints. Joints at corners or angle points shall be closed as shown on the plans or in accordance with recommendation of the manufacturer.

iv. All units above the first course shall interlock with the lower courses. Vertical joints shall be staggered with each successive course, or as shown on shop drawings. The vertical joint opening on the front face of the wall shall not exceed 3/4".

v. The interior of each successive course of precast modular units shall be filled with select granular backfill. The maximum lift thickness shall be 2 feet, and shall then be thoroughly consolidated with a vibratory tamping device.

vi. Backfill behind the wall shall be compacted to at least 95 percent of the maximum laboratory dry density as defined in AASHTO T 99 to within one foot of the top of the wall. The top 12 inches shall be compacted to at least 100 percent of the maximum laboratory dry density.

vii. When erecting a battered wall, placement of backfill behind the wall shall closely follow erection of successive courses of units. At no time shall the difference in elevation between the backfill and the top of the last erected course exceed seven feet.

viii. The overall vertical tolerance of the wall shall not exceed 1/2 inch per 10 feet of wall as shown per plans.

ix. Underdrain, if required, shall be placed in accordance with the details shown on the plans or shop drawings.

x. Storm Drains: Where required, precast concrete wall units shall be provided with the appropriate storm drain openings cast into units at the appropriate elevation and locations indicated on drainage profiles. Catch basins shall be located so pipes will enter perpendicular (plan view) to the precast wall units or below the leveling footing as shown on the plans. Construction of catch basins and placement of storm drains must be coordinated with the bin wall construction.

xi. Cooperation between contractors: Contractors must coordinate all phases of the work to prevent delays and expedite construction.

xii. Dewatering: The Contractor shall furnish, install, operate, and maintain satisfactory dewatering systems as required to maintain the site in a dry and workable condition so as to permit grading and compaction of the wall foundation and proper erection and backfill of the wall. These systems shall include all equipment and materials, and shall be continued as long as necessary. No separate measurement or payment will be made for dewatering.

xiii. Technical Consultations: The fabricator will be required as a part of the contract to provide onsite technical expertise to the Contractor and/or the State upon request. Response to requests shall be required within five (5) days of the request. The cost of furnishing such technical consultations shall be at no cost to the State.

c. On Site Inspection

The quality of materials, the process of manufacture, and the finished member shall be subject to inspection and approval by the Engineer. Any bin wall units damaged prior to acceptance shall be repaired or reconstructed as directed by the Engineer. All costs of repairs or reconstruction shall be at the Contractor's expense.

## E. Gabion Wall

### 1. Description

This section covers the furnishing, assembling, filling with stone and tying open wire mesh rectangular compartmented gabions placed on filter cloth or filter stone as specified herein, and in reasonably close conformity with the lines, grades, dimensions, and cross-sections shown on the plans or as directed by the Engineer, and the design, working drawings, materials, construction, measurement and payment for gabions. Specific Gabion Wall Systems/manufacturers on the approved system list must be used.

### 2. Materials

a. Galvanized Steel Wire Mesh

Gabion basket units shall be of non-raveling construction and fabricated from a triple twisted hexagonal mesh of hot-dipped galvanized steel wire having a minimum diameter of 0.118 inches after galvanization. Gabion basket units may also be constructed of welded wire construction. The steel wire used shall be galvanized prior to fabrication into mesh. All gabion diaphragm and frame wire shall equal or exceed ASTM A 853, ASTM A 818, ASTM A 641, ASTM A 809, possess an average tensile strength of 60,000 PSI, and a Finish 5 Class 3 zinc coating of not less than 0.80 oz/sq. ft. of uncoated wire surface. The weight of zinc coating shall be as determined by AASHTO T 65 or ASTM A 90. The uniformity of coating shall equal or exceed four (4) one minute dips by the Preece Test, ASTM A 239. Mesh openings shall be hexagonal in shape, and uniform in size measuring not more than 3-1/4 inches by 4-1/2 inches.

Selvedge or perimeter basket frame wire shall be of heavier gauge than the wire mesh with a minimum diameter after galvanization of 0.1535 inches. Wire used for lacing or as internal connecting wire within basket cells shall meet the same specifications described above for the mesh wire, except that it may be of lighter gauge with a minimum diameter after galvanization of 0.0866 inches and the zinc coating shall not be less than 0.70 oz./sq. ft. When a P.V.C. coating is specified, all wire used in the fabrication of the gabions and in the wiring operations during construction shall, after zinc coating have extruded onto it a coating of poly vinyl chloride. The coating shall be grey in color of nominal thickness 0.02165 inches and shall nowhere be less than 0.015 inches in thickness. It shall be capable of resisting deleterious effects of natural weather exposure, immersion in salt water and shall not show any material difference in its initial characteristics.

b. Stone Fill

All stone fill shall be approved by the Engineer and shall be of suitable quality to ensure durability. When the stone is subjected to five alterations of sodium sulfate soundness testing, in accordance with AASHTO T-104, the weighted percentage of loss shall not be more than twelve percent. The inclusion of objectionable quantities of shale, dirt, sand, clay, rock fines, and other deleterious material will not be permitted. Stone fill shall be of well-graded mixture with sizes ranging between 4 inches and 10 inches in diameter, based on U.S. Standard square mesh sieves. No stone shall have minimum dimension less than 4 inches. Stone fill material selected for use in the gabions shall meet the minimum in-place density specified on the plans.

c. Filter Cloth

All filter cloth shall meet the applicable requirements of Section 918.27, Sub-Section 27, of the Standard Specifications.

d. Filter Stone

All filter stone shall meet the applicable requirements of Grading Size 68 or 57. See the Standard Specifications section 903.22.

**3. Construction**

a. Filter Cloth or Filter Stone

Upon final foundation preparation and acceptance by the Engineer, the filter cloth or filter stone shall be placed directly on the foundation at those locations shown on the plans or as directed by the Engineer. All end and side laps shall be a minimum of 18 inches for the filter cloth.

b. Assembly (Fabrication)

Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular baskets. Gabions shall be of single unit construction, i.e., the base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh. Gabion units shall be equally divided, by diaphragms of the same mesh and gauge as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. All perimeter edges of the mesh forming the gabion shall be securely selvedged so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh. Lacing wire or connecting wire shall be supplied in sufficient quantity for securely fastening all diaphragms and edges of the gabion.

c. Assembly (Field)

i. Empty gabion units shall be placed on the filter blanket when required on contract drawings and shall be assembled individually to the lines and grades indicated on the Plans. Or as directed by the Engineer, with the sides, ends, and diaphragms erected in such a manner to ensure the correct position. All adjoining empty gabion units must be connected by tie wire lacing along the perimeter of their contact surfaces in order to obtain a monolithic structure. Lacing of adjoining basket units shall be accomplished by continuous stitching with alternating single and double loops at intervals of not more than 5 inches. All lacing wire terminals shall be securely fastened. The use of expedient clip connections for this purpose or as final lid closing will not be permitted. After adjoining empty basket units are set to line and grade and common sides with adjacent units thoroughly laced, they shall be placed in tension and stretched to remove any kinks from the mesh and to a uniform alignment. The stretching of empty basket units shall be accomplished in such a manner as to prevent any possible unraveling and distortion.

ii. Stone filling operations shall carefully proceed with placement by hand or machine so as not to damage galvanized wire coating, to assure a minimum of voids between the stones, to prevent damage to the underlying filter blanket, and to ensure the maintenance of alignment throughout the filling process. The maximum height from which the stone may be dropped into the basket units shall be 36 inches. Along all exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to ensure a neat and compact appearance. The last layer of stone shall be leveled with the top of the gabions to allow for the proper closing of the lid and to provide an even surface that is uniform in appearance.

iii. Lids shall be stretched tight over the stone fill using crowbars or lid closing tools until the lid meets the perimeter edges of the front and end panels. The lid shall then be tightly laced with tie wire along all edges, ends and internal cell diaphragms by continuous stitching with alternating single and double loops at intervals of not more than 5 inches. Special attention shall be given to see that all projections or wire ends are turned into the baskets. Where shown on the drawings or as directed by the Engineer, or where a complete gabion unit cannot be installed because of space limitations, the basket unit shall be cut, folded and wired together to suit existing site conditions. The mesh must be cleanly cut and the surplus mesh cut out completely or folded back and neatly wired to an adjacent gabion face. The assembling, installation, filling, lid closing, and lacing of the reshaped gabion units shall be carried out as specified above.

d. Backfill

Backfilling of the gabion wall shall follow erection as closely as possible and in no case should the height of the wall be greater than seven feet above the backfill. Underdrains, if required, shall be placed in accordance with the details shown on plans. Gabion walls backfill shall have a density of 100 pounds per cubic foot or as specified on contract plans and shall be compacted to at least 95 percent of the maximum laboratory dry density as defined in AASHTO T 99 to within one foot of the top of the wall. The top 12 inches shall be compacted to at least 100 percent of the maximum laboratory dry density. The backfill material shall consist of broken or crushed stone, gravel, sand, slag or other suitable coarse granular material to insure proper drainage. Shale, clay or cinders shall not be permitted as backfill material. Prior to placement, the backfill material must be approved by the Engineer. The Contractor shall furnish, install, operate, and maintain satisfactory dewatering system as required to maintain the site in a dry and workable condition so as to permit grading and compaction of the wall foundation and proper erection and backfill of the wall. These systems shall include all equipment and materials, and shall be continued as long as necessary. No separate measurement or payment will be made for dewatering or dewatering systems.

All backfill material shall be tested prior to use and at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

e. Vertical Wall Tolerance

The overall vertical tolerance of the wall (plumbness from top to bottom) shall not deviate more than ½ inch per 10 feet of wall height from the contract drawings batter of the wall.

f. On Site Inspection

The quality of materials, the process of manufacture, and the finished members shall be subject to inspection and approval by the Engineer. Any gabions damaged prior to acceptance shall be repaired or reconstructed as directed by the Engineer. All costs of repairs or reconstruction shall be at the Contractor's expense.

## F. Segmental, Precast Facing Mechanically Stabilized Earth (MSE) Wall

### 1. Materials

General - The Contractor shall make arrangements to purchase or manufacture the facing elements, reinforcing mesh or strips, attachment devices, joint filler, and all other necessary components. Materials not conforming to this section or the Standard Specifications or from sources not listed in the contract document shall not be used without written consent from the Engineer.
Out-of-state producers shall provide documentation of material quality before the manufacture of any pre-cast products (i.e. aggregate quality reports, cement/steel mill test reports, etc

a. Reinforced Concrete Facing Panels - The panels shall be fabricated in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels."

i. Acceptability of the precast units will be determined on the basis of compressive strength tests, production tolerances, and visual inspection. The Contractor, or the supplier, shall furnish facilities and perform all necessary sampling and testing in an expeditious and satisfactory manner as directed by the Engineer.

ii. The Portland cement shall be types 1, 2, or 3 and shall conform to the requirements of AASHTO M 85 (ASTM C 150). Concrete for precast panels shall be Class D (4000 psi) as specified in Section 604 of the TDOT Standard Specifications. Admixtures containing chlorides shall not be used.

iii. The panels shall be cast using steel forms. The front face of the panel (face exposed to view when installed in the wall) shall be cast against a steel form or architectural form liner. The back face is to be float finished. The concrete in each panel shall be placed without interruption and shall be consolidated by the use of an approved vibrator, supplemented by such hand tamping as may be necessary to force the concrete into the corners of the forms and prevent the formation of stone pocket or cleavage planes. Clear form oil of the same type shall be used throughout the casting operation.

iv. Unless otherwise indicated on the plans or elsewhere in the Standard Specifications, the concrete surface for the front face shall have a Class 1 finish as defined by Section 8.12 of AASHTO, Division II, and for the rear face a uniform surface finish. The rear face of the panel shall be float finished sufficiently to eliminate open aggregate pockets and surface distortions in excess of 1/4 inch. The panels shall be cast on a flat area. The strips or other galvanized attachment devices shall not contact or be attached to the face panel reinforcement steel.

v. Curing and forms removal shall be in accordance with the requirements of Section 604.20 and 604.24 of the Standard Specifications, unless otherwise approved by the Engineer. The forms shall remain in place until they can be removed without damage to the panel.

vi. The units shall be fully supported until the concrete reaches a minimum compressive strength of 1000 psi. The units may be shipped after reaching a minimum specified compressive strength of 4000 psi. TDOT will verify products before shipment in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall

panels, and Retaining wall panels". If products are manufactured out of state, TDOT may verify at the project site PRIOR to the placement of the units. The Contractor, or producer, shall notify the Regional Materials and Tests Division that products need to be verified.

vii. Marking - The date of manufacture, the production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.

viii. Handling, Storage, and Shipping - All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Panels damaged during handling or storage at the casting plant shall be repaired at the plant as directed by the Engineer. Any panels damaged during handling, storing, or shipping may be rejected upon delivery at the option of the Engineer. Panels in storage shall be supported in firm blocking located immediately adjacent to embedded connection devices to avoid bending the connection devices.

ix. Tolerances - All units shall be manufactured within the following tolerances:

- Panel Dimensions - Position panel connection devices within 1 inch, except for all other dimensions within 3/16 inch.
- Panel Squareness - Squareness as determined by the difference between the two diagonals shall not exceed 1/2 inch.
- Angular distortion with regard to the height of the panel shall not exceed 3/16 inch in 5 feet.
- Panel Surface Finish - Surface defects on smooth formed surfaces measured over a length of 5 feet shall not exceed 1/8 inch. Surface defects on the textured-finish surfaces measured over a length of 5 feet shall not exceed 5/16 inch.

x. Steel - In accordance with the Standard Specifications.

xi. Compressive Strength - Acceptance of the concrete panels, with respect to compressive strength, will be determined on the basis of production lots. A production lot is defined as a group of panels that will be represented by a single compressive strength sample and will consist of a single day's production as defined in the certify in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels".

xii. During the production of the concrete panels, the Engineer will sample the concrete in accordance with AASHTO T 141 (ASTM C 172). A single compressive strength sample, consisting of a

minimum of six (6) cylinders, will be randomly selected for every production lot.

xiii. Cylinders for compressive strength tests shall be prepared in accordance with AASHTO T 23 (ASTM C 31) on 6" x 12" or 4” x 8” specimens. For every compressive strength sample, a minimum of two (2) cylinders will be cured in the same manner as the panels and tested for acceptance no later than twenty-eight (28) days. The average compressive strength of these two cylinders, when tested according with AASHTO T 22 (ASTM C 39), will determine the compressive strength of the production lot.

xiv. If the Contractor wishes to remove forms or ship the panels prior to 28 days, a minimum of two (2) additional cylinders will be cured in the same manner as the panels. The average compressive strength of these cylinders when tested in accordance with AASHTO T 22, will determine whether the forms can be removed and the panels are acceptable.

xv. Acceptance of a production lot will be made if the compressive strength test result is greater than or equal to 4,000 psi when tested for acceptance no later than 28 days.

xvi. In the event that a production lot fails to meet the specified compressive strength requirements, the production lot shall be rejected. Such rejection shall prevail unless the manufacturer, at their own expense, obtains and submits cores for testing and the results show that the strength and quality of the concrete placed within the panels of the production lot is acceptable. The cores shall be taken from the panels within the production lot and tested in accordance with the specifications of AASHTO T 24 (ASTM C 42). Two cores per each cylinder that failed will be required. In addition, any or all of the following defects shall be sufficient cause for rejection:

- Defects that indicate imperfect molding.
- Defects indicating honeycombing or open texture concrete.
- Defects in the physical characteristics of the concrete such as cracked or severely chipped panels.
- Color variation on front face of panel due to excess form oil or other reasons.
- Damage due to handling, storing or shipping.

xvii. The Engineer shall determine whether spalled, honeycombed, chipped or otherwise defective concrete shall be repaired or rejected. Repair of concrete, if allowed, shall be done with a TDOT approved cementitious polymer patching mortar in a manner satisfactory to the Engineer. Repair to concrete surfaces

that will be exposed to view after completion of construction must be approved by the Engineer.

b. Soil Reinforcing and Attachment Devices - All reinforcing and attachment devices shall be shop fabricated and carefully inspected to ensure they are true to size and free from defects that may impair their strength and durability.

i. Reinforcing Strips - Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to either AASHTO M 183 (ASTM A 36) or AASHTO M 223 (ASTM A 572) grade 65 or equal. Galvanization shall conform to the minimum requirements or AASHTO M 111 (ASTM A 123).

ii. Tie Strips - The tie strips shall be shop- fabricated of a hot rolled steel conforming to the minimum requirements of ASTM 570, Grade 50 or equivalent. Galvanization shall conform to AASHTO M 111 (ASTM A 123). Tie straps may be partially bent before shipment to the precast yard. Minimum bending radius shall be one inch. Final bending may be accomplished at the precast yard.

iii. Reinforcing Mesh - Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of AASHTO M 32 (ASTM A 82) and shall be welded into the finished mesh fabric in accordance with AASHTO M 55 (ASTM A 185). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of AASHTO M 111 (ASTM A 123).

iv. Fasteners - Fasteners shall be high strength hexagonal cap screw bolts and nuts conforming to AASHTO M 164 (ASTM A 325). Galvanizing fastener elements, including washers, shall be in accordance with AASHTO M 232 (ASTM A 153). Bolts and nuts nominal diameter will be shown in the plans and supplied in accordance with the fasteners as specified previously.

v. Steel Strap Connections - The steel strap connection bar and plate shall meet the same requirements as the reinforcing and tie strips specified above. Bolts, nuts, and washers shall conform to the requirements for the fasteners specified above. Coatings for connecting devices shall be as specified below.

vi. Clevis Loop and Mesh Loop - Clevis loops and mesh loops shall be fabricated of cold drawn steel wire conforming to the requirements of AASHTO M 32 (ASTM A 82) and welded in accordance with AASHTO M 55 (ASTM A 185) and shall develop a minimum stress of 0.9 $F_y$.

vii. Connector Bar - Connector bar shall be fabricated of cold drawn steel wire conforming to the requirements of AASHTO M 32 (ASTM A 82).

viii. Holes for bolts shall be punched in the location shown. Surfaces resulting from punching holes for bolts shall be galvanized in accordance with AASHTO M 111 (ASTM A 123). Those parts of the connecting devices which are threaded shall be galvanized in accordance with AASHTO M 232 (ASTM A 153). Alignment pins are to be hot dip galvanized.

ix. All connecting devices shall be to the dimensions shown on the plans. Connecting members and soil reinforcement devices shall be assembled prior to galvanization. All connecting devices shall be true to size and free from defects that may impair their strength or durability.

x. Any damage sustained to any part of the connecting devices, bolts or reinforcing devices during any phase of fabrication, storage or erection shall be repaired to the satisfaction of the Engineer at no increase in contract cost.

c. Geosynthetic Reinforcement Material - Where geosynthetic reinforcements are used for the construction of MSE walls the following requirements shall apply:

i. Geotextiles and Thread for Sewing - Woven or nonwoven geotextiles shall consist only of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the long chain polymer shall be polyolefin or polyester. The material shall be free of defects and tears. The geotextile shall conform as a minimum to the properties indicated for Separation, Medium Survivability indicated under AASHTO T 288. The geotextile shall be free from any treatment or coating that might adversely alter its physical properties after installation.

ii. Geogrids - The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation.

iii. Required Properties - The specific geosynthetic material(s) shall be preapproved by the Department and shall have certified long-term strength ($T_{al}$) as determined by:

- Long-Term strength ($T_{al}$) based on $T_{al}= T_{ULT}/(RF_D)*(RF_{ID})*(RF_{CR})$ where $RF_{CR}$ is developed from

creep tests performed in accordance with ASTM D 5262, $RF_{ID}$ obtained from site installation damage testing and $RF_{ID}$ from hydrolysis or oxidative degradation testing extrapolated to 75 or 100 year design life.

- Ultimate Strength (TULT) based upon minimum average roll values (MARV) (lb/ft), ASTM D4595.
- Pullout Resistance Factor developed in accordance with Chapter 3 of chapter 3 of FHWA-SA-96-071.

iv. Certification - The Contractor shall submit a manufacturer's certification that the geosynthetics supplied meet the respective index criteria set when the geosynthetic was approved by the Department, measured in full accordance with all test methods and standards specified and as set forth in this document.

The manufacturer's certificate shall state that the furnished geosynthetic meets the requirements of this document as evaluated by the manufacturer's quality control program. The certificates shall be attested to by a person having legal authority to bond the manufacturer. In case of dispute over validity of value, the Engineer can require the Contractor to supply test data from a Department approved laboratory to support the certified values submitted.

v. Manufacturing Quality Control: The geosynthetic reinforcement shall be manufactured with a high degree of quality control. The manufacturer is responsible for establishing and maintaining a quality control program to ensure compliance with the requirements of this document. The purpose of the QC testing program is to verify that the reinforcement geosynthetic being supplied to the project is representative of the material used for performance testing and approval by the Department.

Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum, the following index tests shall be considered as applicable for an acceptable QA/QC program:

| **Property** | **Test Procedure** |
|---|---|
| Specific Gravity (HDPE only) | ASTM D 1505 |
| Wide Width Tensile | ASTM D 4595; GRI:GG1 |
| Melt Flow (HDPE and PP only) | ASTM D 1238 |
| Intrinsic Viscosity (PET only) | ASTM D 4603 |
| Carboxyl End Group (PET only) | ASTM D 2455 |

vi. Sampling, Testing, and Acceptance - Sampling and conformance testing shall be in accordance with ASTM D 4354. Conformance testing procedures shall be as established under 4.3.5. Geosynthetic product acceptance shall be based on ASTM D 4759.

The quality control certificate shall include:

- Roll numbers and identification
- Sampling procedures
- Result of quality control tests, including a description of test methods used

vii. Select Granular Backfill Material - The backfill material shall conform to the requirements set forth in Section F.1.e. except that the maximum size of the backfill shall be 3/4 inch, unless full scale installation damage tests are conducted in accordance with ASTM D 5818.

d. Joint Materials - Installed to the dimensions and thicknesses in accordance with the plans or approved shop drawings.

i. If required, provide flexible foam strips for filler for vertical joints between panels, and in horizontal joints where pads are used, where indicated on the plans.

ii. Provide in horizontal joints between panels preformed EPDM rubber pads conforming to ASTM D 2000 for 4AA, 812 rubbers, neoprene elastomeric pads having a Durometer Hardness of 55 ± 5, or high density polyethylene pads with a minimum density of 59 $lb/ft^3$ in accordance with ASTM D 1505.

iii. Cover all joints between panels on the back side of the wall with a geotextile meeting the minimum requirements for filtration applications as specified by AASHTO M 288. The minimum width and lap shall be 12 inches. Adhesive used to attach the filter fabric to the back of the panels shall be approved by the wall supplier.

e. Select Granular Backfill Material - All backfill material used in the Mechanically Stabilized Earth structure volume, as shown on the plans, shall be reasonably free (maximum of 0.1%) from organic and otherwise deleterious materials, and it shall be approved by the Engineer prior to use. The material shall conform to the following gradation limits and be tested at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)". The Contractor shall also provide test data from an approved laboratory certifying that the material meets the following:

i. Gradation as determined by AASHTO T 27.

| Sieve Size | Percent Passing |
|---|---|
| 4 inches | 100 |

| | |
|---|---|
| 3/8 inch | 0-75 |
| No. 4 | 0-25 |
| No. 8 | 0-10 |
| No. 16 | 0-5 |

Note: Size Nos. 1 through 78 as listed in order of Table 1 Standard Sizes of Processed Aggregate in Section 903.22 of Standard Specifications meet the above gradation requirements.

ii. In addition, the backfill must conform to all of the following requirements:

- Soundness - The material shall be substantially free from shale or other soft, poor durability particles. The material shall have a sodium sulfate loss of less than 12 percent after five (5) cycles determined in accordance with AASHTO T 104.
- The material shall exhibit an angle of internal friction of not less than 34 degrees as determined by the standard direct shear test AASHTO T 236 on the portion finer than the No. 4 sieve, using a sample of the material compacted to 95 percent of AASHTO T 99. No testing is required for backfills where 80 percent of sizes are greater than 3/8 inch.
- Electrochemical requirements - The backfill shall meet the following criteria:

| **REQUIREMENTS** | **TEST METHOD** |
|---|---|
| ph = 5-10 | AASHTO T 289 – 91 |
| Resistivity > 3000 ohm centimeters[1] | AASHTO T 288 – 91 |
| Chlorides < 100 parts per million | AASHTO T 291 – 91 |
| Sulfates < 200 parts per million | AASHTO T 290 – 91 |
| Organic Content < 1 % | AASHTO T 267 – 86 |

1. If the resistivity is greater or equal to 5000 ohm centimeters the chloride and sulfates requirements may be waived.

- Unit weight- The unit weight of the backfill material (at optimum condition) shall meet the requirements of the approved shop drawings or plans.

f. Concrete Leveling Pad, Traffic Barrier and Coping - The concrete shall conform to the requirements of the Standard Specifications for Class A concrete.

g. Acceptance of Material - The Contractor shall furnish the Engineer a Certificate of Compliance certifying the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to assure contract compliance shall be furnished to the Engineer.

Acceptance will be based on the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

**2. Construction**

a. Foundation Preparation - The foundation for the MSE wall shall be graded level for a minimum width equal to the width of the reinforced volume and leveling pad plus one (1) foot, or as shown on the plans, using the top of the leveling pad as the grade elevation. Prior to wall construction, the foundation shall be compacted to 95 percent of optimum density, as directed by the Engineer. Any foundation soils found to be unsuitable shall be removed as directed by the Engineer and replaced with select granular backfill material compacted to 95 percent of AASHTO T 99. The contractor shall conduct any ground improvements required by the contract plans as part of foundation preparation.

At each panel foundation level, a precast reinforced or a cast-in-place unreinforced concrete leveling pad of the type shown on the plans shall be provided. The concrete shall be Class "A" concrete with compressive strength of 3000 psi (28 day strength). The leveling pad shall be cured a minimum of 12 hours before placement of wall panels.

b. Wall Erection - Where a proprietary wall system is used, a field representative shall be available during the erection of the wall to assist the fabricator, Contractor, and Engineer. If there is more than one wall of the same type on the project, this requirement will apply to construction of the initial wall only. After construction of the initial wall, the representative will be available on an as-needed basis, as requested by the Engineer, during construction of the remainder of the walls. Wall erection shall be in conformance with the latest edition of the MSE wall construction manual as published by the wall supplier. For erection, panels are handled by means of a lifting device set into the upper edge of the panel. Precast concrete panels shall be placed such that a final vertical face will be obtained.

It shall be the responsibility of the Contractor to consult with the designer/supplier and to utilize the proper methods necessary to achieve a vertical face for the final wall. Panels should be placed in successive horizontal lifts as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations. External bracing shall also be required for this initial lift. The wedges shall remain in place until the fourth layer of panels is placed, at which time the bottom layer of wedges shall be removed. Each

succeeding layer of wedges shall be removed as the succeeding panel layers are placed. When the wall is completed, all wedges shall be removed. No wedges shall be used as a means of leveling panels on leveling pads. Wedges placed below the ground line on the front face of the wall shall be removed before this area is backfilled.

Tolerances and alignment shall be as follows:

i. Horizontal and vertical joint openings between panels shall be uniform. The maximum allowable offset in any panel joint shall be 3/4 inch.

ii. Vertical tolerance (plumbness) and horizontal alignment tolerances as the wall is constructed shall not exceed 3/4 inch when measured along a 10 foot straightedge.

The overall vertical tolerance of the wall (plumbness from top to bottom) in its final position shall not exceed 3/4 inch per 10 feet of wall height.

Cast-in-place concrete shall be placed on top of wall panels to allow precast coping elements on top of the wall to be brought to proper grade.

Prior to placing any select backfill material on any soil reinforcement device, all connections to the panels shall be completed.

c. Backfill Placement - Backfill placement shall closely follow the erection of each lift of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials including panels, soil reinforcements, and connections, or misalignment of the facing panels or reinforcing elements. Any wall materials which may become damaged or disturbed during backfill placement, or due to wall settlement prior to completion of the project shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this section shall be corrected, as directed by the Engineer at the Contractor's expense. Backfill placement methods near the facing shall assure that no voids exist directly beneath the reinforcing elements.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T 99. When the backfill supports a spread footing of a bridge or other structural load, the top 5 feet shall be compacted to 100 percent of the maximum density. For backfills containing more than 30 percent retained on the ¾ inch sieve, a method compaction consisting of a minimum of 2 passes of a steel drum roller or truck equipment equivalent or larger than a Caterpillar D-6 Bulldozer shall be used.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall be placed at a moisture content not more than 2 percentage points less than or equal to the optimum moisture content. Backfill

material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 99.

At each soil reinforcement device level, backfill shall be compacted to the full length of reinforcement devices and be sloped to drain away from the wall before placing and attaching the next layer of reinforcement devices. The compacted backfill shall be level with the connecting device before the reinforcement device can be connected. Compaction within three feet of the back face of the wall facing panel shall be achieved with at least three (3) passes of a light weight mechanical tamper, roller, or vibratory system.

Unless otherwise indicated on the plans or directed by the Engineer, soil reinforcement devices shall be placed at 90 degrees to the face of the wall. The maximum lift thickness before compaction shall be ten (10) inches and shall closely follow panel erection. The Contractor shall decrease this lift thickness, if required, to obtain the specified density.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to rapidly direct runoff or rainwater away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

## G. Prefabricated Modular Block Facing Mechanically Stabilized Earth (MSE) Wall

### 1. Materials

General - The contractor shall make arrangements to purchase or manufacture the facing elements, reinforcing mesh or strips, attachment devices, joint filler, and all other necessary components. Materials not conforming to this section or from sources not listed in the contract document shall not be used without written consent from the Engineer.

a. Concrete Modular Block Facing - The concrete modular blocks shall be either hollow or solid concrete structural retaining wall units, machine made from Portland cement, water, and mineral aggregates with or without the inclusion of other materials. The units are intended for use in the construction of mortarless, modular block retaining (MBW) walls.

i. Cementious Materials - Materials shall conform to the following:

- Portland Cement - AASHTO M 85 (ASTM C 150).
- Blended Cements – Type IP -AASHTO M 240 (ASTM C 595).
- Pozzolans – Class C or Class F fly ash -AASHTO M 295 Blast Furnace Slag Cement – grade 100 or 120- AASHTO M 302 (ASTM C 989).

ii. Aggregates - Aggregates shall conform to the following specifications, except that grading requirements shall not necessarily apply:

- Normal Weight Aggregates – TDOT Standard Specification sections 903.01 and 903.03.
- Lightweight Aggregates - TDOT Standard Specification section 903.19.

iii. Other Constituents - Air-entraining agents, coloring pigments, integral water repellants, finely ground silica, and other constituents shall be previously established as suitable for use in concrete MBW units and shall conform to applicable AASHTO Standards or, shall be shown by test or experience to be not detrimental to the durability of MBW units or any material customarily used in masonry construction.

iv. Physical Requirements. Prior to delivery to the work site, the units shall conform to the following physical requirements:

1. Minimum required compressive strength = 4,000 psi (Average 3 coupons)
2. Minimum required compressive strength = 3,500 psi (Individual coupon)
3. Maximum water absorption = 5%
4. Maximum number of blocks per lot = 2,000

Also, prior to delivery, TDOT will conduct verification testing on the modular blocks in accordance with the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)

If products are manufactured out of state, TDOT may verify at the project site PRIOR to the placement of the units. The Contractor, or producer, shall notify the Regional Materials and Tests Division that products need to be verified.

v. Tolerances. Blocks shall be manufactured within the following tolerances:

- The length and width of each individual block shall be within 1/8 inch of the specified dimension. Hollow units shall have a minimum wall thickness of 1-1/4 inch.
- The height of each individual block shall be within 1/16 inch of the specified dimension.
- When a broken face finish is required, the dimension of the front face shall be within 1 inch of the theoretical dimension of the unit.

- Finish and Appearance. All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the construction. Minor cracks (e.g. no greater than 1/32 inch in width and no longer than 25 % of the unit height) incidental to the usual method of manufacture or minor chipping resulting from shipment and delivery, are not grounds for rejection.

  The face or faces of units that are to be exposed shall be free of chips, cracks or other imperfections when viewed from a distance of 30 feet under diffused lighting. Up to five (5) percent of a shipment may contain slight cracks or small chips not larger than 1 inch.

  Color and finish shall be as shown on the plans and shall be erected with a running bond configuration.

- If pins are required to align MBW units, they shall consist of a nondegrading, polymer or galvanized steel and be made for the express use with the MBW units supplied.

- Cap units shall be cast to or attached to the top MBW units in strict accordance with the manufacturer's requirements and the adhesive manufacturer's recommended procedures. The Contractor shall provide a written 10 year warranty acceptable to the Department that the integrity of the materials used to attach the cap blocks will preclude separation and displacement of the cap blocks for the warranty period.

vi. Sampling and Testing. Acceptance of the concrete block with respect to compressive strength and absorption, will be determined on a lot basis. The lot will be randomly sampled in accordance with ASTM C 140. Compressive strength and absorption tests shall be performed by the manufacturer and submitted to the Department. Compressive strength test specimens shall be cored or shall conform to the saw-cut coupon provisions of section 6.2.4 of ASTM C 140. Blocks represented by test coupons that do not reach an average compressive strength of 4,000 psi or an individual strength of 3500 psi, or have less than 5 % absorption will be rejected.

vii. Rejection. Blocks shall be rejected because of failure to meet any of the requirements specified above. In addition, any or all of the following defects shall be sufficient cause for rejection.

- Defects that indicate imperfect molding.

- Defects indicating honeycomb or open texture concrete.

- Cracked or severely chipped blocks.

- Color variation on front face of block due to excess form oil or other reasons.

Blocks may also be rejected if TDOT verification test results do not comply with the requirements specified above.

b. Unit Fill - The unit fill and drainage aggregate shall be a well graded crushed stone or granular fill meeting the following gradation:

| **U.S. Sieve Size** | **Percent Passing** |
|---|---|
| 1 inch | 100-75 |
| 3/4 inch | 50-75 |
| No. 4 | 0-60 |
| No. 40 | 0-50 |
| No. 200 | 0-5 |

c. Geosynthetic Reinforcement Material - The following requirements shall apply for geosynthetic reinforcement material:

i. Geotextiles and Thread for Sewing - Woven or nonwoven geotextiles shall consist only of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the long chain polymer shall be polyolefin or polyester. The material shall be free of defects and tears. The geotextile shall conform as a minimum to the properties indicated for Separation, Medium Survivability indicated under AASHTO T 288. The geotextile shall be free from any treatment or coating that might adversely alter its physical properties after installation.

ii. Geogrids - The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation.

iii. Required Properties - The specific geosynthetic material(s) shall be pre-approved by the Department and shall have certified long-term strength ($T_{al}$) as determined by:

- Long-Term strength ($T_{al}$) based on $T_{al} = T_{ult}/(RF_D)*(RF_{ID})*(RF_{CR})$ where $RF_{CR}$ is developed from creep tests performed in accordance with ASTM D 5262, $RF_{ID}$ obtained from site installation damage testing and $RF_{ID}$

from hydrolysis or oxidative degradation testing extrapolated to 75 or 100 year design life.

- Ultimate Strength ($T_{ULT}$) based upon minimum average roll values (MARV) (lb/ft), ASTM D4595.
- Pullout Resistance Factor developed in accordance with chapter 3 of FHWA-SA-96-071.

iv. Certification - The Contractor shall submit a manufacturer's certification that the geosynthetics supplied meet the respective index criteria set when the geosynthetic was approved by the Department, measured in full accordance with all test methods and standards specified and as set forth in this section of the TDOT Earth Retaining Structures Manual. The manufacturer's certificate shall state that the furnished geosynthetic meets the requirements of this document as evaluated by the manufacturer's quality control program. The certificates shall be attested to by a person having legal authority to bond the manufacturer. In case of dispute over validity of values, the Engineer can require the Contractor to supply test data from a Department approved laboratory to support the certified values submitted.

v. Manufacturing Quality Control: The geosynthetic reinforcement shall be manufactured with a high degree of quality control. The manufacturer is responsible for establishing and maintaining a quality control program to ensure compliance with the requirements of the TDOT Earth Retaining Structures Manual. The purpose of the QC testing program is to verify that the geosynthetic being supplied to the project is representative of the material used for performance testing and approval by the Department.

Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum the following index tests shall be considered as applicable for an acceptable QA/QC program:

| **Property** | **Test Procedure** |
|---|---|
| Specific Gravity (HDPE only) | ASTM D 1505 |
| Wide Width Tensile | ASTM D 4595; GRI:GG1 |
| Melt Flow (HDPE and PP only) | ASTM D 1238 |
| Intrinsic Viscosity (PET only) | ASTM D 4603 |
| Carboxyl End Group (PET only) | ASTM D 2455 |

vi. Sampling, Testing, and Acceptance - Sampling and conformance testing shall be in accordance with ASTM D 4354. Conformance testing procedures shall be as established under section 4.3.5. Geosynthetic product acceptance shall be based on ASTM D 4759.

The quality control certificate shall include:

- Roll numbers and identification
- Sampling procedures
- Result of quality control tests, including a description of test methods used.

vii. Select Granular Backfill Material - The backfill material shall conform to the requirements set forth in Section G. 1.e. except that the maximum size of the backfill shall be 3/4 inch, unless full scale installation damage tests are conducted in accordance with ASTM D 5818.

All backfill material shall be tested prior to use and at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)".

d. Soil Reinforcing and Attachment Devices - Where steel reinforcing and attachment devices are used in the construction of the MSE wall the following requirements shall apply.

i. Reinforcing Strips - Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to either AASHTO M 183 (ASTM A 36) or AASHTO M 223 (ASTM A 572) grade 65 or equal. Galvanization shall conform to the minimum requirements or AASHTO M 111 (ASTM A 123).

ii. Tie Strips - The tie strips shall be shop-fabricated of hot rolled steel conforming to the minimum requirements of ASTM A 570, Grade 50 or equivalent. Galvanization shall conform to AASHTO M 111. Tie straps may be partially bent before shipment to the precast yard. Minimum bending radius shall be one inch. Final bending may be accomplished at the precast yard.

iii. Reinforcing Mesh - Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of AASHTO M 32 (ASTM A 82) and shall be welded into the finished mesh fabric in accordance with AASHTO M 55 (ASTM A 185). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of AASHTO M 111

iv. Fasteners - Fasteners shall be high strength hexagonal cap screw bolts and nuts conforming to AASHTO M 164 (ASTM A 325).

Galvanizing fastener elements, including washers, shall be in accordance with AASHTO M 232 (ASTM A 153). Bolts and nuts nominal diameter will be shown in the plans and supplied in accordance with the fasteners as specified previously.

v. Steel Strap Connections - The steel strap connection bar and plate shall meet the same requirements as the reinforcing and tie strips specified above. Bolts, nuts, and washers shall conform to the requirements for the fasteners specified above. Coatings for connecting devices shall be as specified below.

vi. Clevis Loop and Mesh Loop - Clevis loops and mesh loops shall be fabricated of cold drawn steel wire conforming to the requirements of AASHTO M 32 and welded in accordance with AASHTO M 55 and shall develop a minimum stress of 0.9 $F_y$.

vii. Connector Bar - Connector bar shall be fabricated of cold drawn steel wire conforming to the requirements of AASHTO M 32.

Holes for bolts shall be punched in the location shown. Surfaces resulting from punching holes for bolts shall be galvanized in accordance with AASHTO M 111. Those parts of the connecting devices which are threaded shall be galvanized in accordance with AASHTO M 232. Alignment pins are to be hot dip galvanized.

All connecting devices shall be to the dimensions shown on the plans. Connecting members and soil reinforcement devices shall be assembled prior to galvanization. All connecting devices shall be true to size and free from defects that may impair their strength or durability.

Any damage sustained by any part of the connecting devices, bolts or reinforcing devices during any phase of fabrication, storage or erection shall be repaired to the satisfaction of the Engineer at no increase in contract cost.

e. Select Granular Backfill Material - All backfill material used in the Mechanically Stabilized Earth structure volume, as shown on the plans, shall be reasonably free (maximum of 0.1%) from organic and otherwise deleterious materials, and it shall be approved by the Engineer prior to use. The material shall conform to the following gradation limits and be tested at the established frequencies in the TDOT "Procedures for the Sampling and Testing, and Acceptance of Materials and Products (SOP 1-1)". The Contractor shall also provide test data from an approved laboratory certifying that the material meets the following:

i. Gradation as determined by AASHTO T 27.

| Sieve Size | Percent Passing |
|---|---|
| 4 inches | 100 |
| 3/8 inch | 0-75 |

| | |
|---|---|
| No. 4 | 0-25 |
| No. 8 | 0-10 |
| No. 16 | 0-5 |

Note: Size Nos. 1 through 78 as listed in order of Table 1 Standard Sizes of Processed Aggregate in Section 903.22 of Standard Specifications meet the above gradation requirements.

ii. In addition, the backfill must conform to all of the following requirements:

- Soundness - The material shall be substantially free from shale or other soft, poor durability particles. The material shall have a sodium sulfate loss of less than 12 percent after five (5) cycles determined in accordance with AASHTO T 104.
- The Plasticity Index (P.I.), as determined by AASHTO T 90, shall not exceed 6.
- The material shall exhibit an angle of internal friction of not less than 34 degrees as determined by the standard direct shear test AASHTO T 236 on the portion finer than the No. 4 sieve, using a sample of the material compacted to 95 percent of AASHTO T 99. No testing is required for backfills where 80 percent of sizes are greater than 3/8 inch.
- Electrochemical requirements - The backfill shall meet the following criteria:

| **REQUIREMENTS** | **TEST METHOD** |
|---|---|
| ph= 5-10 | AASHTO T 289 – 91 |
| Resistivity > 3000 ohm centimeters[1] | AASHTO T 288 – 91 |
| Chlorides < 100 parts per million | AASHTO T 291 – 91 |
| Sulfates < 200 parts per million | AASHTO T 290 – 91 |
| Organic Content < 1% | AASHTO T 267 – 86 |

1. If the resistivity is greater or equal to 5000 ohm centimeters the chloride and sulfates requirements may be waived.

- Unit weight- The unit weight of the backfill material (at optimum condition) shall meet the requirements of the approved shop drawings or plans.

f. Concrete Leveling Pad, Traffic Barrier and Coping - The concrete shall conform to the requirements of the Standard Specifications for Class A concrete.

g. Acceptance of Material - The contractor shall furnish the Engineer a Certificate of Compliance certifying the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to assure contract compliance shall be furnished to the Engineer.

**2. Construction**

a. Wall Excavation - Unclassified excavation shall be in accordance with the requirements of the Standard Specifications and in reasonably close conformity with the limits and construction lines shown on the plans. Temporary excavation support as required shall be the responsibility of the Contractor.

b. Foundation Preparation - The foundation for the MSE wall shall be graded level for a minimum width equal to the width of the reinforced volume and leveling pad plus one (1) foot, or as shown on the plans, using the top of the leveling pad as the grade elevation. Prior to wall construction, the foundation shall be compacted to 95 percent of optimum density, as directed by the Engineer. Any foundation soils found to be unsuitable shall be removed as directed by the Engineer and replaced with select granular backfill material compacted to 95 percent of AASHTO T 99 methods. The contractor shall conduct any ground improvement required by the contract plans as part of foundation preparation.

At each block foundation level, a precast reinforced or a cast-in-place unreinforced concrete leveling pad of the type shown on the plans shall be provided. The concrete shall be Class A concrete with compressive strength of 3000 psi (28 day strength). The leveling pad shall be cured a minimum of 12 hours before placement of wall panels.

c. Wall Erection - Where a proprietary wall system is used, a field representative shall be available during the erection of the wall to assist the fabricator, Contractor, and Engineer. If there is more than one wall of the same type on the project, this requirement will apply to construction of the initial wall only. After the initial wall, the representative will be available on an as-needed basis, as requested by the Engineer, during construction of the remainder of the walls. Wall erection shall be in conformance with the latest edition of the MSE wall construction manual as published by the wall supplier.

It shall be the responsibility of the Contractor to consult with the designer/supplier and to utilize the proper methods necessary to achieve a

vertical face for the final wall. Blocks should be placed in successive horizontal lifts as backfill placement proceeds per the manufacturer's recommendations.

Cast-in-place concrete shall be placed on top of wall panels to allow precast coping elements on top of the wall to be brought to proper grade.

Prior to placing any select backfill material on any soil reinforcement device, all connections to the blocks shall be completed.

d. Backfill Placement - Backfill placement shall closely follow the erection of each lift of blocks. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials including blocks, soil reinforcements, and connections, or misalignment of the facing blocks or reinforcing elements. Any wall materials which may become damaged or disturbed during backfill placement, or due to wall settlement prior to completion of the project shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any misalignment or distortion of the wall facing blocks due to placement of backfill outside the limits of this section shall be corrected, as directed by the Engineer. Backfill placement methods near the facing shall assure that no voids exist directly beneath the reinforcing elements.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T 99. When the backfill supports a spread footing of a bridge or other structural load, the top 5 feet shall be compacted to 100 percent of the maximum density. For backfills containing more than 30 percent retained on the ¾ inch sieve, a method compaction consisting of a minimum of 2 passes of a steel drum roller or tracked equipment equivalent or larger than a Caterpillar D-6 Dozer shall be used.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 99.

At each soil reinforcement device level, backfill shall be compacted to the full length of reinforcement devices and be sloped to drain away from the wall before placing and attaching the next layer of reinforcement devices. The compacted backfill shall be level with the connecting device before the reinforcement device can be connected. Compaction within three feet of the back of the wall facing shall be achieved with at least three (3) passes of a light weight mechanical tamper, roller, or vibratory system.

Unless otherwise indicated on the plans or directed by the Engineer, soil reinforcement devices shall be placed at 90 degrees to the face of the wall. The maximum lift thickness before compaction shall be ten (10) inches and shall closely follow panel erection. The Contractor shall decrease this lift thickness, if required, to obtain the specified density.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to rapidly direct runoff or rainwater away from the wall face. In addition, the contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

## H. Anchored Wall

**Part A -** Part A covers specifications for permanent ground anchor walls exclusive of the ground anchors.

### 1. Design Criteria

Unless otherwise directed the Contractor shall select the type of wall element to be used. The wall shall be designed for shear, moment, and lateral and axial capacity in accordance with AASHTO LRFD procedures. The Contractor shall be responsible for determining the length of the wall element and required section necessary to resist loadings due to earth, and water forces while controlling ground movements. Structure design life and corrosion protection requirements for sheet-piles and soldier beams will be provided on the contract drawings. Soil properties, safety factors, anchor tendon corrosion protection requirements, wall finish and color requirements, and appurtenance locations are given in the contract plans or specifications.

The Contractor shall be familiar with the requirements for ground anchors described in Part B, "Ground Anchors". The contractor shall incorporate all dimensional and location restrictions on ground anchor locations, spacing, and length of anchor bond length and unbonded length that may affect the design of the wall system covered by this section.

a. The wall system shall be designed to resist maximum anticipated loadings calculated for the effects of any special loadings shown on the contract plans.

b. The wall shall be designed to ensure stability against passive failure of the embedded portion of the vertical wall elements (below the base of excavation). The minimum FS shall be 1.5, unless otherwise noted on the contract plans.

c. The axial load carrying capacity of the embedded portion of the vertical wall elements (below the base of the excavation) shall be evaluated. The minimum FS shall be 2.5 for elements terminating in soil and 2.0 for elements terminating on rock, unless otherwise noted in the contract plans. The wall shall be designed to resist vertical loads including vertical anchor forces and the weight of the lagging and the vertical wall elements. Relying on transfer of vertical load into the soil behind the wall by friction shall not be permitted, unless approved by the Engineer.

d. Permanent facing shall be precast or cast-in-place reinforced concrete. Architectural facing treatments, if required, shall be as indicated on the contract drawings. The facing shall extend a minimum of 2.0ft below the gutter line or, if applicable, the ground line adjacent to the wall unless otherwise indicated on the contract drawings.

e. The external stability of the wall shall be evaluated. Failure surfaces extending beyond the ends of the ground anchors and below the bottom of the wall shall be checked using slope stability calculations. The minimum FS with respect to external stability shall be 1.3 or 1.5 for critical wall systems as designated in the contract plans.

f. Wall Drainage. The wall drainage system shall operate by gravity and shall be capable of relieving water pressures on the back face of the wall under anticipated worst case water pressure conditions. When drainage systems are incorporated into the specific design, hydrostatic head on the back of the wall shall not exceed 6 inches above the elevation of the drainage collection pipe.

**2. Materials**

The Contractor shall not deliver materials to the site until the Engineer has approved the submittals outlined in section 3.0. The Contractor shall protect the materials from the elements by appropriate means. Prestressing steel strands and bars shall be stored and handled in accordance with the manufacturer's recommendations and in such a manner that no damage to the component parts occurs. All steel components shall be stored under cover and protected against moisture.

a. Soldier Beam and Structural Steels

i. Steel Soldier Beams - Steel soldier beams shall be of the type and weight indicated on the approved working drawings. Steel soldier beams shall conform to the requirements of AASHTO M 183 (ASTM A 36) or AASHTO M 223 (ASTM A 572) unless otherwise specified.

ii. Steel Sheet Piles - Steel sheet piles shall be of the type and weight indicated on the approved working drawings. Steel sheet piles shall conform to the requirements of AASHTO M 202 (ASTM A 328) or AASHTO M 270 (ASTM A 709) Grade 50.

iii. Steel Plate - Steel used to fabricate steel studs and other devices shall conform to the requirements of AASHTO M 169 (ASTM A 108)

iv. Steel Tube - Steel tube shall conform to the requirements of ASTM A 500.

v. Reinforcing Steel - Reinforcing steel shall conform to ASTM A 615. The minimum yield stress for No. 6 reinforcing bars and for

smaller diameter bars shall be 40 ksi. The minimum yield stress for No. 7 reinforcing bars and larger diameter bars shall be 60 ksi.

b. Concrete

i. Cement - Portland cement shall be Type I or II and shall conform to AASHTO M 85.

ii. Structural Concrete - Structural concrete shall conform to the requirements of Section 604 of the TDOT Standard Specifications Structural concrete shall be Class A with a minimum 28-day compressive strength of 3000 psi, unless otherwise noted on the contract drawings.

iii. Lean-Mix Concrete Backfill - Lean-mix concrete backfill shall consist of Type I or Type II Portland cement, fine aggregate and water. Each cubic yard of lean-mix concrete backfill shall consist of a minimum of one sack (94lbs) of Portland cement.

iv. Precast Concrete - Precast concrete elements such as panels shall be made by an approved plant in accordance with the TDOT Procedure for the "Manufacture and Acceptance of Pre-cast Concrete Drainage Structures, Noise Wall panels, and Retaining wall panels".

Out-of-state producers shall provide documentation of material quality before the manufacture of any pre-cast products (i.e. aggregate quality reports, cement/steel mill test reports, etc.)

Unless otherwise shown on the contract drawings, Portland cement concrete used in precast elements shall conform to Class D with a minimum 28-day compressive strength of 4000 psi

c. Drainage Materials

i. Drainage Aggregate - Drainage aggregate to be used as a drainage medium shall conform to section 903.17 of the Standard Specifications.

ii. Preformed Permeable Geocomposite Drains – The preformed permeable geocomposite drains shall be continuous and a minimum of one (1) foot wide. The drains shall be placed in sections with a minimum overlap of one (1) foot and be spliced to assure continuous drainage.

iii. Pipe and Perforated Pipe - Pipe and perforated pipe shall conform to section 610 of the Standard Specifications.

d. Lagging

i. Temporary Timber Lagging - Temporary timber lagging shall be construction grade rough cut and shall be a minimum of 3 inches thick. Where necessary, the Contractor shall provide certification that the timber conforms to the grade, species, and other specified

requirements. If the timber is to be treated with a preservative, a certificate of compliance shall be furnished.

ii. Permanent Timber Lagging – Permanent timber lagging shall conform to all requirements of section 2.d.i. and shall be constructed from structural stress-graded lumber.

**3. Construction**

a. General Considerations

i. Wall elements for anchored walls designed and constructed in accordance with this manual shall be either continuous interlocking sheet-piles or steel soldier beams that are either driven or placed in pre-drilled holes that are subsequently backfilled with lean mix or structural concrete.

b. Excavation

i. Excavation below a level of anchors shall be limited to 2 feet below the anchor level and shall not commence below this level until anchors at that level have been installed, load tested, locked off and accepted by the Department. Placement of timber lagging shall immediately follow excavation in the front of the wall.

c. Driven Sheet Pile and Soldier Beam Installation.

i. Driven sheet piles and soldier beams shall be driven to the specified minimum tip elevation shown on the approved working drawings. The Contractor shall select a sheet pile or soldier beam section that satisfies all design criteria. The Contractor shall select a driving method and pile driving and ancillary equipment consistent with the expected ground conditions at the site. The sheet-pile or soldier beam shall be driven to the specified minimum tip elevation or to the approved elevation based on bearing capacity without damaging the sheet pile or soldier beam. The interlocks between adjacent sheet piles shall not be damaged. Equipment shall be used to permit the impact energy to be distributed over the tops of the sheet pile or soldier beam.

d. Soldier Beam Installation in Pre-drilled Holes

i. Excavations required for soldier beam placement shall be performed to the dimensions and elevations on the approved working drawings. The methods and equipment used shall be selected by the Contractor.

ii. The Contractor shall ensure that the sidewalls of the pre-drilled holes (i.e. shafts) do not collapse during drilling. Uncased shafts may be used where the sides and the bottom of the shaft are stable and may be visually inspected prior to placing the soldier beam and concrete. Casing or drilling muds shall be used where the sides of the shaft require additional support.

iii. The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The dimensions and alignment shall be determined by the Contractor but shall be observed by the Inspector. The Inspector will check the alignment of the drilling equipment at the beginning of shaft construction and periodically thereafter. Final shaft depth shall be measured after final cleaning by the Contractor.

iv. Loose material shall be removed from the bottom of the shaft. No more than 2 feet of standing water shall be left in the bottom of the shaft prior to beginning soldier beam installation.

v. The soldier beam shall be placed in the shaft without difficulty and aligned prior to general placement of concrete. The Contractor may place up to 2 feet of concrete at the bottom of the shaft to assist in aligning the soldier beam. The soldier beam shall be blocked or clamped in place at the ground surface, prior to placement of concrete.

vi. For shafts constructed without casing or drilling muds, concrete (either structural or lean-mix backfill) may be placed by free-falling the concrete from the ground surface down the shaft and around the soldier beam. If casing is used, the placement of concrete shall begin prior to casing removal. Remove the casing while the concrete remains workable. For shafts constructed using slurry, concrete shall be placed using the tremie method from the bottom of the shaft. The tremie pipe shall be withdrawn slowly as the level of the concrete rises in the shaft and the level of the tremie pipe outlet shall never exceed the height of the slurry.

e. Wall Tolerances

i. Soldier beams shall be placed at the locations shown on the approved working drawings and shall not deviate by more than 1 foot along the horizontal alignment of the wall. The wall shall not deviate from the vertical alignment shown of the contract drawings by more than 4 inches in each plane.

ii. The soldier beam or sheet pile tip shall be installed to within 1 foot of the specified tip elevation shown on the approved working drawings.

iii. Whenever a soldier beam deviates in location or plumbness by more than the tolerance given in these guidelines, the Contractor, at his option, may provide corrective measures such as 1) rebuilding soldier beams; 2) redesigning soldier beam; 3) adjust soldier beam spacing by adding additional soldier beams; 4) redesigning concrete facing; 5) building up the soldier beam section, or 6) other methods.

f. Welding and Splicing

i. Splicing of sheet piles or soldier beams shall not be permitted, unless approved by the Department. All structural welding of steel and steel reinforcement shall be performed by certified welders qualified to perform the type of welding shown on the shop drawings. All sheet piles or soldier beams shall be cutoff to a true plane at the elevations shown on the approved working drawings. All cutoff lengths shall remain the property of the Contractor and shall be properly disposed.

g. Timber Lagging Installation

i. Timber lagging shall be placed from the top-down in sufficiently small lifts immediately after excavation to prevent erosion of materials into the excavation. Prior to lagging placement, the soil face shall be smoothed to create a contact surface for the lagging. Large gaps behind the lagging shall be backfilled and compacted prior to applying any loads to the ground anchors.

ii. A gap shall be maintained between each vertically adjacent lagging board for drainage between adjacent lagging sections. In no case shall lagging be placed in tight contact to adjacent lagging.

h. Drainage System Installation

i. The Contractor shall handle preformed permeable geocomposite drains in such a manner as to ensure the geocomposite drain is not damaged in any way. Care shall be taken during placement of the geocomposite drain not to entrap dirt or excessive dust in the geocomposite drain that could cause clogging of the drainage system. Delivery, storage, and handling of the geocomposite drains shall be as provided in the plans or based on manufacturer's recommendations.

ii. Drainage geocomposite strips shall be placed and secured tightly against the timber lagging with the fabric facing the lagging. A continuous sheet of drainage geocomposite that spans between adjacent soldier beams shall not be allowed. Seams and overlaps between adjacent composites shall be made according to the special provisions or manufacturer's recommendations and specifications. Repairs shall be performed at no additional cost to the Department and shall conform to the plans or manufacturer's recommendation.

iii. Where drainage aggregate is used to construct a vertical drain behind the permanent wall and in front of the lagging, the drainage aggregate shall be placed in horizontal lifts. The construction of the vertical drain should closely follow the construction of the precast facing elements. Care should be exercised to ensure that

connection devices between wall elements and facing elements are not damaged during the placement of the drainage aggregate.

iv. Perforated collector pipe shall be placed within the permeable material to the flow line elevations and at the location shown on the approved working drawings. Outlet pipes shall be placed at the low end of the collector pipe and at other locations shown or specified in the approved working drawings.

i. Concrete Facing Installation

i. For permanent cast-in-place and precast concrete facings, concrete manufacture, handling, placement, and finishing shall conform to the requirements in Section 8 "Concrete Structures" of the AASHTO *LRFD Bridge Design Specifications* with interims. Connections used to secure the facing to wall elements shall conform to the details shown on the approved working drawings. The exposed surface of the concrete facing shall receive a Class I finish as specified in Section 8 "Concrete Structures," unless a special architectural treatment is specified.

**Part B, Anchored Wall –** Part B covers specifications for the design, construction and testing of Permanent Ground Anchors.

## 1. Description

The work covered under this section includes the furnishing of all materials, labor, tools, equipment, and other incidental items for the designing, detailing, and construction of permanent ground anchors. All other items included in the construction of the permanent ground anchors not specifically mentioned herein shall conform to all applicable sections of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction*, henceforth referred to as the Standard Specifications, the current *AASHTO LRFD Bridge Design Specifications* with latest revisions and the latest version of Post Tensioning Institute (PTI) Standards, including 1. *PTI, "Post Tensioning Manual"*, 2. *PTI "Specification for Unbonded Single Strand Tendons"*, 3. *PTI "Recommendations for Prestressed Rock and Soil Anchors."*

Unless otherwise noted the Contractor shall select the ground anchor type, drilling method, grouting method, and grout pressures, determine the ground anchor capacity, bond length, free stressing (unbonded) length, and anchor diameter. The Contractor shall be responsible for installing ground anchors that will develop the load-carrying capacity indicated on the approved working drawings in accordance with the testing subsection of this section. The anchor tendon shall be protected from corrosion as shown on the approved working drawings and in accordance with the requirements of this specification.

## 2. Design Criteria

a. Unless otherwise directed the Contractor shall select the type of tendon to be used. The tendon shall be sized so the design load does not exceed 60 percent of the specified minimum tensile strength of the prestressing steel. The lock-off load for the tendon shall be chosen based on anticipated time or activity dependent load changes, but shall not exceed 70 percent of the specified minimum tensile stress of the prestressing steel. The prestressing steel shall be sized so the maximum test load does not exceed 80 percent of the specified minimum tensile strength of the prestressing steel.

b. The Contractor shall be responsible for determining the bond length necessary to develop the design load indicated on the approved working drawings. The minimum bond length shall be 15 feet for strand tendons in rock and 10 feet for bar tendons in rock. The minimum bond length shall be 15 feet for strand and bar tendons in soil. The minimum tendon bond length shall be 10 feet.

c. The free stressing length (unbonded length) for rock and soil anchors shall not be less than 10 feet for bar tendons and 15 feet for strand tendons. The free stressing length shall extend at least 5 feet or 20 percent of the height of the wall, whichever is greater, behind the critical failure surface. The critical failure surface shall be evaluated using slope stability or similar procedures.

## 3. Submittals

Requirements for submittals are as outlined above and also include the following:

a. Contractor qualifications as outlined in Part A, of these anchored wall design and construction requirements.

b. The working drawings and design submission shall include the following:

i. A ground anchor schedule giving:

- Ground anchor number
- Ground anchor design load
- Type and size of tendon
- Minimum total anchor length
- Minimum bond length
- Minimum tendon bond length
- Minimum unbonded length

ii. A drawing of the ground anchor tendon and the corrosion protection system including details for the following:

- Spacers and their location

- Centralizers and their location
- Unbonded length corrosion protection system
- Bond length corrosion protection system
- Anchorage and trumpet
- Anchorage corrosion protection system

c. Certificates of Compliance for the following materials , if used. The certificate shall state that the materials or assemblies to be provided will fully comply with the requirements of the contract.

   i. Prestressing steel, strand or bar
   ii. Portland cement
   iii. Prestressing hardware
   iv. Bearing plates
   v. Corrosion protection system

d. The Contractor shall submit to the Engineer for review and approval or rejection mill test reports for the prestressing steel and the bearing plate steel. The Engineer may require the Contractor to provide samples of any ground anchor material intended for use on the project. The prestressing steel and bearing plates shall not be incorporated in the work without the Engineer's approval.

e. The Contractor shall submit to the Engineer for review and approval or rejection calibration data for each test jack, load cell, primary pressure gauge and reference pressure gauge to be used. Testing cannot commence until the Engineer has approved these calibrations.

f. The Contractor shall submit to the Engineer within twenty calendar days after the completion of the ground anchor work a report containing the following:

   i. Prestressing steel manufacturer's mill test reports for the tendons incorporated in the installation
   ii. Grouting records indicating the cement type, quantity injected and the grout pressures
   iii. Ground anchor test results
   iv. As-built drawings showing the location and orientation of each ground anchor, anchor capacity, tendon type, total anchor length, bond length, unbonded length, and tendon bond length as installed and locations of all instruments installed by the Department.

g. Existing Conditions – Prior to beginning work, the Department shall provide utility location plans to the Contractor. The Contractor is responsible for contacting a utility location service to verify the location of underground utilities before starting work.

The Contractor shall survey the condition of adjoining properties and make records and photographs of any evidence of settlement or cracking of any adjacent structures. The Contractor's report of this survey shall be delivered to the Department before work begins.

## 4. Materials

a. General

i. The Contractor shall not deliver materials to the site until the Engineer has approved the submittals outlined in Section 3.0.

ii. The Contractor shall protect all materials from theft, vandalism, and the elements by appropriate means. Prestressing steel strands and bars shall be stored and handled in accordance with the manufacturer's recommendations and in such a manner that no damage to the component parts occurs. All steel components shall be protected from the elements at all times. Cement and additives for grout shall be stored under cover and protected against moisture.

b. Anchorage Devices

*i.* Stressing anchorages shall be a combination of either steel bearing plate with wedge plate and wedges, or a steel bearing plate with a threaded anchor nut. The steel bearing and wedge plate may also be combined into a single element. Anchorage devices shall be capable of developing 95 percent of the specified minimum ultimate tensile strength of the prestressing steel tendon. The anchorage devices shall conform to the static strength requirements of Section 3.1.6 (1) and Section 3.1.8 (1) and (2) of the latest edition of the PTI *"Guide Specifications for Post-Tensioning Materials."*

ii. The bearing plate shall be fabricated from steel conforming to AASHTO M 183 or M 222 specifications, or equivalent, or may be a ductile iron casting conforming to ASTM A 536.

iii. The trumpet shall be fabricated from a steel pipe or tube or from PVC pipe. Steel pipe or tube shall conform to the requirements of ASTM A 53 for pipe or ASTM A 500 for tubing. Steel trumpets shall have a minimum wall thickness of 0.1 inch for diameters up to 4 inches and 0.2 inch for larger diameters. PVC pipe shall conform to ASTM A 1785, Schedule 40 minimum. PVC trumpets shall be positively sealed against the bearing plate and aligned with the tendon to prevent cracking during stressing.

iv. Anchorage covers shall be fabricated from steel or plastic with a minimum thickness of 0.1 inch. The joint between the cover and the bearing plate shall be watertight.

v. Wedges shall be designed to preclude premature failure of the prestressing steel due to notch or pinching effects under static and dynamic strength requirements of Section 3.1.8 (1) and 3.1.8 (2) of the PTI *"Post Tensioning Manual."* Wedges shall not be reused.

vi. Wedges for epoxy coated strand shall be designed to be capable of biting through the epoxy coating and into the strand. Removal of the epoxy coating from the strand to allow the use of standard wedges shall not be permitted. Anchor nuts and other threadable hardware for epoxy coated bars shall be designed to thread over the epoxy coated bar and still comply with the requirements for carrying capacity.

c. Prestressing Steel

i. Ground anchor tendons shall be fabricated from single or multiple elements of one of the following prestressing steels:

- Steel bars conforming to AASHTO M 275
- Seven-wire, low relaxation strands conforming to AASHTO M 203
- Compact,seven-wire, low-relaxation strands conforming to ASTM A 779
- Epoxy coated strand conforming to ASTM A 882
- Epoxy coated reinforcing steel bars conforming to ASTM A 775

ii. Centralizers shall be provided at maximum intervals of 10 feet with the deepest centralizer located 1 foot from the end of the anchor and the upper centralizer for the bond zone located no more than 5 feet from the top of the tendon bond length. Spacers shall be used to separate the steel strands of strand tendons. Spacers shall be provided at maximum intervals of 10 feet and may be combined with centralizers.

d. Prestressing Steel Couplers

Prestressing steel bar couplers shall be capable of developing 100 percent of the minimum specified ultimate tensile strength of the prestressing steel bar. Steel strands used for a soil or rock anchor shall be continuous with no splices, unless approved by the Engineer.

e. Centralizers

i. Centralizers shall be fabricated from plastic, steel or material, which is non-detrimental to the prestressing steel. Wood shall not be used. The centralizer shall be able to support the tendon in the drill hole and position the tendon so a minimum of 2 inches of grout cover is provided and shall permit grout to freely flow around the tendon and up the drill hole.

ii. Centralizers are not required on pressure injected anchors installed in coarse grained soils when the grouting pressure exceeds 145 psi or on hollow stem-augured anchors when they are grouted through the auger with grout having a slump of 9 inches or less.

f. Spacers

Spacers shall be used to separate elements of a multi-element tendon and shall permit grout to freely flow around the tendon and up the drill hole. Spacers shall be fabricated from plastic, steel or material, which is non-detrimental to the prestressing steel. Wood shall not be used. A combination centralizer-spacer may be used.

g. Tendon Bond Length Encapsulations

When the contract plans require the tendon bond length to be encapsulated to provide additional corrosion protection, the encapsulation shall be fabricated from one of the following:

i. High density corrugated polyethylene tubing conforming to the requirements of AASHTO M 252 and having a minimum wall thickness of 0.06 inch except pregrouted tendons, which may have a minimum wall thickness of 0.04 inch.
ii. Deformed steel tubing or pipes conforming to ASTM A 52 or A 500 with a minimum wall thickness of 0.2 inch.
iii. Corrugated, polyvinyl chloride tubes manufactured from rigid PVC compounds conforming to ASTM D 1784, Class 13464- B.
iv. Fusion-bonded epoxy conforming to the requirements of AASHTO M 284.

h. Heat Shrinkable Sleeves

Heat shrinkable sleeves shall be fabricated from a radiation cross-linked polyolefin tube internally coated with an adhesive sealant. Prior to shrinking, the tube shall have a nominal wall thickness of 0.025 inch. The

adhesive sealant inside the heat shrinkable tube shall have a nominal thickness of 0.02 inch.

i. Sheath

A sheath shall be used as part of the corrosion protection system for the unbonded length portion of the tendon. The sheath shall be fabricated from one of the following:

i. A polyethylene tube pulled or pushed over the prestressing steel. The polyethylene shall be Type II, III or IV as defined by ASTM D 1248 (or approved equal). The tubing shall have a minimum wall thickness of 0.06 inch.

ii. A hot-melt extruded polypropylene tube. The polypropylene shall be cell classification B55542-11 as defined by ASTM D 4101 (or approved equal). The tubing shall have a minimum wall thickness of 0.06 inch.

iii. A hot-melt extruded polyethylene tube. The polyethylene shall be high density Type III as defined by ASTM D 1248 (or approved equal). The tubing shall have a minimum wall thickness of 0.06 inch.

iv. Steel tubing conforming to ASTM A 500. The tubing shall have a minimum wall thickness of 0.2 inch.

v. Steel pipe conforming to ASTM A 53. The pipe shall have a minimum wall thickness of 0.2 inch.

vi. Plastic pipe or tube of PVC conforming to ASTM D 1784 Class 13464-B. The pipe or tube shall be Schedule 40 at a minimum.

vii. A corrugated tube conforming to the requirement of the tendon bond length encapsulation Subsection 4.g. above.

j. Bondbreaker

The bondbreaker shall be fabricated from a smooth plastic tube or pipe having the following properties: (1) resistant to chemical attack from aggressive environments, grout, or corrosion inhibiting compound; (2) resistant to aging by ultraviolet light; (3) fabricated from material non-detrimental to the tendon; (4) capable of withstanding abrasion, impact,

and bending during handling and installation; (5) enable the tendon to elongate during testing and stressing; and (6) allow the tendon to remain unbonded after lockoff.

k. Cement Grout

Type I, II, III or V Portland cement conforming to AASHTO M 85 shall be used for grout. The grout shall be a pumpable neat mixture of cement and water and shall be stable (bleed less than 2 percent), fluid, and provide a minimum 28-day compressive strength of at least 3000 psi measured in accordance with ASTM C 109 at the time of stressing.

l. Admixtures

Admixtures which control bleed, improve flowability, reduce water content, and retard set may be used in the grout subject to the approval of the Engineer. Admixtures, if used, shall be compatible with the prestressing steels and mixed in accordance with the manufacturer's recommendation. Expansive admixtures may only be added to the grout used for filling sealed encapsulations, trumpets, and anchorage covers. Accelerators shall not be permitted.

m. Water

Water for mixing grout shall be potable, clean, and free of injurious quantities of substances known to be harmful to Portland cement or prestressing steel.

n. Corrosion Inhibiting Compound

The corrosion inhibiting compound placed in either the free length or the trumpet areas shall be an organic compound (i.e. grease or wax) with appropriate polar moisture displacing, corrosion inhibiting additives and self-healing properties. The compound shall permanently stay viscous and be chemically stable and nonreactive with the prestressing steel, the sheathing material, and anchor grout.

o. Grout Tubes

Grout tubes shall have an adequate inside diameter to enable the grout to be pumped to the bottom of the drill hole. Grout tubes shall be strong enough to withstand a minimum grouting pressure of 145 psi. Post-grout tubes shall be strong enough to withstand post-grouting pressures.

## 5. Construction

a. Tendon Storage and Handling

i. Tendons shall be handled and stored in such a manner as to avoid damage or corrosion. Damage to the prestressing steel, the corrosion protection, and/or the epoxy coating as a result of abrasions, cuts, nicks, welds or weld splatter will be cause for rejection by the Engineer. The prestressing steel shall be protected if welding is to be performed in the vicinity. Grounding of welding leads to the prestressing steel is forbidden. Prestressing steel shall be protected from dirt, rust, or other deleterious substances. A light coating of rust on the steel is acceptable. If heavy corrosion or pitting is noted, the Engineer shall reject the affected tendons.

ii. The Contractor shall use care in handling and storing the tendons at the site. Prior to inserting a tendon in the drill hole, the Contractor and the Inspector shall examine the tendon for damage to the encapsulation and the sheathing. If, in the opinion of the Inspector, the encapsulation is damaged, the Contractor shall repair the encapsulation in accordance with the tendon supplier's recommendations. If, in the opinion of the inspector, the smooth sheathing has been damaged, the Contractor shall repair it with ultra-high molecular weight polyethylene tape. The tape should be spiral wound around the tendon to completely seal the damaged area. The pitch of the spiral shall ensure a double thickness at all points.

iii. Banding for fabricated tendons shall be padded to avoid damage to the tendon corrosion protection. Upon delivery, the fabricated anchors or the prestressing steel for fabrication of the tendons on site and all hardware shall be stored and handled in such a manner to avoid mechanical damage, corrosion, and contamination with dirt or deleterious substances.

iv. Lifting of the pre-grouted tendons shall not cause excessive bending, which can debond the prestressing steel from the surrounding grout.

v. Prestressing steel shall not be exposed to excessive heat (i.e. more than 446° F).

b. Anchor Fabrication

i. Anchors shall be either shop or field fabricated from material conforming to part 4 of this section and as shown in the approved working drawings and schedules.

ii. Prestressing steel shall be cut with an abrasive saw or, with the written approval of the prestressing steel supplier, an oxyacetylene torch.

iii. All of the tendon bond length, especially for strand, must be free of dirt, manufacturer's lubricants, corrosion-inhibitive coatings, or other deleterious substances that may significantly affect the grout-to-tendon bond or the service life of the tendon.

iv. Pre-grouting of encapsulated tendons shall be done on an inclined, rigid frame or bed by injecting the grout from the low end of the tendon.

c. Drilling

i. Drilling methods shall be left to the discretion of the Contractor, whenever possible. The Contractor shall be responsible for using a drilling method to establish a stable hole of adequate dimensions, within the tolerances specified. Drilling methods may involve, amongst others, rotary, percussion, rotary/percussive or auger drilling; or percussive or vibratory driven casing.

ii. Holes for anchors shall be drilled at the locations and to the length, inclination and diameter shown on the approved working drawings. The drill bit or casing crown shall not be more than 0.12 inch smaller than the specified hole diameter. At the ground surface the drill hole shall be located within 1 foot of the location shown on the approved working drawings. The drill hole shall be located so the longitudinal axis of the drill hole and the longitudinal axis of the tendon are parallel. In particular, the ground anchor hole shall not be drilled in a location that requires the tendon to be bent in order to enable the bearing plate to be connected to the supported structure. At the point of entry the ground anchor shall be installed within plus/minus three (3) degrees of the inclination from horizontal shown on the approved working drawings. At the point of entry the horizontal angle made by the ground anchor and the structure shall be within plus/minus three (3) degrees of a line drawn perpendicular to the plane of the structure unless otherwise shown on the approved working drawings. The ground anchors shall not extend beyond the right of-way or easement limits shown on the contract drawings.

d. Tendon Insertion

i. Tendons shall be placed in accordance with the approved working drawings and details and the recommendations of the tendon manufacturer or specialist anchor contractor. The tendon shall be inserted into the drill hole to the desired depth without difficulty.

When the tendon cannot be completely inserted, the Contractor shall remove the tendon from the drill hole and clean or redrill the hole to permit insertion. Partially inserted tendons shall not be driven or forced into the hole.

ii. Each anchor tendon shall be inspected by Department field personnel during installation into the drill hole or casing. Damage to the corrosion protection system shall be repaired, or the tendon replaced if not repairable. Loose spacers or centralizers shall be reconnected to prevent shifting during insertion. Damaged fusion bonded epoxy coatings shall be repaired in accordance with the manufacturer's recommendations. If the patch is not allowed to cure prior to inserting the tendon in the drill hole, the patched area shall be protected by tape or other suitable means.

iii. The rate of placement of the tendon into the hole shall be controlled such that the sheathing, coating, and grout tubes are not damaged during installation of the tendon. Anchor tendons shall not be subjected to sharp bends. The bottom end of the tendon may be fitted with a cap or bullnose to aid its insertion into the hole, casing or sheathing.

e. Grouting

i. The Contractor shall use a neat cement grout or a sand-cement grout. The cement shall not contain lumps or other indications of hydration. Admixtures, if used, shall be mixed in accordance with the manufacturer's recommendation.

ii. The grouting equipment shall produce a grout free of lumps and undispersed cement. A positive displacement grout pump shall be used. The pump shall be equipped with a pressure gauge to monitor pressures. The pressure gauge shall be capable of measuring pressures of at least 145 psi or twice the actual grout pressure used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The mixer should be capable of continuously agitating the grout.

iii. The grout shall be injected from the lowest point of the drill hole. The grout may be pumped through grout tubes, casings, hollowstem-augers, or drill rods. The grout can be placed before or after insertion of the tendon. The quantity of the grout and the grout pressures shall be recorded. The grout pressures and grout takes shall be controlled to prevent excessive heave or fracturing.

iv. After the tendon is installed, the drill hole may be filled in one continuous grouting operation except that pressure grouting shall not be used in the free length zone. The grout at the top of the drill hole shall not contact the back of the structure or the bottom of the trumpet.

v. If the ground anchor is installed in a fine-grained soil using drill holes larger than 6 inches in diameter, then the grout above the top of the bond length shall be placed after the ground anchor has been tested and stressed. The Engineer will allow the Contractor to grout the entire drill hole at the same time if the Contractor can demonstrate that their particular ground anchor system does not derive a significant portion of its load-carrying capacity from the soil above the bond length portion of the ground anchor.

vi. If grout protected tendons are used for ground anchors anchored in rock, then pressure grouting techniques shall be utilized. Pressure grouting requires that the drill hole be sealed and that the grout be injected until a minimum 50 psi grout pressure (measured at the top of the drill hole) can be maintained on the grout for at least five (5) minutes.

vii. The grout tube may remain in the hole on completion of grouting if the tube is filled with grout.

viii. After grouting, the tendon shall not be loaded for a minimum of three (3) days.

f. Anchorage Installation

i. The anchor bearing plate and the anchor head or nut shall be installed perpendicular to the tendon, within plus/minus three (3) degrees and centered on the bearing plate, without bending or kinking of the prestressing steel elements. Wedge holes and wedges shall be free of rust, grout and dirt.

ii. The stressing tail shall be cleaned and protected from damage until final testing and lock-off. After the anchor has been accepted by the Engineer, the stress tail shall be cut to its final length according to the tendon manufacturer’s recommendations.

iii. The corrosion protection surrounding the unbonded length of the tendon shall extend up beyond the bottom seal of the trumpet or 4 inches into the trumpet if no trumpet seal is provided. If the protection does not extend beyond the seal or sufficiently far

enough into the trumpet, the Contractor shall extend the corrosion protection or lengthen the trumpet.

iv. The corrosion protection surrounding the unbonded length of the tendon shall not contact the bearing plate or the anchor head during testing and stressing. If the protection is too long, the Contractor shall trim the corrosion protection to prevent contact.

**g.** Corrosion Protection

i. Protection Requirements

Corrosion protection requirements shall be determined by the Department and shall be shown on the contract plans. The corrosion protection systems shall be designed and constructed to provide reliable ground anchors for temporary and permanent structures.

ii. Anchorage Protection

- All stressing anchorages permanently exposed to the atmosphere shall receive a grout-filled cover, except, for restressable anchorages where a corrosion inhibiting compound must be used. Stressing anchorages encased in concrete at least 2 inches thick do not require a cover.

- The trumpet shall be sealed to the bearing plate and shall overlap the unbonded length corrosion protection by at least 4 inches. The trumpet shall be long enough to accommodate movements of the structure and the tendon during testing and stressing. On strand tendons, the trumpet shall be long enough to enable the tendon to make a transition from the diameter of the tendon along the unbonded length to the diameter of the tendon at the wedge plate without damaging the encapsulation.

- The trumpet shall be completely filled with grout, except restressable anchorages must use corrosion inhibiting compounds. Compounds may be placed any time during construction. Compound filled trumpets shall have a permanent seal between the trumpet and the unbonded length corrosion protection. Grout must be placed after the ground anchor has been tested and stressed to the lock-off load. Trumpets filled with grout shall have either a temporary seal between the trumpet and the unbonded length corrosion protection or the trumpet shall fit tightly over the unbonded length corrosion protection for a minimum of 4 inches.

iii. Unbonded Length Protection

- Corrosion protection of the unbonded length shall be provided by a combination of sheaths, sheath filled with a corrosion inhibiting compound or grout, or a heat shrinkable tube internally coated with a mastic compound, depending on the tendon class. The corrosion inhibiting compound shall completely coat the tendon elements, fill the void between them and the sheath, and fill the interstices between the wires of 7-wire strands. Provisions shall be made to retain the compound within the sheath.

- The corrosion protective sheath surrounding the unbonded length of the tendon shall be long enough to extend into the trumpet, but shall not come into contact with the stressing anchorage during testing. Any excessive protection length shall be trimmed off.

- For pregrouted encapsulations and all Class I tendons, a separate bondbreaker or common sheath shall be provided for supplemental corrosion protection or to prevent the tendon from bonding to the grout surrounding the unbonded length.

iv. Unbonded Length/Bond Length Transition

The transition between the corrosion protection for the bonded and unbonded lengths shall be designed and fabricated to ensure continuous protection from corrosive attack.

v. Tendon Bond Length Protection for Grout Protected Tendons (Class II)

- Cement grout can be used to protect the tendon bond length in non-aggressive ground when the installation methods ensure that the grout will remain fully around the tendon. The grout shall overlap the sheathing of the unbonded length by at least 1 inch.

- Centralizers or grouting techniques shall ensure a minimum of 0.5 inch of grout cover over the tendon bond length.

vi. Tendon Bond Length Protection for Encapsulated Tendons (Class I)

- A grout-filled, corrugated plastic encapsulation or a grout-filled, deformed steel tube shall be used. The prestressing steel can be grouted inside the encapsulation prior to being placed.

- Centralizers or grouting techniques shall ensure a minimum of 0.5 inch of grout cover over the encapsulation.

vii. Epoxy

A fusion-bonded epoxy may be used to provide a layer of protection for the steel tendon in addition to the cement grout.

viii. Coupler Protection

- On encapsulated bar tendons (Class I), the coupler and any adjacent exposed bar sections shall be covered with a corrosion-proof compound or wax-impregnated cloth tape. The coupler area shall be covered by a smooth plastic tube, complying with the requirements set forth in 4.9, overlapping the adjacent sheathed tendon by at least 1 inch. The two joints shall be sealed each by a coated heat shrink sleeve of at least 6 inches in length, or approved equal. The corrosion-proof compound shall completely fill the space inside the cover tube.

- Corrosion protection details for strand couplers, if specifically permitted, shall be submitted for approval of the Engineer.

h. Stressing, Load Testing, and Acceptance

i. General

Each ground anchor shall be tested. No load greater than ten (10) percent of the design load can be applied to the ground anchor prior to testing. The maximum test load shall be no less than 1.33 times the design load and shall not exceed 80 percent of the specified minimum ultimate tensile strength of the prestressing steel of the tendon. The test load shall be simultaneously applied to the entire tendon. Stressing of single-element tendons shall not be permitted.

ii. Stressing Equipment

- The testing equipment shall consist of:

  - A dial or vernier scale capable of measuring to the nearest .001 inch shall be used to measure the ground anchor movement. The movement measuring device shall have a minimum travel equal to the theoretical elastic elongation of the total anchor length at the maximum test load and it shall have adequate travel so the ground anchor movement can be measured without resetting the device at an interim point.

- A hydraulic jack and pump shall be used to apply the test load. The jack and a calibrated primary pressure gauge shall be used to measure the applied load. The jack and primary pressure gauge shall be calibrated by an independent firm as a unit. The calibration shall have been performed within forty-five (45) working days of the date when the calibration submittals are provided to the Engineer. Testing cannot commence until the Engineer has approved the calibration. The primary pressure gauge shall be graduated in 100 psi increments or less. The ram travel shall be at least 6 inches and preferably not be less than the theoretical elongation of the tendon at the maximum test load. If elongations greater than 6 inches are required, restroking can be allowed.

- A calibrated reference pressure gauge shall also be kept at the site to periodically check the production (i.e. primary pressure) gauge. The reference gauge shall be calibrated with the test jack and primary pressure gauge. The reference pressure gauge shall be stored indoors and not subjected to rough treatment.

- The Contractor shall provide an electrical resistance load cell and readout to be used when performing an extended creep test.

- The stressing equipment shall be placed over the ground anchor tendon in such a manner that the jack, bearing plates, load cells and stressing anchorage are axially aligned with the tendon and the tendon is centered within the equipment.

- The stressing equipment, the sequence of stressing and the procedure to be used for each stressing operation shall be determined at the planning stage of the project. The equipment shall be used strictly in accordance with the manufacturer’s operating instructions.

- Stressing equipment shall preferably be capable of stressing the whole tendon in one stroke to the specified test load and the equipment shall be capable of stressing the tendon to the maximum specified test load within 75 percent of the rated capacity. The pump shall be capable of applying each load increment in less than 60 seconds.

- The equipment shall permit the tendon to be stressed in increments so that the load in the tendon can be raised or lowered in accordance with the test specifications, and allow the anchor to be lift-off tested to confirm the lock off load.

- Stressing equipment shall have been calibrated, within an accuracy of plus or minus two (2) percent, a maximum of 45 days prior to use. The calibration certificate and graph shall be available on site at all times. The calibration shall be traceable to the National Institute of Standards and Technology (NIST).

iii. Load Test Setup

- Dial gauges shall bear on the pulling head of the jack and their stems shall be coaxial with the tendon direction. The gauges shall be supported on an independent, fixed frame, such as a tripod, which will not move as a result of stressing or other construction activities during the operation.

- Prior to setting the dial gauges, the Alignment Load (AL) shall be accurately placed on the tendon. The magnitude of the AL depends on the type and length of the tendon.

- Regripping of strands, which would cause overlap wedge bites, or wedge bites on the tendon below the anchor head, shall be avoided.

- Stressing and testing of multiple element tendons with single element jacks is not permitted.

- Stressing shall not begin until the grout has reached adequate strength.

iv. Performance Tests

- Five (5) percent of the ground anchors or a minimum of three (3) ground anchors, whichever is greater, shall be performance tested in accordance with the procedures described in this section. The Engineer shall select the ground anchors to be performance tested. The remaining ground anchors shall be tested in accordance with the proof test procedures as outlined in 5.h. below.

- The performance test shall be made by incrementally loading and unloading the ground anchor in accordance with the schedule provided in section 5.h. The load shall be raised from one increment to another immediately after recording the ground anchor movement. The ground anchor movement shall be measured and recorded to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each increment of load. The load shall be monitored with the primary pressure gauge. The reference pressure gauge shall be placed in series with the primary pressure gauge during each performance test. If the load determined by the reference pressure gauge and the load determined by the primary pressure gauge differ by more than ten (10) percent, the jack, primary pressure gauge and reference pressure gauge shall be recalibrated at no expense to the Department. At load increments other than the maximum test load, the load shall be held just long enough to obtain the movement reading.

- The maximum test load in a performance test shall be held for ten (10) minutes. A load cell shall be used to monitor small changes in load during constant load-hold periods.

- The jack shall be adjusted as necessary in order to maintain a constant load. The load-hold period shall start as soon as the maximum test load is applied and the ground anchor movement, with respect to a fixed reference, shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, and 10 minutes. If the ground anchor movement between one (1) minute and ten (10) minutes exceeds .04 inch, the maximum test load shall be held for an additional 50 minutes. If the load hold is extended, the ground anchor movement shall be recorded at 15, 20, 30, 40, 50 and 60 minutes.

v. Steps for the Performance Test – The steps for the performance test are detailed in the table on the following page:

| **Step** | **Loading** | **Applied Load** | **Record and Plot Total Movement ($d_{ti}$)** | **Record and Plot Residual Movement ($d_{ri}$)** | **Calculate Elastic Movement ($d_{ei}$)** |
|---|---|---|---|---|---|
| **1** | Apply alightment load (AL) | | | | |
| **2** | Cycle 1 | 0.25DL | $\mathbf{d_{t1}}$ | | $\mathbf{d_{t1} - d_{r1} = d_{e1}}$ |
| | | AL | | $\mathbf{d_r}$ | |
| **3** | Cycle 2 | 0.25AL | $\mathbf{d_2}$ | | $\mathbf{d_{t2} - d_{r2} = d_{e2}}$ |
| | | 0.50DL | $\mathbf{d_{t2}}$ | | |
| | | AL | | $\mathbf{d_{r2}}$ | |

| | | | | | |
|---|---|---|---|---|---|
| **4** | Cycle 3 | 0.25DL | $\mathbf{d_3}$ | | $\mathbf{d_{t3} - d_{r3} = d_{e3}}$ |
| | | 0.50DL | $\mathbf{d_3}$ | | |
| | | 0.75FL | $\mathbf{d_3}$ | | |
| | | AL | | $\mathbf{d_{r3}}$ | |
| **5** | Cycle 4 | 0.25DL | $\mathbf{d_4}$ | | $\mathbf{d_{t4} - d_{r4} = d_{e4}}$ |
| | | 0.50DL | $\mathbf{d_4}$ | | |
| | | 0.75DL | $\mathbf{d_4}$ | | |
| | | 1.00DL | $\mathbf{d_{t4}}$ | | |
| | | AL | | $\mathbf{d_{r4}}$ | |
| **6** | Cycle 5 | 0.25DL | $\mathbf{d_5}$ | | $\mathbf{d_{t5} - d_{r5} = d_{e5}}$ |
| | | 0.50DL | $\mathbf{d_5}$ | | |
| | | 0.75DL | $\mathbf{d_5}$ | | |
| | | 1.00DL | $\mathbf{d_5}$ | | |
| | | 1.2DL | $\mathbf{d_5}$ | | |
| | | AL | | $\mathbf{d_{r5}}$ | |
| **7** | Cycle 6 | 0.25DL | $\mathbf{d_6}$ | | |
| | | 0.50DL | $\mathbf{d_6}$ | | |
| | | 0.75DL | $\mathbf{d_6}$ | | |
| | | 1.00DL | $\mathbf{d_6}$ | | |
| | | 1.2DL | $\mathbf{d_6}$ | | |
| | | 1.33DL | $\mathbf{d_{t6}}$ **, zero reading for creep test** | | |
| **8** | Hold load for 10 minutes while recording movement at specified times. If the total movement measured during the load hold exceeds the specified maximum value then the load hold should be extended to a total of 60 minutes. | | | | |
| **9** | Cycle 6 cont=d | AL | | $\mathbf{d_{r6}}$ | Cycle 6: $\mathbf{d_m - d_{r6} = d_{e6}}$ |

Notes: AL = Alignment Load, DL = Design Load, $d_i$ = total movement at a load other than maximum for cycle, i = number identifying a specific load cycle.

vi. Proof Tests

The proof test shall be performed by incrementally loading the ground anchor in accordance with the following schedule. The load shall be raised from one increment to another immediately after recording the ground anchor movement. The ground anchor movement shall be measured and recorded to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each increment load. The load shall be monitored with the primary pressure gauge. At load increments

other than the maximum test load, the load shall be held just long enough to obtain the movement reading.

**Proof Test Schedule**

| **Step** | **Load** |
|---|---|
| 1 | AL |
| 2 | 0.25DL |
| 3 | 0.50DL |
| 4 | 0.75DL |
| 5 | 1.00DL |
| 6 | 1.20DL |
| 7 | 1.33DL |
| 8 | Reduce to lock-off load |
| 9 | AL (optional) |
| 10 | Adjust to lock-off load |

vii. The maximum test load in a proof test shall be held for (10) minutes. The jack shall be adjusted as necessary in order to maintain a constant load. The load-hold period shall start as soon as the maximum test load is applied and the ground anchor movement with respect to a fixed reference shall be measured and recorded at 1, 2, 3, 4, 5, 6, and 10 minutes. If the ground anchor movement between one (1) minute and ten (10) minutes exceeds 0.04 inch, the maximum test load shall be held for an additional 50 minutes. If the load hold is extended, the ground anchor movements shall be recorded at 15, 20, 30, 40, 50, and 60 minutes.

viii. Extended Creep Tests

- The Department shall determine if extended creep testing is required and select those ground anchors that are to be creep tested. If creep tests are required, at least two (2) ground anchors shall be tested. The stressing equipment shall be capable of measuring and maintaining the hydraulic pressure within 50 psi.

- The extended creep test shall be made by incrementally loading and unloading the ground anchor in accordance with the performance test schedule provided in 5.8.5. At the end of each loading cycle, the load shall be held constant for the observation period indicated in the creep test schedule below. The times for reading and recording the ground anchor movement during each observation period shall be 1, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30 , 45, 60, 75, 90, 100, 120, 150, 180, 210, 240, 270 and 300 minutes as appropriate for the load increment. Each load-hold period shall start as soon as the test load is applied. In a creep test, the primary pressure gauge and reference pressure gauge will be used to measure the applied load and the load cell will be used to monitor small changes in load during constant load-hold periods. The jack shall be adjusted as necessary in order to maintain a constant load.

- The Contractor shall plot the ground anchor movement and the residual movement measured in an extended creep test. The Contractor shall also plot the creep movement for each load hold as a function of the logarithm of time.

**Extended Creep Test Schedule**

| **Load** | **Observation period (min)** |
|---|---|
| AL | |
| 0.25DL | 10 |
| 0.50DL | 30 |
| 0.75DL | 30 |
| 1.00DL | 45 |
| 1.20DL | 60 |
| 1.33DL | 300 |

ix. Ground Anchor Acceptance Criteria

- A performance-tested or proof-tested ground anchor with a 10 minute load hold shall be acceptable if the: (1) ground anchor resists the maximum test load with less than 0.04 inch of

movement between 1 minute and 10 minutes; and (2) total elastic movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

- A performance-tested or proof-tested ground anchor with a 60 minute load hold shall be acceptable if the: (1) ground anchor resists the maximum test load with a creep rate that does not exceed 0.08 inch in the last log cycle of time; and (2) total elastic movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

- A ground anchor subjected to extended creep testing is acceptable if the: (1) ground anchor resists the maximum test load with a creep rate that does not exceed 0.08 inch in the last log cycle of time; and (2) total elastic movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

- The initial lift-off reading shall be within plus or minus five (5) percent of the designated lock-off load. If this criterion is not met, then the tendon load shall be adjusted accordingly and the initial lift-off reading repeated.

x. Procedures for Anchors Failing Acceptance Criteria

- Anchors that do not satisfy the minimum apparent free length criteria shall be either rejected and replaced at no additional cost to the Department or locked off at no more than 50 percent of the maximum acceptable load attained. In this event, no further acceptance criteria are applied.

- Regroutable anchors which satisfy the minimum apparent free length criteria but which fail the extended creep test at the test load may be post grouted and subjected to an enhanced creep criterion. This enhance criterion requires a creep movement of not more than 0.04 inch between 1 and 60 minutes at test load. Anchors which satisfy the enhanced creep criterion shall be locked off at the design lock-off load. Anchors which cannot be post grouted or regroutable anchors that do not satisfy the enhanced creep criterion shall be either rejected or locked off at 50 % of the maximum acceptable test load attained. In this event, no further acceptance criteria are applied. The maximum acceptable test load with respect to creep shall correspond to that where acceptable creep movements are measured over the final log cycle of time.

- In the event that the anchor fails, the Contractor shall modify the design and/or construction procedures. These modifications may include, but are not limited to, installing additional anchors, modifying the installation methods, reducing the anchor design load by increasing the number of anchors, increasing the anchor length, or changing the anchor type. Any modification of design or construction procedures shall be at no change in the contract price. A description of any proposed modifications must be submitted to the Engineer in writing. Proposed modifications shall not be implemented until the Contractor receives written approval from the Engineer.

xi. Anchor Lock-Off

- After testing has been completed, the load in the tendon shall be such that after seating losses (i.e. wedge seating); the specified lock-off load has been applied to the anchor tendon.

- The magnitude of the lock-off load shall be specified in the approved working drawings, or as determined by the designer.

- The wedges shall be seated at a minimum load of 50% $F_{pu}$. If the lock-off load is less than 50% $F_{pu}$, shims shall be used under the wedge plate and the wedges seated at 50% $F_{pu}$. The shims shall then be removed to reduce the load in the tendon to the desired lock-off load. Bar tendons may be locked off at any load less than 70% $F_{pu}$.

xii. Anchor Lift-Off Test

After transferring the load to the anchorage, and prior to removing the jack, a lift-off test shall be conducted to confirm the magnitude of the load in the anchor tendon. This load is determined by reapplying load to the tendon to lift off the wedge plate (or anchor nut) without unseating the wedges (or turning the anchor nut). This moment represents zero time for any long time monitoring.

**Method of Measurement**

The method of measurement shall be square foot area of the wall face, measured from the top of footing (or bottom of wall for walls without footings) to the top of the wall excluding any appurtenances.

**Basis of Payment**

The earth retaining wall, complete in place and accepted, shall be paid for at the contract square foot bid price. The bid price for walls shall include as required: grading and compaction of the wall foundation, undercutting and backfilling of weak surficial zones, installation of ground improvement, footing excavation, presplitting, sheeting, shoring, drilling, piles, lagging, grouting, concrete, reinforcing steel, reinforcement strips or mesh, tie strips or rods, fasteners, connectors, wire mesh baskets, prefabricated modular components, post tensioning, performance testing and evaluation, architectural treatment and/or texture finish, drainage system, water-stops and joint sealing material, and all miscellaneous material and labor for the complete installation of the wall. If the contractor's design requires the use of select granular backfill, the unit price bid for the wall shall be full compensation for any additional backfill costs due to the use of select backfill material.

If required for retaining wall protection against vehicle impact, the cost of the barrier wall and end terminals shall be included in the square foot cost of the wall.

Additional area of wall required due to unforeseen foundation conditions or other reasons and approved by the Engineer will be paid for on the basis of the unit price bid except as noted below.

The mechanically stabilized earth wall, complete in place and accepted as noted above, shall be paid for at the contract square foot bid price. No increase in unit price will be paid for increases in wall height less than or equal to 10 feet as compared to the contract plans and wall heights. Wall height increases greater than 10 feet will be paid for by supplemental agreement.

The cast-in-place concrete cantilever or counterfort retaining wall, complete in place and accepted shall be paid for at the contract square foot bid price except as noted below.

If the actual driven quantity of concrete piles varies more than 10% from the estimated quantity based on the estimated lengths, an increase or decrease based on the contract bid price, or in the absence of a bid item, a price of twenty eight (28) dollars, per linear foot of additional or reduced pile length will be added or deducted accordingly from the price paid for the retaining wall. If the Engineer orders additional test piles, they will be paid for at the contract bid price, or in the absence of a bid item, a price of forty (40) dollars per linear foot. If the contractor changes friction pile types or sizes, additional load test(s) may be required at the Engineer’s discretion and at the contractor's expense.

If the contractor uses a different type of pile than those that have estimated lengths shown on the contract plans, the price of the wall shall include all costs associated with piles and pile installation with no additional payment for any variation in pile lengths. All pile types and pile driving procedures, lengths, and bearings shall be in accordance with the Standard Specifications and shall be approved by the Engineer

The contractor shall show the estimated quantity of point bearing steel piles on the design drawings submitted for approval. If the actual quantity of steel piles driven differs more than 10% from this approved quantity because of variation in the rock line, the cost of the retaining wall will be increased or decreased accordingly based on the contract bid price,

or in the absence of a bid item, a unit price of thirty five (35) dollars per linear foot, for the adjusted piling quantity.

If the Engineer orders changes in the work which alters the exposed surface area of the wall without increasing the height of the wall, payment will be increased or decreased accordingly based on the square foot bid price. If the Engineer orders changes in the work which increases the height of the wall, the unit price bid for the wall sections that were increased up to a maximum of 10 feet will be adjusted according the following tables. Adjustments exceeding 10 feet will be made by supplemental agreement.

## RETAINING WALL COST ADJUSTMENT FACTORS

Level Backfill with Slope <= 3 : 1 (Run : Rise)

| Original Height (ft.) | Height Increase (ft.) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1.01 | 1.02 | 1.04 | 1.06 | 1.08 | 1.10 | 1.13 | 1.16 | 1.20 | 1.24 |
| 11 | 1.01 | 1.03 | 1.05 | 1.07 | 1.09 | 1.12 | 1.15 | 1.19 | 1.22 | 1.26 |
| 12 | 1.02 | 1.03 | 1.06 | 1.08 | 1.11 | 1.14 | 1.17 | 1.21 | 1.25 | 1.29 |
| 13 | 1.02 | 1.04 | 1.06 | 1.09 | 1.12 | 1.15 | 1.19 | 1.23 | 1.27 | 1.31 |
| 14 | 1.02 | 1.04 | 1.07 | 1.10 | 1.13 | 1.17 | 1.21 | 1.25 | 1.29 | 1.34 |
| 15 | 1.02 | 1.05 | 1.08 | 1.11 | 1.14 | 1.18 | 1.22 | 1.26 | 1.31 | 1.36 |
| 16 | 1.03 | 1.05 | 1.08 | 1.12 | 1.16 | 1.19 | 1.24 | 1.28 | 1.33 | 1.38 |
| 17 | 1.03 | 1.05 | 1.09 | 1.13 | 1.16 | 1.21 | 1.25 | 1.29 | 1.34 | 1.40 |
| 18 | 1.03 | 1.06 | 1.10 | 1.13 | 1.17 | 1.22 | 1.26 | 1.31 | 1.36 | 1.41 |
| 19 | 1.03 | 1.06 | 1.10 | 1.14 | 1.18 | 1.22 | 1.27 | 1.32 | 1.37 | 1.42 |
| 20 | 1.03 | 1.07 | 1.11 | 1.15 | 1.19 | 1.23 | 1.28 | 1.33 | 1.38 | 1.44 |
| 21 | 1.03 | 1.07 | 1.11 | 1.16 | 1.19 | 1.24 | 1.29 | 1.34 | 1.39 | 1.45 |
| 22 | 1.04 | 1.07 | 1.11 | 1.16 | 1.20 | 1.25 | 1.29 | 1.35 | 1.40 | 1.46 |
| 23 | 1.04 | 1.07 | 1.12 | 1.16 | 1.20 | 1.25 | 1.30 | 1.35 | 1.41 | 1.46 |
| 24 | 1.04 | 1.08 | 1.12 | 1.16 | 1.21 | 1.25 | 1.30 | 1.36 | 1.41 | 1.47 |
| 25 | 1.04 | 1.08 | 1.12 | 1.16 | 1.21 | 1.26 | 1.31 | 1.36 | 1.41 | 1.47 |
| 26 | 1.04 | 1.08 | 1.12 | 1.17 | 1.21 | 1.26 | 1.31 | 1.36 | 1.42 | 1.47 |
| 27 | 1.04 | 1.08 | 1.12 | 1.17 | 1.21 | 1.26 | 1.31 | 1.37 | 1.42 | 1.48 |
| 28 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | 1.37 | 1.42 | 1.48 |
| 29 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | 1.37 | 1.42 | 1.48 |
| 30 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | 1.37 | 1.42 | 1.48 |
| 31 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | 1.37 | 1.42 | |
| 32 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | 1.36 | | |
| 33 | 1.04 | 1.08 | 1.12 | 1.17 | 1.22 | 1.26 | 1.31 | | | |
| 34 | 1.04 | 1.08 | 1.12 | 1.17 | 1.21 | 1.26 | | | | |
| 35 | 1.04 | 1.08 | 1.12 | 1.17 | 1.21 | | | | | |
| 36 | 1.04 | 1.08 | 1.12 | 1.17 | | | | | | |
| 37 | 1.04 | 1.08 | 1.12 | | | | | | | |
| 38 | 1.04 | 1.08 | | | | | | | | |
| 39 | 1.04 | | | | | | | | | |

## RETAINING WALL COST ADJUSTMENT FACTORS

Sloping Backfill with Slope > 3 : 1 (Run : Rise)

| Original Height (ft.) | Height Increase (ft.) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1.03 | 1.07 | 1.11 | 1.16 | 1.22 | 1.28 | 1.35 | 1.43 | 1.51 | 1.60 |
| 11 | 1.04 | 1.08 | 1.13 | 1.18 | 1.25 | 1.31 | 1.39 | 1.47 | 1.56 | 1.65 |
| 12 | 1.04 | 1.09 | 1.14 | 1.20 | 1.27 | 1.34 | 1.42 | 1.50 | 1.59 | 1.69 |
| 13 | 1.05 | 1.10 | 1.15 | 1.22 | 1.29 | 1.36 | 1.44 | 1.53 | 1.62 | 1.72 |
| 14 | 1.05 | 1.10 | 1.16 | 1.23 | 1.30 | 1.38 | 1.46 | 1.55 | 1.65 | 1.75 |
| 15 | 1.05 | 1.11 | 1.17 | 1.24 | 1.32 | 1.40 | 1.48 | 1.57 | 1.67 | 1.77 |
| 16 | 1.05 | 1.12 | 1.18 | 1.25 | 1.33 | 1.41 | 1.49 | 1.59 | 1.68 | 1.78 |
| 17 | 1.05 | 1.12 | 1.19 | 1.26 | 1.33 | 1.42 | 1.50 | 1.59 | 1.69 | 1.79 |
| 18 | 1.05 | 1.12 | 1.19 | 1.26 | 1.34 | 1.42 | 1.51 | 1.60 | 1.70 | 1.80 |
| 19 | 1.05 | 1.12 | 1.19 | 1.27 | 1.34 | 1.42 | 1.51 | 1.60 | 1.70 | 1.80 |
| 20 | 1.05 | 1.13 | 1.19 | 1.27 | 1.34 | 1.43 | 1.51 | 1.60 | 1.69 | 1.79 |
| 21 | 1.05 | 1.13 | 1.19 | 1.27 | 1.34 | 1.42 | 1.51 | 1.60 | 1.69 | 1.79 |
| 22 | 1.05 | 1.13 | 1.19 | 1.27 | 1.34 | 1.42 | 1.51 | 1.59 | 1.68 | 1.78 |
| 23 | 1.05 | 1.13 | 1.19 | 1.27 | 1.34 | 1.42 | 1.50 | 1.59 | 1.68 | 1.77 |
| 24 | 1.05 | 1.13 | 1.19 | 1.26 | 1.34 | 1.41 | 1.50 | 1.58 | 1.67 | 1.76 |
| 25 | 1.05 | 1.12 | 1.19 | 1.26 | 1.33 | 1.41 | 1.49 | 1.57 | 1.66 | 1.74 |
| 26 | 1.05 | 1.12 | 1.19 | 1.26 | 1.33 | 1.40 | 1.48 | 1.56 | 1.64 | 1.73 |
| 27 | 1.05 | 1.12 | 1.19 | 1.25 | 1.32 | 1.40 | 1.47 | 1.55 | 1.63 | 1.72 |
| 28 | 1.05 | 1.12 | 1.18 | 1.25 | 1.32 | 1.39 | 1.46 | 1.54 | 1.62 | 1.70 |
| 29 | 1.05 | 1.12 | 1.18 | 1.25 | 1.31 | 1.38 | 1.46 | 1.53 | 1.61 | 1.69 |
| 30 | 1.05 | 1.12 | 1.18 | 1.24 | 1.31 | 1.38 | 1.45 | 1.52 | 1.60 | 1.67 |
| 31 | 1.05 | 1.11 | 1.17 | 1.24 | 1.30 | 1.37 | 1.44 | 1.51 | 1.58 | |
| 32 | 1.05 | 1.11 | 1.17 | 1.23 | 1.30 | 1.36 | 1.43 | 1.50 | | |
| 33 | 1.05 | 1.11 | 1.17 | 1.23 | 1.29 | 1.36 | 1.42 | | | |
| 34 | 1.05 | 1.11 | 1.17 | 1.22 | 1.29 | 1.35 | | | | |
| 35 | 1.05 | 1.11 | 1.16 | 1.22 | 1.28 | | | | | |
| 36 | 1.05 | 1.10 | 1.16 | 1.22 | | | | | | |
| 37 | 1.05 | 1.10 | 1.16 | | | | | | | |
| 38 | 1.05 | 1.10 | | | | | | | | |
| 39 | 1.05 | | | | | | | | | |

# Appendix A
# Approved Systems

The following wall systems/suppliers have been approved for use on TDOT projects. All approved systems are also found in QPL 38 Retaining Wall Systems:

## SECTION A BIN/CRIB/PRECAST GRAVITY WALLS

**Doublewal Corporation**
7 West Main Street
Plainville, CT 06062
Telephone: (860) 793-0295
Fax: (860) 793-2119
Website: www.doublewal.com

**Evergreen Wall**
Permatile Concrete Products
P.O. Box 2049
100 Beacon Road
Bristol, VA/TN 24203
Telephone: 1 (800) 662-5332
Fax: 1 (276) 669-2120
Website: www.permatile.com

**PRECAST CONCRETE GRAVITY WALL**
Redi-Rock Retaining Wall (Unreinforced only)
Redi-Rock International
05481 US 31 South
Charlevoix, MI 49720
Telephone: (866) 222-8400
Fax : (231) 237-9521
Website: www.redi-rock.com or www.redi-rocktn.com for Tennessee contact info

## SECTION B GABION WALLS

### MANUFACTURER

**MACCAFERRI-USA**
10303 Governor Lane Boulevard
Williamsport, MD 21795-3116
Telephone: (301)223-6910
Fax: (301)223-6134
Website: www.macaferri-northamerica.com

**TERRA AQUA**
1415 North 32nd Street
Fort Smith, AR 72904
Telephone: (800) 736-9089
Fax: (775) 828-1394
Website: www.terraaqua.com

## SECTION C MECHANICALLY STABILIZED EARTH WALL (SEGMENTAL, PRECAST FACING)

### MANUFACTURER

**REINFORCED EARTH WALL**
Retained Earth Wall (Formerly by Foster Geotechnical)
Reinforced Earth Company
25 Technology Parkway South, Suite 100
Norcross, GA 30092
Telephone: (770) 242-9415
Fax: (770) 242-9758
Website www.reinforcedearth.com

**ARES SEGMENTAL PRECAST RETAINING WALL SYSTEM**
Tensar Earth Technologies, Inc.
5883 Glenridge Drive
Suite 200
Atlanta, GA 30328
Telephone (404) 250-1290
Fax (404) 250-0461
Website www.tensarcorp.com

**SineWall**
SineWall, LLC
7162 Liberty Centre Drive, Suite 105
West Chester, Ohio 45069
Contact: Tim Brereton
Phone: 513 759-2345
Fax: 513 297-7930
Email: breretont@sinewall.com,
Web site: www.sinewall.com
Note: SineWall is currently conditionally approved for use on TDOT projects for retaining walls where an MSE Segmental Facing is an acceptable wall type and the wall(s) for the project are less than 25 feet in height (measured from top of wall to front of wall finished ground line) and the total estimated wall surface area for all MSE wall(s) for the project totals less than 10,000 square feet.

**SSL MSE PLUS™ RETAINING WALL SYSTEM**
SSL, LLC
4740 Scotts Valley Drive, Suite E
Scotts Valley, CA 95066
Telephone: (831) 430-9300
Fax: (831) 430-9340
Website www.mseplus.com

**TRICON RETAINED SOIL WALL SYSTEM**
TRICON Precast, LTD
15055 Henry Road
Houston, Texas 77060
Telephone: (281) 931-9832
Fax: (281) 931-0061
Website: www.triconprecast.com

## SECTION D MECHANICALLY STABILIZED EARTH WALL (MODULAR BLOCK FACING)

### MANUFACTURER

**Allan Block AB Commercial Wall**
Red River Concrete Products
4235 Guthrie Highway
P.O. Box 30399
Clarksville, Tn. 37040
Contact: Mike Brewer
Phone: 931 647-3308
Fax: 931 553-0534

Email: mbrewer@redriverproducts.com
Website: www.allanblock.com
Note: Allan Block AB Commercial Wall is currently conditionally approved for use on TDOT projects for retaining walls where an MSE Modular Block Facing is an acceptable wall type and the wall(s) for the project are less than 25 feet in height (measured from top of wall to front of wall finished ground line) and the total estimated wall surface area for all MSE wall(s) for the project totals less than 10,000 square feet.

**MESA Wall System**
Tensar Earth Technologies, Inc.
5883 Glenridge Drive
Suite 200
Atlanta, GA 30328
Telephone (404) 250-1290
Fax (404) 250-0461
Website: www.tensarcorp.com

**KEYSYSTEM I**
Contech Construction Products
9025 Centre Pointe Drive, Suite 400
Westchester, OH 45069
Telephone: 1(800) 338-1122
Website: www.contech-cpi.com

**LANDMARK REINFORCED WALL SYSTEM**
Anchor Wall Systems
5959 Baker Road, Suite 390
Minnetonka, Minnesota 55345-5996
Telephone: (952) 933-8855
Website: www.anchorwall.com

**VERSA-LOK RETAINING WALL SYSTEM**
Kiltie Corporation
6348 Highway 36 Blvd., Suite 1
Oakdale, MN 55128
Telephone: (651) 770-3166
Local Contact – Chris Lazarides – (865) 363-5052
Website: www.versa-lok.com

# SECTION E ANCHOR WALLS

## MANUFACTURER

**Berkle & Company Contractors, Inc.**
Atlanta Regional Office
7300 Marks Lane
Austell, GA 30168
Telephone: (770) 941-5100
Fax: (770) 941-6300

**Coastal Drilling East, LLC**
70 Gum Springs Road
Morgantown, WV 26508
Telephone: (304) 296-1120
Fax: (304) 296-1569

**F & W Construction**
1225 Johnson Ferry Road, Suite 230
Marietta, GA 30068
Telephone: (770) 973-9091
Fax: (770) 973-9015

**Goettle**
12071 Hamilton Ave.
Cincinnati, OH 45231
Telephone: (513) 825-8100
Fax: (513) 825-8107

**Hayward-Baker, Inc.**
P.O. Box 6
Hermitage, TN 37076
Telephone: (615) 883-6445
Fax: (615) 883-6418
Website: www.haywardbaker.com

**The Judy Company**
8334 Ruby Avenue
Kansas City, KS 66111
Telephone: (913) 422-5088
Fax: (913) 422-5307

**Schnabel Foundation Company**
1654 Lower Roswell Road
Marietta, GA 30068
Telephone: (770) 971-6455
Fax: (770)977-8530
Website: www.schnabel.com

**Nicholson Construction Company**
**P.O. Box 7**
2117 Immel Mine Road
Mascot, TN 37806
Telephone: (865) 933-3111
Fax: (865) 933-1652
Website: www.nicholsonconstruction.com

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 12-18-1995) March 1, 2006

## SPECIAL PROVISION

## REGARDING

## SECTION 730 – TRAFFIC SIGNALS

Delete Subsection 730.05 and add the following:

**730.05-Working Drawings.** The contractor shall provide detailed technical circuit description and circuit schematic information applicable to the operation and maintenance of the controller and associated auxiliary equipment. Cabinet wiring diagrams with interconnection details, schematics, and maintenance techniques shall be furnished. Information in manual form shall include a materials guide which shall contain the replacement part numbers and description of all components used. All solid-state devices shall be listed by their generic name or in lieu of this, a complete cross-index from manufacturers' numbers to generic number shall be provided and shall be identified on all printed circuit boards or other mounting locations. Parts lists shall be itemized with the respective chassis, module, or circuit wherein parts may be found. A total listing of parts without grouping shall not be acceptable. Schematic circuit drawings shall be furnished that are slow to fade when exposed to sunlight over long periods of time. A developed and fixed printing process, or one of the forms of printing by actual ink transfer, will be acceptable.

Two (2) copies of all the above information shall be provided with the controllers. In addition, three (3) copies of a cabinet wiring diagram, including all auxiliary equipment, shall be supplied with each controller unit. A clear, resealable plastic envelope shall be attached with screws to the inside of each cabinet door for storage of the cabinet wiring prints. This envelope shall be mounted so as to avoid restriction of the circulation of air into and out of the cabinet.

Delete Subsection 730.07 and add the following:

**730.07-Training.** The Contractor shall provide (with manufacturer personnel), as part of the contract of the signals, a minimum of twenty-four (24) hours of classroom and laboratory instruction on the operation and maintenance of each separate type of controller supplied for three (3) City of Memphis technicians. Instructions shall be on a highly technical level, describing the design and operation of electronic circuitry in great detail as well as demonstrating troubleshooting and repair techniques. The rudiments of dial systems and basic solid-state theory are below the level of the instruction required by this specification. This instruction shall begin at a time requested by the City and approved by the Engineer, and shall be conducted at facilities provided by the Contractor.

Add the following to Subsection 730.16:

Cable Hangers

All cable and conductors running in a pole shall be hung with a strain relief hanger-gripper from the "J" hook in the top of the pole before leaving or after entering the pole through a weatherhead, entering a Mast arm, signal head, push button, or controller cabinet. Cable(s) entering or leaving via the pole foundation shall be hung in a strain relief hanger-gripper if the cable(s) rises more than 2.5 meters (8 feet) above the foundation. The cable and conductors shall be in one or more hanger-grippers with the gripper distributing the weight over a minimum of 300 millimeters(one foot).

Entry Bushings

All entry or exit points through field-drilled holes in poles, pedestals, or mast arms at the point of attachment of vehicle or pedestrian heads shall be tapped and shall have a threaded PVC stub extending 50 millimeters (2 inches) beyond the outside surface to protect the cable and conductors from sharp edges or corners and to maintain cable alignment, in conformance with the Plans.

Delete Subsection 730.19 and substitute the following:

The sealant is intended to protect the detector loop wire against ambient environment and roadway conditions.

General:

1. The sealant shall be a one-part electrometric compound requiring no mixing, measuring or application of heat prior or during its installation.
2. The sealant must provide compressive yield strength to withstand normal vehicular traffic as well as sufficient flexibility to withstand normal movement in asphalt and concrete road pavement.
3. The sealant shall have flow characteristics which insure complete encapsulation of the wires.
4. The sealant shall not run out of the detector saw-cut in sloped areas during or after application.
5. The sealant shall enable vehicular traffic to pass over the properly filled saw-cut immediately after installation.
6. The cured sealant shall be landfill disposable in accordance with environmental protection agency requirements.
7. The sealant shall have the following physical properties:

Physical Properties of the Uncured (wet) Encapsulant

| Property | Requirement | Test Procedure | ASTM Reference |
|---|---|---|---|
| a. Weight | 1.2-1.27 kg/l (10.0-10.6 lbs/gal) | Kilograms/Liter (Weight/gallon) | D 1875 |
| b. Total solids by Weight | 75% min. | Determination of non-volatile content | D 2834 |
| c. Viscosity | 5,000-85,000 cps | Viscosity | D 1048B |
| d. Drying Time | Touch: 24 hrs. max. | Tack-Free Time | D 1640 |
| e. Non-Flow | 70% min. | Retention Test | --- |

Physical Properties of the Cured Encapsulant

| Property | Requirement | Test Procedure | ASTM Reference |
|---|---|---|---|
| a. Hardness (Indentation) | 60-85 | Rex hardness | D 2240 |
| b. Tensile Strength | 5515 kPa min. (800 psi min.) | Tensile and Elongation | D 412A |
| c. Elongation at Break | 400-700% | Tensile and Elongation | D 412A |

Delete Subsection 730.24 and add the following:

**730.24-Signal Heads.** The Contractor shall provide and install vehicle and pedestrian signals as shown on the Plans. Each signal face shall consist of one or more signal sections, each containing an optical unit, lens, main housing, door and visor and designed and constructed so as to fit rigidly and securely together, one above the other to present a clean appearance and provide a weathertight enclosure for the optical and electrical equipment. These signal heads shall meet the requirements of the latest Institute of Transportation Engineers Standards for "Adjustable Face Vehicle Traffic Control Signal Heads," the "Adjustable Face Pedestrian Signal Head Standard," the National Electrical Code, and the Manual on Uniform Traffic Control Devices where applicable. Each signal head assembly shall be supplied complete with an incandescent traffic signal lamp bulb and ready for operation with the connection of field wiring. Signal heads shall be covered or "bagged" on installation until all work at the intersection has been completed, tested, accepted, and the signal turned on for traffic. At the time of turn-on of the signal, any old signals shall be covered or immediately removed.

Materials

The housing and door of each signal section shall be fabricated from corrosion-resistant U.V. stabilized Polycarbonate resin material. The moldings shall be a minimum of 2.3 millimeters (0.090 inches) thick and be ribbed for additional strength at point of high stress. Additional thickness shall be provided as necessary to eliminate light transmission through the housing, door, visor, or backplate.

Visors and backplates shall be fabricated from corrosion-resistant U.V. stabilized Polycarbonate resin material. Visors shall have a 2.5 millimeters (0.100-inch) minimum thickness. Backplates shall have a 3.2 millimeters (0.125-inch) minimum thickness.

Construction

Wiring. Signal head leads shall be 0.82 square millimeter (No. 18 AWG) stranded with 105 degrees C Thermoplastic insulation. A separate white (common) lead shall be wired to each socket shell; and a colored lead, corresponding to the color code specified in the Plans, shall be wired to each socket terminal. Leads shall be of sufficient length to allow connection to the terminal block specified herein. Each complete signal head shall be provided with a minimum 4-point terminal block, properly mounted in a signal section. Stud type terminal blocks shall have not less than 6 millimeters (1/4") edge clearance to any portion of the stud. Exterior wiring shall have a 360 degree drip loop in advance of entering the head.

Housing. The housing of each section shall be a one-piece, corrosion-resistant, Polycarbonate resin molding with integral sides; top and bottom; free of voids, cracks, inclusions, or blow holes; and furnished with provisions for mounting of a backplate. The top and bottom of the housing shall have an opening 50 millimeters (2-inches) in diameter to accommodate standard 38 millimeter (1-1/2 inch) pipe, with no other opening in the top or bottom of the housing. Individual signal sections shall be fastened together, one above the other into a complete signal face, by means of plated nuts, bolts, and washers in such a manner that any section may be rotated about a vertical axis and positioned at an angle with respect to an adjacent section. The opening hub shall have 72 circumferential serrations to secure each section in its orientation, adjustable in 5-degree increments, and prevent its inadvertent rotation. A six-position labeled barrier terminal block shall be provided in each signal face for the purpose of field connections. The barrier terminal shall be installed in the circular yellow or yellow arrow section of each signal face. If the face has neither of these sections, the terminal block shall be installed in the uppermost section of the head. There shall be provisions for the attachment of a 6 millimeters (1/4-inch) tether line to the bottom of each span wire-mounted signal head employing a wire rope clip (Crosby #G450, Oliver #9072, Chance #6480 or equal) attached to the pinnacle. A pinnacle shall be provided to close all 50 millimeter (2-inch) openings in each housing which will not otherwise be sealed from the weather when installed with the specified mounting hardware.

Door. The housing door of each signal section shall be a one-piece, corrosion-resistant Polycarbonate resin molding; free of voids, cracks, inclusions, or blow holes. The outer face of the door shall have four (4) holes equally spaced about the circumference of the lens opening to accommodate the secure mounting of the signal head tunnel visor. The visor shall fit flush against the door, and no light shall leak between the door and the visor. Two stainless-steel hinge pins shall attach the door to the housing, one in the upper left corner and one in the lower left corner of the door. To stainless-steel wing nuts or screws, one in the upper right corner and one in the lower right corner of the door, shall be used for opening the door and closing it tight against the housing. The wing screws or nuts shall be installed to prevent their accidental removal or falling out. The removal of the hinge pins and the operation of the wing nuts or screws shall not require the use of tools.

Optical System. The optical system shall consist of a lens, reflector, and lamp socket. The system shall be designed to minimize sun phantom and eliminate light spillover. Prefocused, incandescent lamps shall be the light source for all signals. Signal lamps for 200 millimeter (8 inch) lenses shall be clear, 595 rated initial lumen output, with a minimum life of 6,000 hours. Signal lamps for 300 millimeter (12 inch) lenses shall be clear, 1750 rated initial lumen output, with a minimum life of 6,000 hours. All vehicle signal lenses shall be glass and shall conform to the latest standards of the Institute of Transportation Engineers and American National Standards Institute optical specification. All reflectors shall be of ALZAK aluminum construction. The lamp socket shall be of Bakelite construction. Lamp replacement shall be accomplished without the use of tool or the removal of the lens or reflector. The socket shall be fixed-focus and permit its rotation a full 360 degrees to any position to orient bulb filament openings. The socket shall be securely held in the reflector so as not to loosen, rotate, or fall out under vibration of traffic and wind movement of the signal head. The lamp socket shall be provided with two coded 0.82 square millimeter (#18 AWG) copper wire leads. The leads shall be fitted with insulated spade wire terminals and be of sufficient length to make field connections at the barrier terminal block.

The vehicular and pedestrian signal lens, signal lamp socket, and reflector shall form a sealed module with molded neoprene gaskets holding the sealed optical module securely in the signal door. The gasket shall provide a seal to prevent moisture, dust, and road film contamination from entering the optical module and the signal housing.

Visors. Each signal door shall be fitted with a corrosion-resistant Polycarbonate resin tunnel visor. 200 millimeter (eight-inch) signals shall have visors a minimum of 175 millimeters (7-inches) long; 300 millimeter (12-inch) signals shall have visors a minimum of 240 millimeters (9-1/2 inches) long. The visor shall be flat black inside and outside. The visors shall be attached to the door at four equally spaced locations with four plated screws or four bayonet-type self-locking tabs integrally formed with the visor. The visor shall be preformed into a fixed cylindrical shape of the proper diameter to be installed around the lens.

Directional Louvers. Where shown on the Plans, louvers shall be furnished and installed in the hoods of the signal head sections designated.

Directional louvers shall be so constructed as to have a snug fit in the signal hoods. The outside cylinder and vanes shall be constructed of a non-ferrous metal or galvanized sheet steel. Louvers shall be painted with two coats of black enamel as specified in these specifications.

Backplate. Each signal head assembly, so required by the Plans, shall be equipped with a backplate with a minimum width of 125 millimeters (5-inches) with rounded corners. Stainless-steel screws shall be provided for mounting to the signal housing. The backplate shall consist of one or more pieces fabricated from corrosion-resistant, flat Polycarbonate resin material colored flat black front and back.

Legends. Pedestrian heads shall be fitted with lenses that, when illuminated, shall provide a Portland Orange "DONT WALK" in the top section and a Lunar White "WALK" in the bottom section, all conforming to the I.T.E. Standard for "Adjustable Face Pedestrian Signal Heads." The remainder of the lens shall be black and opaque. When not illuminated, the legends shall not be distinguishable.

Traffic signal lenses shall be circular, red, yellow, or green in color and 200 or 300 millimeter (8-inch or 12-inch) nominal diameter, as specified. No legend shall be permitted. Arrow lenses shall be circular, 300 millimeters (12-inches) in diameter, green or yellow in color, and be opaque except for the arrow legend. If an arrow lens is only applicable for one orientation; i.e., left, straight, or right, this information shall be indicated in a permanent and appropriate manner on the lens but without impairing the optical properties of the lens.

Mounting Hardware. Spanwire suspension fitting with cable entrance shall be a one piece malleable iron casting, minimum wall thickness 5 millimeters (3/16-inch), and free of flash and voids. The cable entrance shall have a plastic bushing with a minimum inside diameter of 32 millimeters (1-1/4 inches). The suspension fitting shall provide six separate, clevis pin positions for balancing the signal assembly. The thickness of the solid casting in this suspension area shall be a minimum of 16 millimeters (5/8-inch). A hex head threaded malleable iron lock nipple shall be provided for attaching the signal head to the bottom of the suspension fitting for one-face signals or to the top bracket of multiface signal brackets.

The mounting hardware for each signal face shall include a nylon, serrated, 72-tooth lock ring with full locking pins and a circular neoprene gasket for weather sealing.

All openings in signal heads, top or bottom which are not otherwise utilized for signal mounting, shall be closed with a hex ornamental pinnacle assembly complete with circular neoprene gasket and malleable iron hex lock nut. No conduit lock nuts are permitted.

Spanwire Suspension Clamp Assembly, where required, shall consist of a galvanized, malleable iron spanwire clevis saddle, 16 millimeters (5/8-inch) diameter plated steel clevis pin with cotter key, two 13 millimeters (1/2-inch) plated steel "U" bolts with nuts and washers (no "J" bolts are permitted), and a galvanized malleable iron cable locking bar, all fitted to the diameter of the guy span as specified in the Plans. Galvanizing to meet ASTM A 153.

Balance Adjustor required for each spanwire suspended signal head shall be supplied with a malleable iron balance adjustor complete with steel I-bolt and steel clevis pin with cotter key to be installed between the spanwire suspension clamp and the suspension fitting with cable entrance.

Brackets, where required, shall consist of a malleable iron center outlet body, schedule 40 pipe, elbows, serrated fittings, and other hardware as required to provide a multiface signal head assembly with internal wiring raceways to each face as specified.

Spanwire Bottom Bracket, where required, shall consist of 65 x 3 millimeter (2-5/8" x 1/8") steel brace with an arm fitted with a pinnacle, neoprene washer, and malleable iron hex lock nut for each signal face to be accommodated (conduit lock nuts not acceptable). An attachment fitting for 6 millimeter (1/4-inch) tetherwire shall be mounted at the center of the bracket.

Polycarbonate Side of Pole Bracket, where required, shall be one-piece molding with internal wiring raceway for banding or lag screw attachment to steel or wood poles. Brackets shall be designed to withstand 160 km per hour (100 mph) wind loading on it and the signal head. Each bracket shall have an integrally molded 72-tooth serrated ring for signal head positioning and come complete with 38 millimeter (1-1/2 inch) nipple, hex lock nut, pinnacle, neoprene washer, and one 1/4-inch interlocking shim for plumbing signals.

Elevator Plumbizer, where required, shall be malleable iron or bronze alloy for mast arm installation, with internal wire raceway, sized to fit a 38 millimeter (1-1/2 inch) tenon, complete with three set screws and one through bolt with nuts and lock washer, complete with serrations to lock signal position to be installed between the red and yellow signal sections.

Slip Fitter Collar, where required, for top post mounting shall be malleable iron, including one vertical 38 millimeter (1-1/2 inch) nipple with hex lock nut; two 38 millimeter (1-1/2 inch) threaded horizontal entrances; and three set screws for attachment to the post. All horizontal entrances not used for attaching signal brackets shall be closed with a pinnacle and neoprene washer.

Color, Finish, and Painting

Polycarbonate resin hardware shall have color impregnated throughout the material. The finish shall be smooth and unflawed. Signal head parts shall be colored as follows:

a. Vehicle Head:

Housing - Federal Yellow
Door - Flat Black
Tunnel Visor - Flat Black inside and out
Backplate - Flat Black front and back
Pole Bracket - Federal Yellow

b. Pedestrian Head:

Housing - Federal Yellow
Door - Black
Tunnel Visor - Flat Black inside and out
Pole Bracket - Federal Yellow

All metal hardware, except those specified as galvanized, plated, or stainless steel shall be painted Federal Yellow. The metal parts shall be painted with a primer coat and a finish coat of the best quality oven-baked enamel. Lenses, reflectors, gaskets, and Polycarbonate parts shall not be painted.

Signal Head Installation - Signal heads shall be installed with the faces completely covered until the entire installation is ready for operation.

Delete the section under Controller Cabinets in Subsection 730.25 and substitute the following:

Cabinet

Cabinets shall be provided for each controller installed by the Contractor. The cabinet Installed by the Contractor shall be equipped with a radio interference filter installed at the electric service line input. The filter shall provide a minimum electrical noise attenuation of 50 decibels over the range of 200 kilohertz to 75 megahertz.

Surge Protection. The controller assembly shall conform to requirements of NEMA TS 1, part 2 - "Environmental Standards and Test Procedures". No cabinet surge protection or line filters shall be considered in providing the required transient protection of NEMA Part 2 (Reference note on NEMA Part 2, Page 6, Figure 2-2). Each 120 VAC electromechanical relay in the cabinet, flash transfer, signal monitor, etc., shall be suppressed with a 150-volt, 20-amp Varistor across it to ground.

The Cabinet AC service must be provided with the following surge protection:

1. Unit must be a series hybrid type rated at 20,000 amps (8 x 20 microsecond) 20 times.
2. The protector must be provided with terminals as defined below:

   a. Main line (AC line first stage terminal)
   b. Main neutral (AC neutral input terminal)
   c. Equip line in (AC line second stage input terminal, 10 amps)
   d. Equip line out (AC line second stage output terminal, 10 amps)
   e. Equip neutral out (neutral terminal to protected equipment)
   f. GND (earth connection)

3. The equip line in and quip line out terminals must be separated by a 200 microhenry (minimum) inductor rated to handle 10 amps AC service.
4. The first stage clamp must be between main line and GND terminals.
5. The second stage clamp must be between equip line out and equip neutral.
6. Main neutral and equip neutral out are connected together internally and must have a gas discharge tube rated at 20 KA between main neutral and GND terminals.
7. Main line and equip line terminals are isolated internally.
8. If gas discharge tubes are utilized for the first stage clamps, each tube must have a minimum of 0.15 OHM follow-current limiters in series.
9. Peak clamp voltage; 350 volts at 20 KA (voltage measured between equip line out and equip neutral out terminals. Current applied between main line and GND terminals with GND and main neutral terminals externally tied together).
10. Response time: voltage in 9 above can never exceed 350 volts.
11. Protector must be epoxy encapsulated in a flame retardant material.
12. Continuous service current: 10 amps @ 120 VAC RMS.

Pin Connectors. Electrical connections between the control unit and the cabinet wiring harness(es) shall be accomplished using one or more "MS" type multiple pin connectors at the controller (NEMA type) and insulated spade wire terminal connectors at the cabinet terminal blocks. The pin connectors and function pin assignments shall be in accordance with Tables 1, 2, and 3. All functions developed within the control unit for existing or future expanded phasing, up to the maximum capability of the controller, shall be available at the cabinet terminals for greatest operational flexibility. All functions and pin assignments required by NEMA shall be provided as a minimum. Additional functions and features, either required by these specifications or offered by the manufacturer, shall be provided through the pin connector on otherwise spare positions.

TABLE 1

CONNECTOR A

Alphabetical Listing of Pin Assignments

| Pin | Function | Pin | Function |
|---|---|---|---|
| A | Spare 1 | f | Phase 1 Vehicle Call Det |
| B | +24V DC External | g | Phase 1 Ped Call Det |
| C | Voltage Monitor Output | h | Phase 1 Hold |
| D | Phase 1 Red Driver | i | Force Off Ring 1 |
| E | Phase 1 Don't Walk Driver | j | Ext Min Recall All Phases |
| F | Phase 2 Red Driver | k | Manual Control Enable |
| G | Phase 2 Don't Walk | m | Call to Nonactuated I |
| H | Phase 2 Ped Clear | n | Test Input A |
| J | Phase 2 Walk | p | AC+ |
| K | Phase 2 Vehicle Call Det | q | Spare 3 |
| L | Phase 2 Ped Call Det | r | Coded Status Bit B Ring 1 |
| M | Phase 2 Hold | s | Phase 1 Green |
| N | Stop Timing Ring 1 | t | Phase 1 Walk |
| P | Inhibit Max Term Ring 1 | u | Phase 1 Check |
| R | External Start | v | Phase 2 Ped Omit |
| S | Interval Advance | w | Omit All Red Clear Ring 1 |
| T | Spare 2 | x | Red Rest Mode Ring 1 |
| U | AC- | y | Spare 4 |
| V | Chassis Ground | z | Call to Nonactuated II |
| W | Logic Ground | AA | Test Input B |
| X | Flashing Logic Output | BB | Walk Rest Modifier |
| Y | Coded Status Bit C Ring 1 | CC | Coded Status Bit A Ring 1 |
| Z | Phase 1 Yellow | DD | Phase 1 On |
| a | Phase 1 Ped Clear | EE | Phase 1 Ped Omit |
| b | Phase 2 Yellow | FF | Ped Recycle Ring 1 |
| c | Phase 2 Green | GG | Max 2 Selection - Ring 1 |
| d | Phase 2 Check | HH | Spare 5 |
| e | Phase 2 On | | |

TABLE 2

CONNECTOR B

Alphabetical Listing of Pin Assignments

| Pin | Function | Pin | Function |
|---|---|---|---|
| A | Phase 1 Next | f | Phase 4 Next |
| B | Spare 1 | g | Phase 4 Omit |
| C | Phase 2 Next | h | Phase 4 Hold |
| D | Phase 3 Green Driver | i | Phase 3 Hold |
| E | Phase 3 Yellow Driver | j | Phase 3 Ped Omit |
| F | Phase 3 Red Driver | k | Phase 6 Ped Omit |
| G | Phase 4 Red Driver | m | Phase 7 Ped Omit |
| H | Phase 4 Ped Clear Driver | n | Phase 8 Ped Omit |
| J | Phase 4 Don't Walk Driver | p | Overlap A Yellow Driver |
| K | Phase 4 Check | q | Overlap A Red Driver |
| L | Phase 4 Veh Call Det | r | Phase 3 Check |
| M | Phase 4 Ped Call Det | s | Phase 3 On |
| N | Phase 3 Veh Call Det | t | Phase 3 Next |
| P | Phase 3 Ped Call Det | u | Overlap D Red Driver |
| R | Phase 3 Omit | v | Spare 4 |
| S | Phase 2 Omit | w | Overlap D Green Driver |
| T | Phase 5 Ped Omit | x | Phase 4 Ped Omit |
| U | Phase 1 Omit | y | Spare 5 |
| V | Ped Recycle Ring 2 | z | Max 2 Selection - Ring 2 |
| W | Spare 2 | AA | Overlap A Green Driver |
| X | Spare 3 | BB | Overlap B Yellow Driver |
| Y | Phase 3 Walk Driver | CC | Overlap B Red Driver |
| Z | Phase 3 Ped Clear Driver | DD | Overlap C Red Driver |
| a | Phase 3 Don't Walk Driver | EE | Overlap D Yellow Driver |
| b | Phase 4 Green Driver | FF | Overlap C Green Driver |
| c | Phase 4 Yellow Driver | GG | Overlap B Green Driver |
| d | Phase 4 Walk Driver | HH | Overlap C Yellow Driver |
| e | Phase 4 On | | |

TABLE 3

CONNECTOR C

Alphabetical Listing of Pin Assignments

| Pin | Function | Pin | Function |
|---|---|---|---|
| A | Coded Status Bit A Ring 2 | i | Phase 5 Green Driver |
| B | Coded Status Bit B Ring 2 | j | Phase 5 Walk Driver |
| C | Phase 8 Don't Walk Driver | k | Phase 5 Check |
| D | Phase 8 Red Driver | m | Phase 5 Hold |
| E | Phase 7 Yellow Driver | n | Phase 5 Omit |
| F | Phase 7 Red Driver | p | Phase 6 Hold |
| G | Phase 6 Red Driver | q | Phase 6 Omit |
| H | Phase 5 Red Driver | r | Phase 7 Omit |
| J | Phase 5 Yellow Driver | s | Phase 8 Omit |
| K | Phase 5 Ped Clear Driver | t | Phase 8 Veh Call Det |
| L | Phase 5 Don't Walk Driver | u | Red Rest Mode Ring 2 |
| M | Phase 5 Next | v | Omit All Red Ring 2 |
| N | Phase 5 On | w | Phase 8 Ped Clear Driver |
| P | Phase 5 Veh Call Det | x | Phase 8 Ped Green Clear Driver |
| R | Phase 5 Ped Call Det | y | Phase 7 Don't Walk Driver |
| S | Phase 6 Veh Call Det | z | Phase 6 Don't Walk Driver |
| T | Phase 6 Ped Call Det | AA | Phase 6 Ped Clear Driver |
| U | Phase 7 Ped Call Det | BB | Phase 6 Check |
| V | Phase 7 Veh Call Det | CC | Phase 6 On |
| W | Phase 8 Ped Call Det | DD | Phase 6 Next |
| X | Phase 8 Hold | EE | Phase 7 Hold |
| Y | Force Off Ring 2 | FF | Phase 8 Check |
| Z | Stop Timing Ring 2 | GG | Phase 8 On |
| a | Inhibit Max Termination Ring 2 | HH | Phase 8 Next |
| b | Spare 1 | JJ | Phase 7 Walk Driver |
| c | Coded Status Bit C Ring 2 | KK | Phase 7 Ped Clear Driver |
| d | Phase 8 Walk Driver | LL | Phase 6 Walk Driver |
| e | Phase 8 Yellow Driver | MM | Phase 7 Check |
| f | Phase 7 Green Driver | NN | Phase 7 On |
| g | Phase 6 Green Driver | PP | Phase 7 Next |
| h | Phase 6 Yellow Driver | | |

TABLE 4

CONNECTOR D

Alphabetical Listing of Pin Assignments

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | TBC On Line (Sys Det #1) | 20 | Set Clock (Sp Status #5) |
| 2 | Dial A (Sys Det #7) | 21 | Dimmer (Sp Status #6) |
| 3 | Dial B (Sys Det #8) | 22 | Dial A (Sys Out 7) |
| 4 | Split A (Sys Det #5) | 23 | Dial B (Sys Out 8) |
| 5 | Split B (Sys Det #6) | 24 | Split A (Sys Out 5) |
| 6 | Offset 1 (Sys Det #2) | 25 | Split B (Sys Out 6) |
| 7 | Offset 2 (Sys Det #3) | 26 | Offset 1 (Sys Out 2) |
| 8 | Offset 3 (Sys Det #4) | 27 | Offset 2 (Sys Out 3) |
| 9 | Remote Flash | 28 | Offset 3 (Sys Out 4) |
| 10 | Preempt 1 | 29 | Flash (Sys Out 1) |
| 11 | Preempt 2 | 30 | Auxiliary 1 |
| 12 | Preempt 3 | 31 | Auxiliary 2 or any Preempt |
| 13 | Preempt 4 | 32 | Auxiliary 3 or Det Reset |
| 14 | Conflict Flash Status | 33 | Logic Ground |
| 15 | Manual Flash Status | 34 | Optional Serial Comm. 1 |
| 16 | Alt Seq A (Sp Status #1) | 35 | Optional Serial Comm. 1 |
| 17 | Alt Seq B (Sp Status #2) | 36 | Optional Serial Comm. 2 Reserved-1 |
| 18 | Alt Seq C (Sp Status #3) | 37 | Optional Serial Comm. 2 Reserved |
| 19 | Alt Seq D (Sp Status #4) | | |

Signal Conflict Monitor

All cabinets shall be supplied with a Signal Conflict Monitor (SCM) which meets the NEMA Standards. The SCM for all controller cabinets with three or more phases shall be the 12-channel type, and shall have the following features:

1. Liquid Crystal Display to show all data in English language format.
2. Shall monitor all Green/Yellow/Red/Walk field display outputs.
3. Shall monitor the Controller 24 VDC output and be user programmable to have this monitor function Latch on.
4. Shall monitor the Controller Voltage Monitor output, and be user programmable to have this monitor function Latch On.
5. Per Channel monitoring of Phase Yellow Clearance Interval, and shall cause flash operation if Yellow Clearance is less than the SCM programmed time (2.7 - 9 seconds).

6. Front panel mounted over-current protection (no internally mounted fuses are acceptable).
7. Front panel mounted reset switch.
8. Fault logging features:
   The SCM shall log all faults as to the:

   a. Date of fault
   b. Time of fault
   c. The fault condition
   d. Power failure

   and store these fault conditions in no-volatile memory for user retrieval. The monitor shall be able to store at least 9 such faults. The internal time clock shall automatically adjust for Daylight Savings Time changes. There shall be a keyboard method for the user to display and clear the stored event log.
9. There shall be an RS-232 port on the SCM to allow the user to print all data stored in the SCM. The printer shall interface with the SCM via a standard RS-232 cable. Printer to be supplied by others.
10. The SCM shall detect the following conditions and place the cabinet in the flash mode by De-energizing the Flash Transfer Relays:

    a. Absence of an active AC input on a channel
    b. Green/Yellow both active on a channel
    c. Yellow/Red both active on a channel
    d. Green/Red both active on a channel
    e. Green/Green active on conflicting channels
    f. Green/Yellow active on conflicting channels
    g. Green/Walk active on conflicting channels
    h. Low 24 VDC sample
    i. Controller Voltage Monitor active
    j. Clearance time less than programmed

11. On circuits where all field outputs are not used (such as left-turn phases) unused circuits shall be terminated at a load resistor and the monitor plus features shall function
12. No functional field display shall be permitted unless monitored by the SCM
13. The SCM sampling inputs shall be terminated at the closest tie point to the field termination

Cabinet Material

Pole mounted cabinets (required for two and three phase non-expandable controllers) shall be fabricated from cast aluminum or welded sheet aluminum or a combination of both. All welds shall occur on the inside surfaces of the cabinet to maintain a clean appearance.

Base mounted controller cabinets shall be installed as shown and fabricated from welded sheet aluminum or welded, copper bearing, 14 gauge (min.) sheet steel painted inside and out with zinc chromate primer and two coats of high grade aluminum paint. All welds shall occur on the inside surfaces of the cabinet to maintain a clean appearance.

1. Front Door.

   The cabinets shall have a right-hinged front-opening door, which shall include substantially the full area of the cabinet front and one auxiliary police door-in-door for access to emergency controls. The main door shall be equipped with a positive hold-fast device to secure the door in at least two open positions--one position being approximately 90 degrees open and the other at 120 degrees or more. The hold-fast device shall be easily secured and released without the use of tools. Each door shall be furnished with a neoprene rubber door sealing gasket to assure the weatherproof integrity of the cabinet doors when closed. The main cabinet door shall employ two or three heavy duty hinges which shall be welded to the cabinet and door with hinge pins of 6 millimeter (1/4-inch) diameter (minimum) stainless steel. No "piano" hinges or riveted construction shall be acceptable. The police panel door shall employ hinges meeting the above requirements.

2. Front Door Lock.

   The main door shall have a pin-tumbler cylinder lock, conforming to the City of Memphis Master Key as registered with the Corbin Lock Company. The Memphis Key Code shall be furnished with the approval of the equipment. The auxiliary police door shall be furnished with a standard police subtreasury lock. One (1) key for each lock shall be provided with each controller cabinet.

3. Frame.

   a. Base mounted cabinets shall be furnished for multi-phase controllers which have a frame capable of providing four (4) to eight (8) phases. All controllers supplied with railroad preemption equipment shall be furnished in base mounted cabinets. All hardware for mounting on a concrete foundation shall be furnished including Hot Dip Galvanized anchor bolts, nuts, washers, and template. All other controllers shall be furnished in pole-mounted cabinets.

   b. Pole mounted cabinets for two phase and three phase non-expandable controllers shall be equipped with brackets for stainless steel banding to either wood or steel pole mounting.

4. Ventilation.

All cabinets shall be furnished with a thermostatically operated, roof mounted electric exhaust fan. Pole mounted cabinet fans shall be capable of moving 5.6 cubic meters (200 cubic feet) of air per minute at cabinet temperature above 37 degrees C (100 degrees Fahrenheit). Base mounted cabinets shall have fans rated at 5.6 cubic meter per minute at 37 degrees C (200 CFM at 100 F). The fan shall be equipped with long lasting permanently lubricated bearings for constant unattended operation. The exhaust fan shall be mounted in a rain-tight housing attached to the cabinet top. The thermostat shall be adjustable from 20° C to 70° C (70° F to 160° F).

For pole and base mounted cabinets the inlet ventilation openings, located in the lower part of the cabinet, shall be screened and fitted with a fiberglass, furnace-type, replaceable air filter of adequate size and capacity to pass a volume of air equal to or greater than the rated capacity of the fan. The air filter supplied shall be a type and size which is readily available commercially.

5. Dimensions.

All cabinets for the controllers shall be consistent with the following minimum and maximum dimensions and equipment locations:

a. Top Shelf positioned to allow a minimum of 100 millimeters (4-inches) above controller to top of cabinet and 100 millimeters (4-inches) on each side of controller to the sides of the cabinet.
b. Second Shelf positioned approximately 200 millimeters (8 inches) below the top shelf to allow for a 150 millimeter (6-inch) high amplifier with a 50 millimeter (2-inch) space between top of amplifier and bottom of top shelf
c. Width of Cabinet must allow at least 50 millimeters (2-inches) clearance on each side of the set of amplifiers from the terminal strips mounted on the sides of the cabinet.
d. Third Shelf (optional) required if the top and second shelves will not accommodate the conflict monitor, amplifiers, pre-emptor (if required), and other equipment as required. The third shelf shall allow for the same top and side clearances as on the second shelf.
e. Load Switches to be mounted below the bottom shelf at the left rear of the cabinet. With the load switches in their bases, a minimum clearance of 50 millimeters (2-inches) shall be maintained below the bottom shelf and from the terminal blocks mounted on the sides of the cabinet.
f. Field Connectors to be made at the bottom rear of the cabinet on horizontal terminal strips. Terminal strip blocks shall be positioned not less than 50 millimeters (2-inches) nor more than 100 millimeters (4-inches) from the cabinet bottom.

g. Field Loop Connections to be made on terminal strips located on the left wall of the cabinet below the bottom shelf.
h. Loop Amplifier Cabinet Connections to be made on terminal strips on the left watt of the cabinet at the same level as that of the loop amplifier shelf with connections available for AC+, AC-, logic common, and the appropriate input to the controller for each module.
i. Cabinet Power Connections to be made on the right wall of the cabinet below the bottom shelf and 50 to 100 millimeters (2 to 4-inches) above the bottom of the cabinet.
j. The Maximum Outside Dimensions of a base-mounted cabinet (exclusive of mounting flanges) shall not exceed 1425 millimeters (56-inches) in height, 1020 millimeters (40-inches) in width, and 760 millimeters (30-inches) in depth.

Other cabinet facilities shall be furnished as follows:

a. A minimum of two, fully adjustable metal shelves with brackets to support controller, signal monitor, detector amplifiers, and other accessory equipment. The shelves shall be capable of vertical adjustment through virtually the full height of the cabinet.
b. Electric service line terminals for 6-gauge copper with 30-ampere circuit breaker line protection.
c. 120-volt duplex convenience receptacle with separate 30- ampere circuit protection.
d. Insulated barrier terminals to be used for detector field connections, AC power supply for amplifiers, and controller inputs from amplifiers. Quantities of terminals shall be for the above connections as follows:

   2 phase controller - 24 terminal positions

   3 & 4 phase controllers - 36 terminal positions

   5 to 8 phase controllers - 48 terminal positions

e. Grounded neutral buss with multiple screw terminals for 12- gauge copper signal neutrals and 4-gauge copper earth connection.
f. Insulated barrier terminals (two positions per phase module) for connection of 12-gauge copper pedestrian detector field wires. A 36-volt ziner diode shall be installed across each pedestrian detector field terminal to ground.
g. Insulated barrier terminals (five positions per phase module) for connection of 12-gauge copper signal display field wires. A 150-volt, 20-amp Varistor shall be installed across each signal field terminal to ground.
h. Insulated barrier terminals (four positions) for connection of 12-gauge copper system interconnect lines. A 150-volt, 20-amp Varistor shall be installed across each system interconnect terminal to ground.

i. Insulated barrier terminals for internal wiring interconnection of all other cabinet accessories and circuitry.

j. All barrier terminal blocks shall consist of twelve (12) terminal pairs using a minimum ten 32-size screws with the minimum center-to-center distance between terminal pairs being 16 millimeters (5/8-inch). Terminal blocks shall be furnished with an engraved or indelibly printed numbering strip attached with screws to the terminal block. This type and size terminal block shall be provided for all applications including controller inputs and outputs, field connections, and detector connections.

k. A 120-vac, 20-watt, fluorescent Light fixture mounted on the cabinet ceiling at the front of the cabinet. Fixture shall employ #F20T12/CW20, 20-watt, fluorescent tube. An on-off switch for the light shall be mounted on the inside of the main cabinet door.

l. Detector micro-switches shall be provided for placing vehicular and pedestrian calls on each individual phase separately. A sufficient number of switches shall be provided to serve the maximum phase capability of the controller unit. All switches are to be permanently labeled and identified.

m. An on-off power switch shall be mounted on the inside of the main cabinet door to disconnect all equipment in the cabinet from the 120-vac service line current with the exception of the cabinet light and the duplex convenience receptacle.

n. An automatic/flashing switch shall be mounted on the inside of the main cabinet door to preempt the normal signal display and initiate the specified flashing display. The controller shall continue to operate during this flashing mode.

o. All cabinet wiring shall be neatly bundled and attached to the sides and back of the cabinet.

p. All cabinets shall be furnished with a police compartment accessible through the door-in-door. The back side of the compartment extending into the cabinet shall have all exposed electrical facilities enclosed in a protective housing. The police compartment shall be furnished as follows:

(1) On-off power switch to operate same as the main on-off switch, above.

(2) An automatic/flashing switch with a flashing position to permit the normal red, yellow, and green signal display to be preempted to the flashing operation. Power shall be removed from the controller unit during this flashing mode. Upon resuming automatic operation, the controller display shall be in the pre-programmed start-up orientation.

(3) A normal/manual switch so that, when in manual position, this switch shall stop the automatic sequence of the controller and hold the then existing display until manually advanced into the next interval. When in normal position, the automatic controller sequence shall continue.

(4) A miniature panel connector for connecting a detachable hand-held push button for manual operation. The connector shall have three (3) male pins and mate with a screw on type, coarse threaded, female connector plug.

(5) A high quality retractile cord with molded hand-held push button with attached connector plug for engaging the connector described above. The retractile cord shall be capable of an extension of 2.1 meters (7-feet) (minimum) and shall be stored in the police compartment when not in use.

6. Expansion.

The cabinet for four to eight phase controllers shall be furnished of sufficient size to accommodate the control equipment described, a coordinating unit, and eighteen (18) loop detector amplifiers The cabinet for two and three phase controllers shall be sized as above for eight (8) loop detector amplifiers and a coordinating unit.

The cabinet shall have provisions for all additional equipment associated with the future expansion to full functional capability, including but not limited to load switch bases, complete cabinet wiring, field connection terminals, and detector terminals.

Add the following to the end of Subsection 730.37:

Removal and Salvable Equipment. Utility companies will be responsible for the relocation and/or removal of their poles and equipment. The poles and equipment to be removed by the Contractor have been generally noted on the Plans; however, it is the intent of these Specifications to have the Contractor remove any traffic control-related equipment that is in conflict with the installation of the proposed equipment and deliver to the City of Memphis Traffic Signal Shop. All new or temporary signals, shall be removed and stockpiled in such a manner that the removed equipment will not be damaged. Poles shall be removed complete and undamaged. The pole shall be cleaned of any concrete foundation material. Any damage due to negligence on the part of the Contractor because of lack of proper care of equipment shall be cause for the Contractor to replace in kind. The cost of such replacement shall be borne fully by the Contractor without extra compensation. All such removed and salvageable equipment is now and shall remain the property of the City of Memphis.

**S T A T E** **O F** **T E N N E S S E E**

March 15, 2006
Project No.:
County:
Contract No.:

# SPECIAL PROVISION

# REGARDING

# SEEDING WITH WOOD CELLULOSE FIBER MULCH

Description: This work shall consist of furnishing and placing seed, agricultural limestone, and wood cellulose fiber mulch material in accordance with the Standard Specifications for Road and Bridge Construction except as modified herein.

Materials:

Seed: Include Seed Mixes containing plant species mixed in accordance with the drawings. Seed application rates vary by Mix. Install in accordance with the drawings.

Agricultural limestone as required to amend soil and bring soil into conformance with the Specifications.

Wood cellulose fiber mulch for hydraulic seeding shall consist of specifically prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. The fiber mulch, including dye, shall contain no germination or growth inhibiting factors. The mulch material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry.

The manufacturer shall provide certification the wood cellulose fiber mulch conforms to the following:

| | | |
|---|---|---|
| Fiber or Particle Size | | |
| Length | | 10.0 mm Max. |
| Thickness of Diameter | | 1.0 mm Approx. |
| Net Dry Weight Content | See “B” below | Min. stated on bag |
| pH Range | ASTM D778 | 4.0 – 8.5 |
| Ash Content | ASTM D586 | 3.0 Max. |

| | | |
|---|---|---|
| Water Holding Capacity | See "A" below | 90% Min. |

The mulch material shall contain no elements or compounds at concentration levels that will be phytotoxic.

The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings. The material shall be delivered in packages of uniform weight and shall bear the name of the manufacturer, the net weight, and a supplemental statement of the net dry weight content.

Tests:

A. Water Holding Capacity of Fiber Mulch

1. Scope

This method covers the procedure to be used in determining the water holding capacity of fiber mulch.

2. Apparatus

a. Scale, capable of weighing to nearest 0.1 gram
b. 200 mesh sieve – 8 X 2 in.
c. Cover for sieve – may be aluminum foil
d. Two 1000 ml graduated glass beakers
e. Pan – used to partially submerge sieve
f. Demineralized water
g. Sink and/or area free of drafts to drain sample

3. Procedure

a. Determine the total moisture content of fiber according to the following formula:

$$\% \text{ Moist.} = \frac{\text{Wet Wt.} - \text{Dry Wt.}}{\text{Wet Wt.}} \times 100$$

b. Weigh duplicate sample of "as-is" material equivalent to 12.0 grams of oven-dry fiber. Weigh to nearest 0.1 gram and place into a 1000 ml beaker. The equivalent weight can be determined by the following formula:

$$\text{"As-is" weight} = \frac{12.0}{1 - \frac{\% \text{ Moist.}}{100}}$$

c. Add 800 ml demineralized water to sample, stir and/or shake until thoroughly mixed. Allow to stand for 30 minutes.

d. Wet 200 mesh sieve. Cover top of sieve with aluminum foil or other material to retard evaporation. Prop sieve up at an angle of 30° - 45° and drain for 10 minutes. Remove cover and wipe excess water from outside rim of sieve and weigh immediately.

e. Place sieve in pan and pour fiber onto screen. Add sufficient water to float fibers inside of sieve. Stir, so that the fiber will form a uniform mat over the screen area. Carefully lift the sieve and mat from the water. Cover top to retard evaporation. Prop sieve up at an angle of 30° - 45°and drain for 10 minutes. Remove cover and wipe excess water from outside rim of sieve and weigh immediately.

f. Obtain net weight of wet mat by subtracting the screen weight from the total weight.

g. Calculate and report the water holding capacity by use of the following formula:

$$\% \text{ Water holding capacity} = \frac{\text{Net Wt. Wet Mat} - 12.0}{\text{Net Wt. Wet Mat}} \times 100$$

B. Moisture Content and Dry Weight of Fiber Mulch

1. Scope

This method covers the procedure to be used in determining the moisture content and dry weight of fiber mulch as packaged.

2. Apparatus

a. Scale, capable of weighing 100 lbs. (to nearest 0.1 pound)
b. Scale, capable of weighing to nearest 0.1 gram
c. Oven, capable of maintaining 212 ± 4°F.
d. (3) One gallon containers (Paint cans may be used)
e. (3) 200 mesh screens to cover containers

3. Procedure

a. Weigh bag of mulch as received. Use this weigh in Step H.

b. The moisture content should be determined from the average results of three (3) separate samples. Take one (1) sample each from the top, center, and bottom portions of the bag.

c. For each sample, loosely fill a one gallon container of known weight with mulch to approximately one (1) inch from the top.

d. Weigh immediately and cover the can with 200 mesh screen.

e. Dry in oven for 24 hours @ 212°F.

f. Cool to room temperature. Remove screen and weigh can and mulch.

g. % moisture is determined by the following formula:

$$\% \text{ Moisture} = \frac{A - B}{A - C} \times 100$$

Where: A = Original weight of can and mulch, in lbs.
B = Weight of can and dry mulch, in lbs., and
C = Weight of can, in lbs.

h. The total dry weight of the packaged fiber mulch is determined from the following formula:

Dry Wt. of packaged product = X – (X x Y)

Where: X = Actual Wt. of mulch as packaged (Step A) in lbs. and

$$Y = \frac{\text{Avg. \% Moisture}}{100}$$

Compare with dry weight printed on bag.

Construction Requirements: The wood cellulose fiber mulch shall satisfactorily perform in hydraulic seeding equipment without clogging or damaging the system.

Wood cellulose fiber mulch shall be applied at a rate of approximately 35 pounds net dry weight per unit and shall be sprayed uniformly on the surface of the prepared seedbed.

Wood cellulose fiber mulch shall be held in place by an approved mulch binder conforming to one of the following:

a. Emulsified asphalt applied at the approximate rate of 4 gallons per unit as required to hold the mulch in place.

b. A non-toxic, degradable additive that will disperse in cold water to provide a homogenous lump-free solution which after application will cure to form a water insoluble, porous binder for the hay or straw mulch. The proportions of the additive and water mixture and the application thereof to the mulch shall be in accordance with the recommendations of the manufacturer.

The Contractor shall submit a sample of the additive to the Division of Materials and Tests for approval prior to use. Upon receipt of approval, the additive may be incorporated into the work.

Compensation: Measurement and payment shall be made in accordance with Subsections 801.09 and 801.10 of the Standard Specifications except that payment will be made under:

| Item No. | Description | Pay Unit |
|---|---|---|
| 801-01.05 | Seeding with Wood Cellulose Fiber Mulch | Unit |

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006

# SPECIAL PROVISION

# REGARDING

# EQUAL EMPLOYMENT OPPORTUNITY

Reference:
Federal-Aid Highway Program Manual
Transmittal 147, June 26, 1975
Replaces FHWA Order Interim 7-2(1)

## Specific Equal Employment Opportunity Responsibilities

### GENERAL

a) Equal employment opportunity requirements not to discriminate and to take affirmative action to assure equal employment opportunity as required by Executive Order 11246 and Executive Order 11375 are set forth in Required Contract Provisions (Form FHWA-1273 or PR-1316, as appropriate) and these Special Provisions which are imposed pursuant to Section 140 of Title 23, U.S.C., as established by Section 22 of the Federal-Aid Highway Act of 1968. The requirements set forth in these Special Provisions shall constitute the specific affirmative action requirements for project activities under this contract and supplement the equal employment opportunity requirements set forth in the Required Contract Provisions.

b) The contractor will work with the Tennessee Department of Transportation and the Federal Government in carrying out equal employment opportunity obligations and in their review of his/her activities under the contract.

c) The contractor and all his/her subcontractors holding subcontracts not including material suppliers, exceeding $10,000, will comply with the following minimum specific requirement activities of equal employment opportunity: (The equal employment opportunity requirements of Executive Order 11246, as set forth in Volume 6, Chapter 4, Section 1, Subsection 1 of the Federal-Aid Highway Program Manual, are applicable to material suppliers as well as contractors an subcontractors). The contractor will include these requirements in every subcontract exceeding $10,000 with such modification of language as is necessary to make them binding on the subcontractor.

**Equal Employment Opportunity Policy**

The contractor will accept as his operating policy the following statement which is designed to further the provision of equal employment opportunity to all persons without regard to their age, race, color, religion, sex, national origin or disability and to promote the full realization of equal employment opportunity through a positive continuing program:

> It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment opportunity officer (hereinafter referred to as the EEO Officer) who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of equal employment opportunity and who must be assigned adequate authority and responsibility to do so.

**Equal Employment Opportunity Officer**

The contractor will designate and make known to the Tennessee Department of Transportation contracting officers an equal employment opportunity officer (hereinafter referred to as the EEO Officer) who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of equal employment opportunity and who must be assigned adequate authority and responsibility to do so.

**Dissemination of Policy**

(a) All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's equal employment opportunity policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

(1) Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's equal employment opportunity policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

(2) All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer or other knowledgeable company official covering all major aspects of the contractor's equal employment opportunity obligations within thirty days following their reporting for duty with the contractor.

(3) All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer or appropriate company official in the contractor's procedures for locating and hiring minority group employees.

(b) In order to make the contractor's equal employment opportunity policy known to all employees, prospective employees and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the contractor will take the following actions:

(1) Notices and posters setting forth the contractor's equal employment opportunity policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

(2) The contractor's equal employment opportunity policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

**Recruitment**

(a) When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be published in newspapers or other publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

(b) The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants, including, but not limited to, State employment agencies, schools, colleges and minority group organizations. To meet this requirement, the contractor will, through his EEO Officer, identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

(c) In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with equal employment opportunity contract provisions. (The U.S. Department of Labor has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended).

(d) The contractor will encourage his present employees to refer minority group applicants for employment by posting appropriate notices or bulletins in areas accessible to all such employees. In addition, information and procedures with regard to referring minority group applicants will be discussed with employees.

**Personnel Actions**

Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to age, race, color, religion, sex, national origin or disability. The following procedures shall be followed:

(a) The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

(b) The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

(c) The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

(d) The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

**Training and Promotion**

(a) The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

(b) Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event the Special Provision Regarding Training Program Requirements is provided under this contract, this subparagraph will be superseded as indicated therein.

(c) The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

(d) The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

**Unions**

If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

(a) The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

(b) The contractor will use best efforts to incorporate an equal employment opportunity clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their age, race, color, religion, sex, national origin or disability .

(c) The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the Tennessee Department of Transportation and shall set forth what efforts have been made to obtain such information.

(d) In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to age, race, color, religion, sex, national origin or disability, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The U.S. Department of Labor has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees). In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the Tennessee Department of Transportation.

**Subcontracting**

(a) The contractor will use his best efforts to solicit bids from and to utilize minority group subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of minority-owned construction firms from the Tennessee Department of Transportation.

(b) The contractor will use his best efforts to ensure subcontractor compliance with their equal employment opportunity obligations.

**Records and Reports**

(a) The contractor will keep such records as are necessary to determine compliance with the contractor's equal employment opportunity obligations. The records kept by the contractor will be designed to indicate:

(1) The number of minority and non-minority group members and women employed in each work classification on the project.

(2) The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women. (Applicable only to contractors who rely in whole or in part on unions as a source for their work force).

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees.

(4) The progress and efforts being made in securing the services of minority group subcontractors or subcontractors with meaningful minority and female representation among their employees.

(b) All such records must be retained for a period of 3 years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the of the Tennessee Department of Transportation and the Federal Highway Administration.

(c) Each contractor and subcontractor shall submit to the Tennessee Department of Transportation an annual report for every July during which work is performed indicating the number of minority, women and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form PR 1391 and is to be received by the Department not later than the 20th of the month following the reporting period.

(d) The contractor and/or sub-contractor will be required to complete other reports as instructed by the Engineer.

(e) Current estimates may be withheld by the Project Engineer when reports are not received within the above specified time limits.

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006

## SPECIAL PROVISION

## REGARDING

## STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY

## CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

1) As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941

   d. "Minority" includes:

      I. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      II. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish or Portuguese Culture or origin, regardless of race);

      III. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      IV. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining indentifiable tribal affiliations through membership and participation or community identification).

2) Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation arid which is set forth in the solicitations from which this contract resulted.

3) If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals (including goals and time tables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a though p of these specifications. The goal set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specification, Executive Order 11246, or the regulations promulgated pursuant thereto.

6) In order for the nonworking training hours of apprentices and the trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   (a) Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

(b) Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available and maintain a record of the organization's responses.

(c) Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

(d) Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(e) Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources complied under 7b above.

(f) Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

(g) Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(h) Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

(i) Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screenings procedures, and tests to be used in the selection process.

(j) Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

(k) Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

(l) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriation training, etc., such opportunities.

(m) Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

(n) Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

(o) Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(p) Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor

association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women, generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of age, race, color, religion, sex, national origin or disability.

11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12) The Contractor shall carry out such sanctions and penalties for violations of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13) The Contractor, in fulfilling its obligations under these specifications, shall implement' specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records

shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

**S T A T E** **O F** **T E N N E S S E E**

Revised 10-19-2012 March 1, 2006

## SPECIAL PROVISION

## REGARDING

## NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION

## TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work are as follows:

| County | Goals for Female Participation in each Trade |
|---|---|
| All Counties | 6.9 |

| County | Goals for Minority Participation for each Trade |
|---|---|
| Lincoln | 11.2 |
| Hamilton, Marion, Sequatchie | 12.5 |
| Bledsoe, Bradley, Grundy, McMinn, Meigs, Monroe, Polk, Rhea | 8.6 |
| Carter, Hawkins, Sullivan, Unicoi, Washington | 2.6 |
| Greene, Hancock, Johnson | 3.2 |
| Anderson, Blount, Knox, Union | 6.6 |
| Campbell, Claiborne, Cocke, Cumberland, Fentress, Grainger, Hamblen, Jefferson, Loudon, Morgan, Roane, Scott, Sevier | 4.5 |

| County | Goals for Minority Participation for each Trade |
|---|---|
| Montgomery | 18.2 |
| Davidson, Cheatham, Dickson, Robertson, Sumner, Williamson, Wilson, Rutherford | 15.8 |
| Bedford, Cannon, Clay, Coffee, Dekalb, Franklin, Giles, Hickman, Houston, Humphreys, Jackson, Lawrence, Lewis, Macon, Marshall, Maury, Moore, Overton, Perry, Pickett, Putnam, Smith, Stewart, Trousdale, Van Buren, Warren, Wayne, White | 12.0 |
| Shelby, Tipton | 32.3 |
| Benton, Carroll, Chester, Crockett, Decatur, Dyer, Fayette, Gibson, Hardeman, Hardin, Haywood, Henderson, Henry, Lake, Lauderdale, McNairy, Madison, Obion, Weakley | 26.5 |

These goals are applicable to all the Contractor's construction work whether or not it is Federal or federally assisted.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in CFR Part 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform through- out the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from Project to Project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Office of Federal Contract Compliance Programs at the following address within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation:

U.S. Department of Labor – Regional Office
Office of Federal Contract Compliance Program
61 Forsyth Street, Room 7B75
Atlanta, GA 30303

The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 03-23-09) March 1, 2006
(Rev. 05-11-09)

# SPECIAL PROVISION

# REGARDING

# TRAINING PROGRAM REQUIREMENTS

Reference:

Federal-Aid Highway Program
Transmittal 147, June 26, 1975
Replaces FHWA Order Interim 7-2(2)

This Training Special Provision supersedes subparagraph 7b of the Special Provision Regarding Equal Employment Opportunity, and is in implementation of 23 U.S.C. 140(a).

As part of the contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The contractor shall provide on-the-job training aimed at developing full journeymen in the type of trade or job classification involved.

The number of training hours under this Special Provision will be indicated in the Proposal.
.

In the event that a contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, however, the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this training special provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to pre-construction conference, the contractor shall submit to the Tennessee Department of Transportation OJT Program Coordinator for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the contractor shall make every effort

to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision.

This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Tennessee Department of Transportation and the Federal Highway Administration. The Tennessee Department of Transportation and the Federal Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Employment and Training Administration, or with a State apprenticeship agency recognized by the Department of Labor and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Office of Apprenticeship, Employment and Training Administration, shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-Aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Federal Highway Administration division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by Change Order and the AAPO, reimbursement will be made for training persons in excess of the number specified herein.

This reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee, or pays the trainee's wages during the offsite training period.

No payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees be on board for the entire length of the contract. Failure of the contractor to employ a trainee in the classification he has requested by the time 15 percent of that type work has been performed will be just cause for withholding progress estimates unless the contractor has furnished the AAPO a satisfactory explanation in writing of his failure to do so. A contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Department of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision. However, in no case will the trainee be paid less than the minimum wage shown in the contract for the classification of laborer.

The contractor shall furnish the trainee a copy of the program he will follow in providing the training. The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

The contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

Payment is to be made under item 109-10.01, Trainee, at the unit price of $0.80 per hour, for each hour of approved training provided. In any case the number of training hours for which payment is made will not exceed number of hours specified for the approved classification by the approved Training program.

The contractor shall not be permitted to commence construction without an approved training program**.** Failure of the contractor to provide an approved training program shall not be considered "As a condition not under the control of the contractor" in regards to Contract Time.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 06-01-03) March 1, 2006
(Rev. 06-23-08)
(Rev. 11-10-08)

## SPECIAL PROVISION

## REGARDING

## DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION

Disadvantaged Business Enterprises (DBE) as defined in 49 CFR Part 23/26 shall have the maximum opportunity to participate in the performance of contracts let by the Department. Consequently, the disadvantaged business enterprise requirements of 49 CFR Part 23/26 apply to this contract.

Disadvantaged Business Enterprises (DBE) as defined in 49 CFR Part 23/26 shall have the maximum opportunity to participate in the performance of this contract or in the performance of subcontracts to this contract. In this latter regard, the Contractor shall take all necessary and reasonable steps in accordance with 49 CFR Part 23/26 to ensure that disadvantaged enterprises, including enterprises owned and controlled by women, have the maximum opportunity to compete for and perform subcontracts. The Contractor shall not discriminate on the basis of age, race, color, religion, national origin, sex or disability in the award of subcontracts.

The Contractor shall submit to the Civil Rights Office Small Business Development Program copies of any agreements with DBE/WBEs upon execution.

The Contractor is advised that failure to carry out the requirements as set forth above shall constitute a breach of contract, and after notification by the Department, may result in termination of the contract or other remedy deemed appropriate by the Department.

**S T A T E** **O F** **T E N N E S S E E**

(Rev. 12-01-06) March 1, 2006
(Rev. 11-10-08)
(Rev. 9-17-11)

## SPECIAL PROVISION

## REGARDING

## DBE CONTRACT GOAL

All contractors shall pursue affirmative action requirements to encourage and increase participation of disadvantaged individuals in business enterprises as set forth in this specification which is imposed pursuant to 49 CFR 26. The bidder shall arrange for ___ percent of the work to be performed by Disadvantaged Business Enterprises (DBEs) or clearly demonstrate adequate good faith efforts as described herein.

**A. Disadvantaged Business Enterprise Policy.**

The Contractor shall accept as operating policy and include in all subcontract agreements the following statement, which is designed to promote full participation of DBEs as suppliers and subcontractors through a continuous, positive result-oriented program on contracts let by the Department:

*The Contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of Department assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the Department deems appropriate.*

**B. Counting DBE Participation Toward Meeting Goals.**

The Contractor shall count DBE participation toward goals in accordance with 49 CFR 26. The Contractor may count toward the goals only expenditures to DBEs that perform a commercially useful function of a contract, including those functions as a subcontractor. A DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself. Work performed by a DBE firm

in a particular transaction may be counted toward the goal only if the Department determines that it involves a commercially useful function. The work performed by the DBE firm shall be necessary and useful to the completion of the contract, and consistent with normal highway construction industry practices in Tennessee. The bidder may count the following DBE expenditures towards the DBE commitment:

1. **Projects where the DBE is the Prime Contractor** - The portions of the contract to be completed by certified DBE firms will be counted toward meeting the goal. Items of the contract subcontracted to non-DBE firms will not be counted in the commitment.

2. **Portions of a bid from a Joint Venture** - A bid from a joint venture, between a DBE and non-DBE Contractor, shall include a "Statement of DBE Commitments" which must be approved by the Department prior to the Letting. Only the DBE's portion will be counted toward the goal. Joint venture agreements have to be approved separately from the bid documents, prior to the awarding of the contract.

3. **DBE Subcontractors** - The DBE subcontractor shall assume actual and contractual responsibility for provision of materials and supplies, subcontracted work, or other commercially useful functions of the items of work subcontracted to them. Cost of materials purchased from or the cost of equipment leased from the Contractor will not count toward the project DBE commitment. Prior written approval must be obtained from the Department's Civil Rights Office - Small Business Development Program (CRO - SBDP) for any DBE use of prime contractor's personnel or equipment.

4. **Manufacturers -** The Contractor may count toward the DBE commitment 100% of its expenditures for materials and supplies required under a contract and obtained from a DBE manufacturer only if the DBE firm produces and supplies goods manufactured from raw materials or substantially alters them before resale.

5. **Regular Dealers (e.g. Material Suppliers)** - The Contractor may count toward the DBE goal 60% of its expenditures for materials and supplies required under a contract and obtained from a DBE regular dealer only if the DBE firm performs a commercially useful function in the supply process. For purposes of this section, a regular dealer is a firm that owns; operates; or maintains a store, warehouse, or other establishment in which materials or supplies required for the performance of the contract are bought, kept in stock, and regularly sold to the public in the usual course of business. To be a regular dealer, the firm shall engage in, as its principal business and in its own name, the purchase and sale of the products in question. A regular dealer in such bulk items as steel, cement, gravel, stone, and petroleum products need not keep such products in stock if it owns or operates the distribution equipment. If the DBE supplier does not own the distribution equipment, a lease containing the terms of the agreement shall be available and must be approved in writing by the CRO - SBDP.

6. **Brokers and Packagers** - Brokers and packagers will not be regarded as regular dealers within the meaning of this section. Only the cost of the service performed may be used towards meeting the DBE commitment.

7. **Transportation or Hauling of Materials** –The Department will continue to utilize the trucking regulations, under 49 CFR 26.55. This regulation allows for DBE goal hauling-credit in either DBE trucks or in trucks leased to or by DBE firms. The verification of truck drivers employed by DBE firms will continue to be by submission of payrolls independent from any Davis-Bacon regulations.

   a) The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting DBE goals.
   b) The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
   c) The DBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.
   d) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
   e) The DBE may also lease trucks from a non-DBE firm, including an owner-operator. The DBE who leases trucks from a non-DBE is entitled to the total value of transportation services provided by non-DBE lessees not to exceed the value of transportation services provided by DBE-owned trucks on the contract. Additional participation by non-DBE lessees receives credit only for the fee or commission it receives as a result of the lease arrangement.
   f) For purposes of this paragraph a lease must indicate that the DBE has exclusive use of and control over the truck. Leases cannot be Department contract-specific, must be long term, and must be approved by the CRO - SBDP Staff. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

   g) Prior to hauling, the Contractor and DBE shall provide the Department's Project Supervisor a complete list of trucks that will be used on the project for DBE goal participation. The Department will provide a form that shall be used by the Contractor and DBE to identify the trucks. A revised list will be required any time the trucks used changes. The Contractor and DBE must be able to adequately document the actual amount of hauling eligible for DBE goal participation.

7. **Contracted Labor / Temporary Employment Agencies** – utilization of these services via subcontract will be allowed to count toward DBE goal commitment, in accordance with 49 CFR part 26.55. The Department will count the entire amount of fees or commissions charged by a DBE for providing a bona fide service. Provided, the Department must find the fee to be reasonable and not excessive as compared to the fees customarily allowed for similar services.

8. **Other Commercially Useful Functions -** The fees paid to certified DBE firms, which are necessary for the completion of the contract and commonplace outside of the DBE program, may be counted towards the commitment.

**C. Contract Award Procedures**

The established DBE goal will be shown on the proposal as a percent of the total amount bid. If the total proposed DBE work submitted with the bid is less than the percentage of participation goals set by the Department, the bidder shall, within three (3) business days from the bid openings, propose sufficient additional DBE participation to meet the goal or shall clearly demonstrate by documentation that good faith efforts were made to meet the goal.

**1. Bidder' Responsibility.**

It is the bidder's responsibility to determine the level of professional competence and financial responsibility of any proposed DBE subcontractor. The bidder shall ascertain that the proposed DBE subcontractor has suitable experience and equipment to perform a commercially useful function for work that is common industry practice in the Tennessee highway construction industry.

Contractor shall develop and maintain records of negotiations with DBEs to reach agreeable prices, quotations and work schedules, including but not limited to a record of dates when the Contractor first contacted each DBE.

**2. Proposals With Established Project DBE Goals.**

For proposals with established project goals, the bidder will be required to complete computer generated Form 1247A. The bidder shall list the following information on Form 1247A that is submitted:

**a.** All DBE firms being used or being considered for use as part of the bidder's DBE commitment.

**b.** The type of work items on the contract for which the DBE will be used.

**c.** The "Amount to DBE" which has been committed to each DBE firm which will be used on the contract.

The completed 1247A form shall be submitted within three (3) business days of the Letting. Failure to provide a completed form or documentation clearly evidencing a good faith effort, as detailed in C.3. below, within three (3) business days of the Letting may cause the bid to be rejected as irregular. Only certified DBE firms may

be used. Contractor may access this information on the DBE list by viewing the Department's website or the certified DBE listing.

When DBE goal projects are involved and the prime contractor subcontracts to a non DBE, and the non-DBE subcontractor in turn subcontracts to a DBE as a second tier subcontractor, the prime contractor must affirm in writing his/her knowledge and approval of such an arrangement. Recognition of a second tier arrangement with a DBE subcontractor for goal work must be forwarded to the Director of the CRO - SBDP for verification, in writing, prior to any work performed by the DBE being counted toward the goal.

**3. Bidder Selection and Good Faith Efforts**

**a.** Bidders shall submit proposals that meet the DBE goal or shall submit documentation clearly evidencing that they made good faith effort to meet the DBE goal. Contractors who meet or exceed the contract goal will be assumed to have made good faith efforts to utilize DBE firms. DBE firms who bid as prime contractors will be considered to have met the goal.

**b.** The following are illustrative of factors which will be considered in determining whether the bidder has made adequate good faith efforts:

1) Whether the bidder selected portions of the work likely to attract DBE participation. The total dollar value of the portions selected should meet or exceed the contract DBE goal. If it is necessary, the bidder should break down subcontracts into economically feasible units in order to facilitate participation.

2) Whether the bidder provided notice to a reasonable number of specific DBEs, including those not regularly used by the bidder, that their participation in the contract is being solicited in sufficient time to allow them to participate effectively.

.

3) Whether the bidder provided interested DBEs with adequate information about the plans, specifications and requirements of the contract.

4) Whether the bidder advertised in general circulation, trade association, or minority-focus media concerning participation opportunities or effectively used the services of available minority, community organizations, minority contractors groups, local, state or federal minority business assistance offices, or other organizations that provide assistance in the recruitment and placement of DBEs.

.

5) Whether the bidder negotiated in good faith with interested DBEs, not rejecting DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities.

6) Whether the bidder made efforts to assist interested DBEs in obtaining bonding or insurance required by the bidder.

7) Whether the bidder submitted all quotations received from DBEs, and for those quotations not accepted, an explanation of why the DBE was not accepted including price comparisons. Receipt of a lower quotation from a non-DBE will not in itself excuse a bidder's failure to meet contract goal.

8) Whether the bidder has adequate records of its contacts and negotiations with DBEs

c) If the Contractor has not met the DBE goal or submitted documentation clearly evidencing good faith efforts within three (3) business days after the bid opening, the Contractor's bid will be considered non-responsive and the Department may consider the next lowest responsive bid for award.

d) Failure of the bidder to meet the DBE goal in its bid or failure to provide documentation clearly evidencing good faith efforts to meet the goal, may be cause for the forfeiture of the Proposal Guaranty which shall become the property of the Department, not as penalty, but in liquidation of damages sustained.

As soon as practical after award of the contract, the contractor shall submit copies of all binding subcontracts and purchase orders with DBEs to the Project Supervisor and the CRO - SBDP Director. No progress estimate shall be processed until this information is received.

**4. Joint Checking Allowance for DBE**

A DBE must receive pre-approval by the Department before using a joint check. Joint check requests shall be submitted, by the DBE, to the CRO - SBDP prior to the contract agreement.

The following are some general conditions that must be met regarding joint check use:

a. The second party (typically the prime contractor) acts solely as a guarantor.
b. The DBE must release the check to the supplier.
c. The use of joint checks must be a commonly recognized business practice in the industry.
d. The DBE remains responsible for all other elements of 49 CFR 26.55(c)(1)
e. The DBE is not required to use a specific supplier nor the prime contractor's negotiated unit price.
f. The DBE shall submit receipt/copy of cancelled checks to the CRO - SBDP.

**D. Construction Period Requirements.**

1. After adequate notice by the Contractor, if any DBE is unable to perform work committed toward the goal, the DBE shall provide to the CRO - SBDP a signed statement saying why they are unable to complete the work. The Contractor shall document their efforts to have another DBE perform the item or to have a DBE perform other items to replace the original DBE commitment amounts. In the event the Contractor is not able to find replacement DBE work, the Contractor must provide the CRO - SBDP documentation clearly evidencing good faith efforts, as detailed in C.3. above. Any request for substitution of a DBE subcontractor shall be made to the Department and approved by the CRO - SBDP.

2. Brokering of work by DBEs is not allowed and is a material breach of contract. A DBE firm involved in brokering of work may have their certification removed or suspended. Any firm involved in brokering of work that engages in willful falsification distortion, or misrepresentation with respect to any facts related to the project shall be referred to the U. S. Department of Transportation's Office of the Inspector General for prosecution under Title 18, U. S. Code, Section 100.20**.** Contractor shall place this provision in all subcontracts with DBEs.

3. A Department Project Supervisor/Inspector shall complete a Commercially Useful Function (CUF) Checklist to document the first date of work, work items, equipment, and forces of each DBE.

4. The Contractor shall provide monthly payment certification to the Department entitled "Prompt Payment Certification Form." The Department shall provide Contractor with the Prompt Payment Certification Form. An officer of the contractor shall sign the Prompt Payment Certification Form. The Department will hold estimate payments if information is not submitted. Reasons for non payment to a DBE could include the following:
   a) Whether the DBE is performing satisfactorily;
   b) Whether Contractor has reason to believe the DBE is not performing a commercially useful function, and if so, why and what steps Contractor is taking to rectify the situation.

   In the event the Contractor promptly reports questions on the Prompt Payment Certification Form regarding whether a DBE is independent and performing a commercially useful function and takes appropriate steps promptly to address the issue, then the Department will take this effort into account when considering contractor compliance measures as described below.

**E. Post Construction Requirements.**

Prior to receiving final payment, the Contractor shall provide to the Engineer certification of the dollars paid to each DBE firm, using Form CC3, Certification of DBE Accomplishment. The certification shall be dated and signed by a responsible officer of the contractor and by the DBE. Falsification of this certification will result in suspension of bidder qualifications.

The final estimate will not be paid to the Contractor until proper certifications have been made.

**F. Required Records.**

The Prime Contractor and all subcontractors shall retain, for a period of not less than 3 years after final acceptance of a project, copies of canceled checks or other documentation that substantiates payments to DBE firms. These records shall be available at reasonable times and places for inspection by authorized representatives of the Department and Federal Agencies.

**G. Contractor Compliance**

**1.** It is the intent of this Special Provision to require the Contractor to take full responsibility for the performance of a commercially useful function by all DBE subcontractors, manufacturers and materials suppliers who work on the project and are counted by the Contractor toward the project DBE goal. A DBE is considered to perform a commercially useful function when it is responsible for execution of a distinct element of the work of a contract and carrying out its responsibilities by actually performing, managing and supervising the work involved (49 CFR Part 26).

**2.** If the Contractor fails to comply with this Special Provision 1247, the Department may take one or a combination of the following steps:

1) Require the Contractor to have its entire management staff attend DBE training arranged by the Department and paid by the Contractor.

2) The next bid when Contractor is the low bidder on a DBE goal project, require that Contractor shall achieve a DBE participation that is twice the stated goals.

3) For the Contractor's failure to find another DBE subcontractor to substitute for a DBE that is terminated or fails to complete its work on the contract for any reason or to provide the CRO - SBDP documentation clearly evidencing good faith efforts, as detailed in D.1. above, then the Department may withhold from the Contractor an amount not to exceed the amount of money originally committed to the non-complying DBE subcontractor, not as a penalty but as liquidated damages.

4) Suspend the Contractor from participation in Department bid lettings pursuant to rules promulgated by the Department.

5) For repeated failures to comply, debar the Contractor pursuant to rules promulgated by the Department.

6) Invoke other remedies available by law and/or in the contract.

7) Invoke remedy agreed upon by the Commissioner and Contractor in writing.

# REQUIRED CONTRACT PROVISIONS
# FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Nonsegregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Compliance with Governmentwide Suspension and Debarment Requirements
XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

## I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

## II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

**1. Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

**2. EEO Officer:** The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

**3. Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

**4. Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

**5. Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

**6. Training and Promotion:**

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

**7. Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

**8. Reasonable Accommodation for Applicants / Employees with Disabilities:** The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

**9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

**10. Assurance Required by 49 CFR 26.13(b):**

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

**11. Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

## III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

## IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

### 1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

**2. Withholding**

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

**3. Payrolls and basic records**

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee ( e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

**4. Apprentices and trainees**

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

**5. Compliance with Copeland Act requirements.** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

**6. Subcontracts.** The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

**7. Contract termination: debarment.** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

**8. Compliance with Davis-Bacon and Related Act requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

**9. Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

**10. Certification of eligibility.**

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

## V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

**1. Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

**2. Violation; liability for unpaid wages; liquidated damages**. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

**3. Withholding for unpaid wages and liquidated damages.** The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

**4. Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

## VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

## VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

## VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

## IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

## X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

**2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:**

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

**XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING**

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS**

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

**S T A T E** **O F** **T E N N E S S E E**

March 1, 2006

(Rev. 09-12-11)
(Rev. 12-15-11)
(Rev. 01-11-12)
**(Rev. 01-09-13)**

## SPECIAL PROVISION

## REGARDING

## TENNESSEE DEPARTMENT OF TRANSPORTATION

## 2013 MINIMUM WAGE SCALES FOR FEDERAL-AID CONSTRUCTION

## & 2013 MINIMUM WAGE SCALES FOR STATE FUNDED CONSTRUCTION

This Contract contains "Tennessee Department of Transportation 2013 Minimum Wage Scales for State Funded Construction", Tennessee Department of Labor Decision No. T-34300, dated January 2, 2013, and Tennessee Department of Transportation 2013 Minimum Wage Scales for Federal-Aid Highway Construction, U. S. Department of Labor Decision No. TN130002 (dated January 4, 2013).

The Contractor is required to pay the greater of the two (2) rates for each classification.

Note: Minimum Wage Scales for Federal-Aid Heavy Construction are on file with the Department, and will be included in all applicable Contract Proposals.

**(Rev. 01-09-13)**

**STATE OF TENNESSEE**

## TENNESSEE DEPARTMENT OF TRANSPORTATION

## MINIMUM WAGE SCALES FOR FEDERAL AID HIGHWAY CONSTRUCTION

General Decision Number: TN130002 01/04/2013 TN2

Superseded General Decision Number: TN20120002

State: Tennessee

Construction Type: Highway

Counties: Tennessee Statewide.

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects & railroad construction; bascule, suspension & spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

| Modification Number | Publication Date |
|---|---|
| 0 | 01/04/2013 |

SUTN2010-002 05/06/2010

| | Rates | Fringes |
|---|---|---|
| BRICKLAYER | $ 16.62 | |
| CARPENTER | $ 16.10 | |
| CEMENT MASON/CONCRETE FINISHER | $ 13.91 | |
| ELECTRICIAN | $ 21.62 | |
| IRONWORKER | | |
| Reinforcing | $ 15.90 | |
| Structural | $ 17.15 | |

LABORER

Common/Unskilled.....$ 11.50

Skilled

Air Tool Operator, Asphalt Raker, Chain Saw Operator, Concrete Mixer (less than 1 yd), Concrete Rubber, Edger, Fence Erector, Form Setter (steel), Guard Rail Erector, Mechanic's Tender (tire changer or oiler), Mortar Mixer, Nozzleman or Gun Operator (gunite), Pipelayer, Sign Erector.....$ 13.34

OPERATOR: Power Equipment

Drill Operator (Caisson)....$ 18.43

Farm Tractor Operator (Power Broom).....$ 12.58

Group 1

Backhoe/Hydraulic Excavator (3/4 yd & over), Crane, End Loader (3 yd & over), Motor Patrol (rough), Tractor (crawler/ utility), Scraper, Shovel, Trenching Machine.....$ 17.14

Group 2

Backhoe/Hydraulic Excavator (less than 3/4 yd), Bulldozer or Push Dozer, End Loader (less than 3 yd), Motor Patrol (rough), Tractor (crawler/ utility), Scraper, Shovel, or Trenching Machine.....$ 15.26

Group 3

Asphalt Paver, Concrete Finishing Machine, Concrete Paver, Scale, Spreader (self-propelled), Concrete Grinder, Asphalt Milling Machine, Boring Machine (horizontal).....$ 15.75

Group 4

Bobcat, Central Mining Plant, Concrete Pump, Concrete Saw, Curb Machine (automatic or

manual), Dozer or Loader
(stockpile), Drill
(piling), Mulcher or
Seeder, Rock Drill (truck
mounted), Roller
(asphalt), Roller
(compaction self-
propelled), Soil
Stabilization Machine,
Tractor (boom and hoist),
Bituminous Distributor
Machine, pump, Track
Drill, Striping Machine....$ 14.19
Heavy Duty Mechanic.....$ 18.04
Light Duty Mechanic.....$ 16.27
Sweeping Machine (Vacuum)
Operator.....$ 13.39

Painter & Sandblaster.....$ 21.54

Powder Person.....$ 17.79

Traffic Controller.....$ 16.98

TRUCK DRIVER
2 axles.....$ 13.02
3-4 axles.....$ 12.91
5 or more axles.....$ 15.24
Heavy Duty Off Road.....$ 12.98

---

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

---

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

**S T A T E** **O F** **T E N N E S S E E**

## TENNESSEE DEPARTMENT OF TRANSPORTATION

## 2013 MINIMUM WAGE SCALES FOR STATE FUNDED CONSTRUCTION

**January 2, 2013** **Tenn. DOL Decision No. T-34300**

| CLASSIFICATION (ENGLISH) | CLASSIFICATION (SPANISH) | Basic Hourly Rates | Craft No. |
|---|---|---|---|
| Bricklayer | Ladrillero | 18.32 | 01 |
| Carpenter / Leadsperson | Carpintero o Lider | 16.55 | 02 |
| Class "A" Operators | Operador Clase A | 18.62 | 03 |
| Class "B" Operators | Operador Clase B | 16.51 | 04 |
| Class "C" Operators | Operador Clase C | 16.79 | 05 |
| Class "D" Operators | Operador Clase D | 15.97 | 06 |
| Concrete Finisher | Terminador de Cemento | 14.69 | 07 |
| Drill Operator (Caisson) | Operador de Perfordora | 23.84 | 08 |
| Electrician | Electricista | 22.38 | 09 |
| Farm Tractor Operator (Power Broom) | Operador de Tractor de Rancho | 13.09 | 10 |
| Ironworkers (Reinforcing) | Herrero | 16.06 | 11 |
| Ironworkers (Structural) | Herrero de Estructura | 17.11 | 12 |
| Mechanic (Class I) Heavy Duty | Mecanico Clase 1 | 21.92 | 13 |
| Mechanic (Class II) Light Duty | Mecanico Clase 2 | 18.61 | 14 |
| Painter / Sandblaster | Pintor o Lajador | 23.78 | 15 |
| Powder Person / Blaster | Proveedor de Explosivos | 20.37 | 16 |
| Skilled Laborer | Obrero Diestro | 15.00 | 17 |
| Survey Instrument Operator | Operador de Agrimensor | 24.88 | 18 |
| Sweeping Machine (Vacuum) Operator | Operador de Barredora | 14.79 | 19 |
| Truck Driver (2 axles) | Camionero (2 ejes) | 15.16 | 20 |
| Truck Driver (3/4 axles) | Camionero (3 o 4 ejes) | 13.99 | 21 |
| Truck Driver (5 or more axles) | Camionero (5 o más ejes) | 16.50 | 22 |
| Laborer /Unskilled , Flagger, Traffic Control, Pickup Driver | Obrero no Diestro | 12.57 | 23 |
| Worksite Traffic Coordinator | Coordinar de Trafico en el Lugar de Trabajo | 18.98 | 24 |

| **CLASSIFICATION** | **CRAFT NO.** |
|---|---|
| **SKILLED LABORER:** | **17** |

**Air Tool Operator, Asphalt Raker, Chain Saw Operator, Concrete Mixer Operator (less than 1 yard), Concrete Rubber/Edger, Fence Erector, Form Setter (Steel Road), Guardrail Erector, Mechanic's Helper (Tire Changer or Oiler), Mortar Mixer, Nozzelman or Gun Operator (Gunite), *Pipelayer, Sign Erector**

| | |
|---|---|
| **CLASS "A" OPERATORS:** | **03** |

**Backhoe/Hydraulic Excavator (3/4 yard and over), Crane, End Loader (3 yards and over), Motor Patrol (Finish), Pile Driver, Dragline**

| | |
|---|---|
| **CLASS "B" OPERATORS:** | **04** |

**Backhoe/Hydraulic Excavator (less than 3/4 yard), Bull Dozer or Push Dozer, End Loader (less than 3 yards), Motor Patrol (Rough), Tractor (Crawler/Utility), Scraper, Shovel, Trenching Machine, Truck Driver (Heavy Duty, Off- Road)**

| | |
|---|---|
| **CLASS "C" OPERATORS:** | **05** |

**Asphalt Paver, Concrete Finishing Machine, Concrete Paver, Scale, Spreader (Self-Propelled), Concrete Grinder, Asphalt Milling Machine, Boring Machine Operator (Horizontal)**

| | |
|---|---|
| **CLASS "D" OPERATORS:** | **06** |

**Bobcat, Central Mixing Plant, Concrete Pump, Concrete Saw, Curb Machine (Automatic or Manual), Dozer or Loader (Stockpile), Drill (Piling), Mulcher or Seeder, Rock Drill (Truck Mounted), Roller (Asphalt), Roller (Compaction Self-Propelled), Soil Stabilization Machine, Tractor (Boom & Hoist), Bituminous Distributor Machine, Pump, Track Drill, Striping Machine Operator, Ditch Paving Machine**

***Skilled Laborer - Pipelayer Classification**

**For any work where prevailing wage rates apply which is located five feet or more outside the actual building if building construction is involved:**

**AND**

**(a) which consists of the building, rebuilding, locating, relocating or repairing any street, highway, bridges, water lines, sewer lines, gas lines, force mains or other related utilities**

**OR**

**(b) which involves the construction or upgrading of industrial parks or sites and is located outside the five foot limitation.**

**The classification of pipelayer shall be applicable and the description of work under this classification shall be as follows:**

**Lays, connects, inspects and tests water lines, force mains, gas lines, sanitary or storm sewers and drains, underground telephone and electric ducts or other utilities manufactured from clay, concrete, steel, plastic, cast iron pipe or other similar materials.**

**May smooth bottom of trench to proper elevation by scooping with a shovel; receives pipe lowered from top of trench; inserts spigot end of pipe into bell end of last laid pipe; adjusts pipe to line and grades, caulks and seals joint with cement or other sealing compound; may connect threaded or flanged joint pipe; may assemble and place corrugated metal or plastic pipe and performs other related duties.**

**Additional Information :**

**Wage Rates : http://www.tennessee.gov/labor-wfd/prevail.html**

**Poster Page : http://www.state.tn.us/labor-wfd/poster.htm**

**Note: Adobe Acrobat Reader is required in order to download & print. If you do not have this software a link is provided at the bottom of the Poster Page for a free download.**

**Tenn.Dept. of Labor & Workforce Development (Labor Standards Division) : (615) 741-2858.**

**APPRENTICESHIP REGULATIONS:**

**Under T.C.A., §12-449, the Prevailing Wage Commission has promulgated Rule 0800-3-2-.04 which provides that: "Apprentices shall mean those persons registered individually under a bona fide apprenticeship program registered with the Bureau of Apprentiship and Training in the United States Department of Labor. The state agency contracting officer shall require the contractor or sub-contractor using the apprentice to submit evidence of his indenture and/or apprenticeship registration when the apprentice's name first appears on a submitting payroll."**

**AUTHORITY: T.C.A., §12-449. Administrative History: Original Rule filed June 4, 1976. Effective: July 14, 1976.**

SPECIAL PROVISIONS FOR PROTECTION OF RAILWAY INTEREST

Kind of Project: **New Construction of the Fite Road Bridge over the ICRR at RR Milepost J 380.12 (DOT# 931 949v) with closure of the existing Fite Road at grade crossing at grade crossing milepost 380.40 (DOT#297483f) upon completion of the new Fite Road Bridge over ICRR at Woodstock, TN.**

Tennessee Project Number: **Construction No. STP-M-7900(29), 79946-3455-54**
**ROW No. STP-M-7900(29), 79946-2455-54**
**PIN 043071.00**

County: **Shelby**

**Railroad Company:** **Illinois Central Railroad**
**17641 South Ashland Avenue**
**Homewood, IL 60430-1345**

---

AUTHORITY OF RAILROAD SR ENGINEERING MANAGER/MANAGER OF PUBLIC WORKS AND STATE ENGINEER:

The contractor shall, before entering upon the right of way of the railroad for performance of any construction work, or work preparatory thereto, secure permission from the Railroad's Sr Engineering Manager, in writing, at least **ten (10)** days prior to the occupancy and use of the railroad's right-of-way, and shall confer with the Railroad's Sr Engineering Manager relative to requirements for railroad clearances, operation and general safety regulations, and with the Railroad's Manager of Public Works-Southern Region relative to engineering related questions or requirements:

**Railroad SR Engineering Manager**
**Mr. M.D. Chapman**
**2921 Horn Lake Road**
**Memphis, TN 38109**
**(901) 789-6392; Fax: (901) 786-5604**

**Manager of Public Works:**
**Mr. John W. Dinning**
**Southern Region Office**
**2151 North Mill Street**
**Jackson, MS 39202**
**(601) 914-2658; Fax: (601) 914-2649**

In addition to any other forms of insurance or bonds required under the terms of the contract and specifications, the contractor will be required to carry insurance of the following kinds and minimum amounts:

1. Contractor's Public Liability And Property Damage Liability Insurance:
   (To include automobile liability)
   The contractor shall furnish certificate of insurance, in duplicate, as evidence to the railroad that, with respect to the operations he performs, he carries regular **Contractors'** Public Liability and Property Damage Insurance providing for bodily injury, death and property damage, **and without exclusion of certified acts of terrorism**, and in the combined amount of $2 million per occurrence with an aggregate limit of $6 million for the term of the policy, and regular Contractor's Property Damage Liability Insurance providing for bodily injury, death and property damage in the combined amount of $2 million per occurrence with an aggregate limit of $6 million for the term of the policy.

   If any of the work is sublet, similar insurance, and evidence thereof, in the same amounts as required of the general contractor, shall be provided by or in behalf of the subcontractors to cover their operations.

2. Contractors' Protective Public Liability And Property Damage Liability Insurance:
   (To include automobile liability)

   The contractor shall furnish certificate of insurance, in duplicate as evidence to the railroad that, with respect to the operations performed for him by **subcontractors**, he carries in his own behalf regular Contractors' Protective Public Liability Insurance, providing for bodily injury, death and property damage, **and without exclusion of certified acts of terrorism**, and in the combined amount of $2 million per occurrence with an aggregate limit of $6 million for the term of the policy, and regular Contractors' Protective Property Damage Liability Insurance providing for bodily injury, death and property damage in the combined amount of $2 million per occurrence with an aggregate limit of $6 million for the term of the policy.

3. Railroads' Protective Public Liability and Property Damage Liability Insurance:

   In addition to the above, the contractor shall furnish to the State for transmittal to the railroad named below, an original insurance policy, which with respect to the operations he or any of his subcontractors perform, he has provided for and in behalf of **Illinois Central Railroad**, **17641 S. Ashland Ave., Homewood, IL 60430-1345** of Railroad Protective Liability Insurance of a form that is acceptable to the Railroad company to cover:

   Bodily injury, death and property damage, **and without exclusion of certified acts of terrorism**, and limited to a higher than normal combined amount of **$5 million** per occurrence with an aggregate limit of **$10 million** for the term of the policy due to the Railroad having demonstrated the danger of real and appreciably higher risks on this project.

Evidence of insurance as required above shall be furnished to the address below for review and approval by the Railroad with a courtesy copy of the railroad protective insurance certificate to the Shelby County Administrator:

**Shelby County:**
**Mr. Darren Sanders, P.E.**
**Administrator**
**Shelby County Roads, Bridges & Engineering**
**6449 Haley Road, Bldg. 11**
**Memphis, TN 38134**
**(901) 222-7700 Fax: (901) xxx-xxxx**

**Railroad:**
**Mr. John W. Dinning**
**Manager of Public Works**
**Southern States Region**
**2151 North Mill Street**
**Jackson, MS 39202**
**(601) 914-2658; Fax: (601) 592-1815**

**GENERAL**

All insurance hereinbefore specified shall be carried until all work required to be performed under the terms of the contract has been satisfactorily completed within the limits of the right-of-way of the railroad, as evidenced by the formal acceptance by the State.

Insuring Companies may not cancel insurance except by permission of the State and railroad insured, or on **thirty (30)** days written notice to the State and the railroad.

All policies of insurance provided for above shall be primary as they relate to the work provided for herein.

EXHIBIT B

SPECIAL PROVISIONS

RELATIVE TO FLAGGING AND OTHER PROTECTION OF RAILROAD TRAFFIC DURING CONSTRUCTION ALONG, ON, UNDER OR ADJACENT TO THE PROPERTY OR TRACKS OF THE ILLINOIS CENTRAL RAILROAD COMPANY

---

PART A

Licensee's contractor ("contractor") shall , before entering upon the property of the Railroad for the performance of any construction work, or work preparatory thereto, secure permission from the Chief Engineer of the Railroad for the occupancy and use of the Railroad's property and shall confer with the Railroad relative to requirements for railroad clearances, operation and general safety regulations.

The contractor shall, at all times, conduct his work in a manner satisfactory to the Chief Engineer of the Railroad, or his authorized representative, and shall exercise care so as to not damage the property of the Railroad or to interfere with the operations of the Railroad.

The Chief Engineer of the Railroad , or his authorized representative, will at all times have jurisdiction over the safety of railroad operations, and the decision of the Chief Engineer or his authorized representative as to procedures which may affect the safety of railroad operations shall be final, and the contractor must be governed by such decision.

All work shall be conducted in such a manner as will assure the safety of the Railroad. The Railroad's authorized representative shall have the right, but not the duty, to require certain procedures be used or to supervise the work on the Railroad's property.

Should any damage occur to railroad property as a result of contractor's operations, and the Railroad deems it necessary to repair such damage or to perform any work for the protection of its property, the required materials, labor and equipment shall be furnished by the Railroad, and the contractor shall reimburse the Railroad for any costs so incurred.

PART B

If the contractor requires the construction of a temporary grade crossing across the track(s) of the Railroad for use during the construction of the improvement, the contractor shall make the necessary arrangements with the Railroad for the construction, protection and later removal of such temporary grade crossing, and contractor shall promptly reimburse the Railroad for the costs of such temporary grade crossing construction, protection, maintenance and removal on the basis of the Railroad's bills, to be rendered monthly.

The contractor shall at no time cross the Railroad's property or track(s) with vehicles or equipment of any kind or character except at such temporary grade crossing as may be constructed as outlined herein, or at an existing and open public grade crossing.

PART C

Any flagging protection or watchman services required by the Railroad for the safety of railroad operations because of work being performed by the contractor, or in connection therewith, will be provided by the Railroad and the cost thereof shall be prepaid to the Railroad on the current rate sheet for flagging. The requirements of the Railroad are as follows:

The services of at least one (1) and possibly two (2) watchmen or flagmen will be required during: any excavation, placing and removal of cofferdams or sheeting, driving of foundation piling and placing of the concrete footings adjacent to the track(s); construction and removal of any falsework, bracing or forms over or adjacent to the track(s); moving construction material or equipment across the track; the setting or placing of beams or girders over or adjacent to any track(s); any construction operations involving direct interference with the Railroad's track(s) or traffic, fouling of railroad operating clearances or reasonable probability of accidental hazard to railroad traffic; or whenever men or equipment will be working within the Railroad Right of way. If an existing structure is to be removed, the services of at least one (1) and possibly two (2) watchmen or flagmen will be required during the removal of that portion of the existing structure immediately over or adjacent to any track. Flagmen will also be furnished whenever, in the opinion of the Railroad's Chief Engineer, such protection is needed.

In order that the Railroad may be prepared to furnish protective services, the contractor shall notify the Railroad five (5) days in advance of when the protective services will be needed.

PART D

The rates of pay for the Railroad employees will be the prevailing railroad hourly wage for an eight (8) hour day for the class of employee(s) involved during the regularly assigned hours, overtime in accordance with any Labor Agreements and Schedules and the Railroad's standard additives, all as in effect at the time the work is performed or the standard rate for our outside contractor. The Railroad may at it's option contract the flagging work out with a continuing service provider and the contractor will reimburse cost.

Wage rates are subject to change, at any time, by law or by agreement between the Railroad and employees, and may be retroactive as a result of negotiations or a ruling of an authorized Governmental Agency. If the wage rates are changed, the contractor shall pay on the basis of the new rates.

The contractor shall prepay for flagging services based on expected length of project and will be billed or reimbursed the difference from actual useage.

The contractor shall promptly reimburse the Railroad for the costs of all services performed by the Railroad for said contractor, upon receipt of bill(s) therefore

PART E

If, in the opinion of the Chief Engineer of the Railroad or his authorized representative, the work is being conducted in a manner considered unsafe for Railroad operations, the contractor shall cease his operations and immediately make such provisions as may be deemed necessary to correct any such undesirable condition(s) and, if, in the opinion of the Chief Engineer of the Railroad or his authorized representative, such provisions as made by the contractor are not adequate to protect train operations or the property of the Railroad, the Railroad shall, with its own forces, proceed with the necessary work to correct conditions considered undesirable or unsafe for Railroad operation's, at the expense of said contractor.

PART F

The following temporary clearances are the minimum which must be maintained at all times during the construction operations:

Vertical: 21'-6" above top of highest rail
Horizontal: 15' from centerline of nearest track, measured at right angles thereto

If lesser clearances than the above are required for any part of the work, the contractor shall secure written authorization from the Chief Engineer of the Railroad for such lesser clearances in advance of the start of work of that portion of the project along, on, over or adjacent to the property or track(s) of the Railroad.

The contractor shall not store any materials, supplies or equipment closer than 25'-0" from the centerline of any railroad track, measured at right angles thereto.

PART G

The contractor shall, upon completion of the work: remove from within the limits of the property of the Railroad, all machinery, equipment, surplus materials, falsework, rubbish or temporary buildings of said contractor; remove the approaches to any temporary grade crossing(s) constructed for the contractor's use, restoring same as nearly as practicable to conform to the adjoining terrain; remove any accumulated silt in Railroad's side ditches, restoring proper flow thereto, employ erosion control measures as appropriate to prevent further siltation until ground cover is reestablished; and in all other respects leave said property in a neat condition satisfactory to the Chief Engineer of the Railroad or his authorized representative.

PART H

Nothing in these Special Provisions shall be construed to place any responsibility on the Railroad for the quality or conduct of the work performed by the contractor hereunder. Any approval given or supervision exercised by the Railroad hereunder, or failure of Railroad to object to any work done, material used, or method of operation shall not be construed to relieve the contractor of any obligations pursuant hereto or under the agreement these Special Provisions are appended to.

Office of Chief Engineer
Illinois Central Railroad Company October, 2010

# ATTACHMENT "A"

## REQUIREMENTS REGARDING FLAGGING AND CABLE LOCATION FOR CONSTRUCTION ON CN

**(Hereinafter called "Railroad")**
**(Revised: Effective August 1, 2011)**

NOTE: Flagging and/or Cable Locate fees may apply

A utility or contractor shall not commence, or carry on, any work for installation, maintenance, repair, changing or renewal of any FACILITY, under, over or on RAILROAD property at any location without giving notice to the RAILROAD authorized representative at the RAILROAD's office located at Troy, Michigan, Phone (248) 740-6227; and if, in the opinion of the RAILROAD the presence of an authorized representative of the RAILROAD is required to supervise the same, the RAILROAD shall render bills to the utility or contractor for all expenses incurred by it for such supervision. This includes all labor costs for flagmen or cable locate supplied by the RAILROAD to protect RAILROAD operation, and for the full cost of furnishing, installation and later removal of any temporary supports for said tracks, as the RAILROAD's Chief Engineer's Office may deem necessary.

A flagman is required anytime a utility or contractor does any work on or near RAILROAD property within twenty-five (25) feet horizontally of the centerline or any work over any railroad track. The RAILROAD, however, also reserves the right to require a flagman for work on RAILROAD property, which is more than twenty-five (25) feet from the centerline of a railroad track when there are other conditions, or considerations that would dictate the need for a flagman to safeguard the RAILROAD's operations, property and safety of working personnel.

A cable locate of RAILROAD owned facilities may be required to identify and protect Signal & Communication cables that have been installed to provide power, signal control, and wayside communications. These cables are vital to a safe and reliable railway operation. The cable locate will be performed by a qualified RAILROAD employee.

**Cost for a cable locate is $250.00, which is to be prepaid before installation is to begin.**

Outside contractors are prohibited from driving on, along, or across any track that does not have a CN installed crossing. They may utilize an existing public crossing. The practice of allowing rubber tired equipment to operate over track with no crossing has been banned.

Exceptions to this rule will require the express approval from CN Engineering.

**Prior to any project being started, the RAILROAD requires a "Request for flagging services" form to be completed and submitted; including check for prepayment based on the number of days flagman protection will be required.**

# ATTACHMENT "A"

## Request for flagging services

Southern Region

TO: **Mary Ellen Carmody**
**Audit Officer**
**CN**
**2800 Livernois, Suite 220**
**Troy, Michigan 48083**
**(248) 740-6227**
**(248) 740-6036 fax**
**maryellen.carmody@cn.ca**

**Date submitted:** _____

FROM: _____
(Name)

**I am requesting a flagman for the following project. All blanks below must be completely filled in before any flagman request will be honored. Proof of Insurance must accompany this form. Flagman will be provided at your cost, depending on availability, within five (5) business days. Direct your calls concerning availability and problems to (248) 740-6227.**

Project Location: _____

RR milepost, Street, etc. _____

Company: _____

Billing Address: _____

City: _____ State: _____ Zip: _____

Company Phone: _____ Company Fax: _____ E-Mail_____

**Agreement or Authorization No.: _____ Dated: _____

With: _____

Contractor's Contact Person: _____ Phone: _____

Date(s) Flagging needed: _____

Starting time: _____ Ending Time: _____

Location for flagman to report: _____

Description of work to be performed_____

_____

_____

**A check for the number of days flagman protection is required, and MUST be over-nighted to the address shown at the top of this page. Flagging is based on the number of days a flagman is required, at the base rate of $1,000.00 per day (1 – 8 hours). Any hours in excess of eight (8) hours are billed at the rate of $150.00 per hour.**
**Prepayment check MUST be received prior to the beginning of this project.**
**Weekend and Holiday flagman protection will be billed at the minimum rate of eight hours (8) at $150.00 per hour, $1,200.00. If project runs longer than originally anticipated, then MaryEllen Carmody must be contacted, and an additional check must be submitted. Rates are Effective August 1, 2011.**
**Cost for cable locate is $250.00, and is to be prepaid before installation is to begin.**
***** *You must have an agreement with CN railroad subsidiary, such as a Right of Entry Permit, Formal Agreement or State, County, City Project Number and proof of insurance before you can enter the property.*
**Will you receive State or Federal Funds as reimbursement for this project? Yes __ No __**
**I agree to pay for flagging services as requested:** _____

*Attach map or other location info and fax completed form with cover letter on your company's letterhead and proof of insurance to MaryEllen Carmody (248) 740-6036*

**FLAGGING RATE DATA**

**Estimated flagging rate for this contract is $1,000.00 per regular week day per flagman based on an eight hour work day.**

**Overtime rate = $187.50 per hour over eight (8) hours**

**Weekend or Holiday rate = $187.50 per hour (eight (8) hour minimum)**

**Minimum hours per call out = 8 hours**

**All additives and costs for travel, meals and lodging are included in the above rates.**

**Flagging costs are to be paid by the Contractor directly to the IC Railroad prior to commencement of work. The Contractor shall submit documentation to Shelby County showing payment to RR for reimbursement from pay item 920-10 (allowance for ICRR Flagman). The Contractor will be allowed 300 regular work days to complete all work within the RR ROW that will require a flagman. The Contractor shall plan his work schedule to fit within the 300 day allowance and shall show all activities requiring a flagman in the required CPM schedule. The Contractor shall copy Shelby County Engineering Department on all correspondence with the RR including Flagman Requests.**

**If the actual flagging rates differ from the rates estimated above, an adjustment will be made either positive or negative to allow for the difference in the actual flagging rates charged by the railroad documented by invoices and the estimated rates with the additives noted above.**

**The adjustment for the difference between the estimated flagging rates and the actual flagging rates shall be determined as follows:**

1. **The actual total flagging costs will be determined by totaling all of the flagging costs, including per diem charges, submitted by the railroad for payment.**

2. **The total estimated flagging costs will be determined by multiplying the actual number of eight hour days (or regular hours if the base flagging rate is an hourly rate instead of a daily rate), overtime hours and holiday hours and days of per diem by their corresponding estimated rates, including all additives where applicable, and then obtaining the sum of the four products.**

**The amount of the adjustment shall be the difference between the costs obtained in Items 1 and 2 above. If the total cost obtained in Item 1 exceeds the total cost obtained in Item 2, the Contractor will receive the adjustment. Conversely, if the total cost obtained in Item 2 is the greater amount, Shelby County will receive the adjustment.**

**Payment of the adjustment will be made under:**

| Item Number | Pay Item | Pay Unit |
|---|---|---|
| 105.02 | Flagging Rate Adjustment | Dollar |

**Special Provision Regarding Environmental Concerns**

For worker safety, a review of file materials in the Tennessee Department of Environment and Conservation (TDEC) office for the Chromasco and W. R. Grace sites must be performed to determine the depth of contamination (primarily groundwater contaminated with solvents at W. R. Grace site) and the areas and depth of subsurface construction (especially if workers are personally in below grade areas breathing potentially contaminated soil vapors.

All hazardous materials (i.e. slab at Chromasco) encountered shall be handled in accordance with Federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. section 6901 et seq. and State of Tennessee statues and regulations, including the Rules of the Division of Solid and Hazardous Waste Management Rules 0400-11 and 0400-12.

At the W. R. Grace site, the alignment is very close to monitoring wells, to the extent that construction activities could damage the wells, rendering them unusable. If construction activities might damage the wells, then the existing wells must be properly closed and new wells installed in coordinated with TDEC and W. R. Grace. The well closure and new well installation should be performed in accordance with TDEC requirements and Shelby County Well Construction Code.

At the Chromasco site, there is a closed landfill located north of the project. The location of the landfill should be identified and delineated to avoid any disturbance, including, but not limited to, breaching the landfill cap, disturbing the fill, and parking heavy equipment or placing materials on the cap.

Contact Timminco Metals, the current property owner of the Chromasco site, prior to commencement of any construction activities on the site. Chromasco/Timminco Property Contact Information:

Primary Contact:
Mr. Sean Dunphy, CRO
Timminco
130 King Street, W, Suite 1800
Toronto, ON M5X1E3
Phone (416)364-5171
Secondary Contact (property security only): Mr. Howard Buchanan, cell (901)413-4388

Contact TDEC's Memphis Environmental Field Office, Division of Remediation Manager Jordan English at (901)371-3039 or at jordan.english@tn.gov prior to commencement of any construction activities at either W. R. Grace or Chromasco sites. The Contractor shall review the attached Phase II Environmental Site Assessment report that is in the Appendix which describes some of the environmental considerations on this project. Additionally, the Contractor is to provide a detailed construction schedule to Mr. Jordan English prior to commencement of any field work.

**Special Provision Regarding Special Seed Mixtures [for Contract Items 801-01.05, Seeding (Special Mixture – Shade Mix) and Contract Item 801-01.06, Seeding (Special Mixture – Sun Mix)]**

1. **Description:** This work shall consist of furnishing and placing seed, agricultural limestone and mulch material in accordance with the Standard Specifications for Road and Bridge Construction as follows: Section 801 – Seeding; and SP801A – Special Provision Regarding Seeding With Wood Cellulose Fiber Mulch , except as modified herein.

2. **Materials - Seed:**
The following two seed mixes shall be applied to slopes in excess (steeper than) of 3:1. The Shade Mix shall be applied to slopes on the north side of Fite Road, and the Sun Mix shall be applied to slopes on the south side of Fite Road, as shown on the plans. Seed shall be locally adapted (ecotype for Memphis region).

**Shade Mix** for erosion control on slopes > 3:1. **Application rate 30.01 Lbs. Pure Live Seed / Acre**

| Common name | Botanical Name | PLS Lbs. / Acre |
|---|---|---|
| Spring Oats | *Avena sativa* | 15.00 |
| Broomsedge | *Andropogon virginicus* | 1.00 |
| Little Bluestem | *Schizachyrium scoparium* | 2.50 |
| Upland Bentgrass | *Agrostis perennans* | 0.50 |
| Creeping Red Fescue | *Festuca rubra* | 1.50 |
| Virginia Wildrye | *Elymus virginicus* | 2.50 |
| Fall Panicum | *Panicum anceps* | 2.00 |
| Purple Coneflower | *Echinacea purpurea* | 1.25 |
| Blackeyed Susan | *Rudbeckia hirta* | 0.63 |
| Partridge Pea | *Cassia fasciculate* | 1.25 |
| Bergamot | *Monarda fistulosa* | 0.44 |
| Hairy Mountain Mint | *Pycnanthemum pilosum* | 0.19 |
| Gray Goldenrod | *Solidago nemoralis* | 0.44 |
| Yarrow | *Achillea millefolium* | 0.31 |
| Lupine | *Lupinus perennis* | 0.50 |
| Total Lbs. Pure Live Seed (PLS) / Acre: | | **30.01** |

**Sun Mix** for erosion control on slopes > 3:1. **Application rate 28.76 Lbs. Pure Live Seed / Acre**

| Common name | Botanical Name | Lbs. / Acre |
|---|---|---|
| Spring Oats | *Avena sativa* | 15.00 |
| Purple Top | *Tridens flavus* | 1.50 |
| Creeping Red Fescue | *Festuca rubra* | 1.50 |
| Virginia Wildrye | *Elymus virginicus* | 1.88 |
| Side Oats Grama | *Bouteloua curtipendula* | 1.25 |
| Switchgrass | *Panicum virgatum* | 1.56 |
| Tall Dropseed | *Sporobolus compositus* | 0.94 |
| Little Bluestem | Schizachyrium scoparium | 1.38 |
| Blackeyed Susan | *Rudbeckia hirta* | 0.50 |
| Purple Coneflower | *Echinata purpurea* | 0.63 |
| Partridge Pea | *Chamaecrista fasciculate* | 0.81 |
| Lanceleaved Coreopsis | *Coreopsis lanceolata* | 0.44 |
| Purple Prairie Clover | *Dalea purpurea* | 0.31 |
| Indian Blanket | *Gaillardia pulchella* | 0.44 |
| Mexican Hat | *Ratibida columnaria* | 0.31 |
| Butterfly Milkweed | *Asclepias tuberosa* | 0.31 |
| Total Lbs. Pure Live Seed (PLS) / Acre: | | 28.76 |

Seed must be pure live seed (PLS) weight. Submit current test with seed delivery. All seed must be labeled according to origin of seed, purity, germination rate, and year produced. Only current year seed production seed will be accepted. Seed material in their original, labeled containers must be inspected by the Construction Inspection upon arrival. Contractor shall notify Engineer when seed mixes have been delivered, and shall schedule the inspection and sampling. The Construction Inspector shall extract a one-pound sample of each mix during the initial inspection, and shall deliver the samples to the Engineer in clearly labeled containers.

**3. Materials – Agricultural Limestone:**

Soil shall be tested for pH value, and agricultural limestone shall be added and incorporated to amend soil as required to achieve a soil pH of between 6.0 and 6.7.

**4. Construction Requirements :**

Timing of seeding operations:

Apply seed according to the following schedule:

| | |
|---|---|
| February 1 – April 14: | apply the specified Shade Mix and Sun Mix, increasing the required PLS (Pure Live Seed) application rate by 25% |
| April 15 – June 15: | apply the specified Shade Mix and Sun Mix, at the required PLS application rate |
| June 15 – August 15: | apply 60 lbs PLS / acre Spring Oats *(Avena sativa*) and 30 lbs PSL / acre Brown Top Millet (*Panicum ramosum*) |
| August 15 – December 1: | apply 30 lbs PLS / acre Spring Oats (*Avena sativa*) and 30 lbs PLS / acre Winter Wheat (*Triticum aestivum*) |
| December 1 – January 31: | apply Annual Rye (*Lolium multiflorum* ) at a rate of 120 PLS per acre. |

Site Preparation:

Prepare the seed bed as specified in Subsection 801.05, except that NO fertilizer shall be applied. If winter cover was required, it shall be tilled under in the spring, prior to seeding with the Special Mixture – Sun Mix and Special Mixture – Shade Mix.

Seeding Operations:

Seed shall be broadcast in two passes. The first pass shall consist of an emulsion composed of the full seed weight required for distribution, mixed with ten percent (10%) of the mulch material, water and tackifier. The second pass shall consist of applying the balance of the hydromulch (mulch material, water and tackifier) in a second layer. Erosion control mats, if specified, shall be placed on top of the second hydromulch layer.

Compensation:

Measurement and payment shall be made in accordance with Subsections 801.09 and 801.10 of the Standard Specifications except that payment will be made under the following item numbers:

| Item No. | Description | Pay Unit |
|---|---|---|
| 801-01.05 | Seeding (Special Mixture – Shade Mix) | Unit |
| 801-01.06 | Seeding (Special Mixture – Sun Mix) | Unit |

# SECTION A

# SHELBY COUNTY GOVERNMENT

# ENGINEERING DEPARTMENT

# SEALED BID

## I. INTRODUCTION

Shelby County Government (the "County"), is soliciting currently registered Construction Companies to provide Construction Services for the construction of a new alignment of Fite Road and construction of a new bridge overpass over the Illinois Central Railroad in Shelby County Tennessee. This Sealed Bid ("SBI") is being released to invite interested and qualified firms to prepare and submit proposals in accordance with the plans and specifications provided where the successful candidate will be selected and invited to enter into a contractual relationship with Shelby County for the Services outlined in this SBI.

## II. MINIMUM BIDDER REQUIREMENTS

All bidders must:

1. **Prime** and **LOSB** contractors must **apply** and **qualify** for an Equal Opportunity Compliance (EOC) certification number through our EOC Administration **prior to submitting your response**.
2. Firms located within the boundaries of Shelby County are required to have a current Shelby County Business License or be considered exempt from the license requirement by the Shelby County Clerk's Office.
3. Meet all other requirements for the performance such as LOSB and performance requirements for Services in accordance with the provisions of this SBI.
4. Must submit a Bid Bond in the amount of 5% of their bid. This bond must be submitted with your bid.
5. The successful contractor must be able to submit a performance/labor material bond separate bonds each in the amount of 100% of the amount of the contract.
6. Must submit LOSB Form B and A with their bid.
7. Have all appropriate licenses and certifications required in the State of Tennessee to perform the Services.
8. A written statement of compliance to Title VI and the Living Wage Ordinance must be provided by the successful contractor. Please see item **"H**" for the Living Wage Ordinance and item, **"I"** for Title VI.
9. Also see item # M for forms to be submitted with your bid.
10. Independent contractors (sole proprietors) must adhere to State of Tennessee Public Chapter No. 436, known as the "Tennessee Lawful Employment Act" (effective date of 01/01/12). Proof and documentation of employment eligibility must be included with the proposal.
11. Be TDOT Pre-Qualified.

***Please Note:*** ***As a part of doing business with Shelby County, each individual, company or organization is required to obtain a vendor number and an "Equal Opportunity Compliance" certification number.***

***You can access the online application to receive the numbers indicated above at www.shelbycountytn.gov and click the link "Department" at the top, then P for Purchasing Department, then click on the link "Conducting business with Shelby County". Please download the application instructions and read thoroughly prior to accessing the application.***

## III. CORRESPONDENCE

**All correspondence, proposals, and questions concerning the SBI are to be submitted to:**

**Nelson Fowler, Manager A**
**Shelby County Government**
**160 N. Main St. Suite 550**
**Memphis, TN 38103**
**(901) 222-2250**

Respondents requesting additional information or clarification are to contact Nelson Fowler in writing at nelson.fowler@shelbycountytn.gov or at the address listed above. Questions should reference the section of the SBI to which the question pertains and all contact information for the person submitting the questions. ***IN ORDER TO PREVENT AN UNFAIR ADVANTAGE TO ANY RESPONDENT, VERBAL QUESTIONS WILL NOT BE ANSWERED***. ***The deadline for submitting questions will be July 1, 2013 @ 12:00 p.m.***

**Note: All written questions submitted by the deadline indicated above will be answered and posted on the County's website at *www.shelbycountytn.gov* within forty eight (48) hours of the above cut-off date.**

***These guidelines for communication have been established to ensure a fair and equitable process for all respondents. Please be aware that contact with any other personnel (other than the person clearly identified in this document) within Shelby County or its benefit administrators regarding this SBI may disqualify your company from further consideration.***

***Respondents requesting additional information or clarification are to contact Mr. Nelson Fowler in writing at nelson.fowler@shelbycountytn.gov or at the address listed above. Questions should reference the section of the SBI to which the question pertains and all contact information for the person submitting the questions.***

***The vendor number is obtained through the Purchasing Department and the EOC certification is obtained through the Shelby County EOC Administration.***

***If you have any questions regarding the vendor number, please call the Purchasing Department @ 901-222-2250 or download the Bidder's List Application & W-9 form at www.shelbycountytn.gov. and click the link "Department" at the top, then P for the Purchasing Department, then click on the link "Conducting business with Shelby County" and then select," Vendor Registration."***

***If you have any questions regarding the EOC qualification, please call 901-222-1100.***

## IV. PROPOSAL SUBMISSION DEADLINE

All proposals must be received at the address listed above no later than **2:30 pm, July 15, 2013.** Facsimile or electronically transmitted proposals will not be accepted since they do not contain

original signatures. Postmarks will not be accepted in lieu of actual receipt. Late or incomplete proposals may not be opened and considered.

## V. PROPOSAL TIMELINE

Shelby County reserves the right to modify this timeline at any time. If the due date for proposals is changed, all prospective Bidders shall be notified.

| | |
|---|---|
| **Request for Proposals Released** | **June 20, 2013** |
| **Pre-Bid Conference** | **June 25, 2013** |
| **Deadline for Questions** | **July 1, 2013** |
| **Proposal Due Date** | **July 15, 2013** |
| **Notification of Award** | **August/September 2013** |

The County may reproduce any of the Bidders proposal and supporting documents for internal use or for any other purpose required by law.

## VI. PROPOSAL CONDITIONS

### A. Contingencies

This SBI does not commit the County to award a contract. The County reserves the right to accept or reject any or all proposals if the County determines it is in the best interest of the County to do so. The County will notify all Bidders, in writing, if the County rejects all proposals.

### B. Modifications

The County reserves the right to issue addenda or amendments to this SBI.

### C. Proposal Submission

To be considered, all proposals must be submitted in the manner set forth in this SBI. It is the Bidders responsibility to ensure that its proposals arrive on or before the specified time.

### D. Incurred Costs

This SBI does not commit the County to pay any costs incurred in the preparation of a proposal in response to this SBI and Bidders agree that all costs incurred in developing this SBI are the Bidders responsibility.

### E. Final Authority

The final authority to award a contract rests solely with the Shelby County Purchasing Department.

### F. Proposal Validity

Proposals submitted hereunder will be firm for one hundred twenty (120) calendar days from the due date unless otherwise qualified.

## G. Disclosure of Proposal Contents

Proposer understands and acknowledges that the County is a governmental entity subject to the laws of the State of Tennessee and that any reports, data or other information supplied to the County is subject to being disclosed as a public record in accordance with the laws of the State of Tennessee. All proposals and other materials submitted become the property of Shelby County Government.

## H. Living Wage Ordinance and Prevailing Wage Ordinance

Living Wage - In accordance with Ordinance Number 328, commonly referred to as the Living Wage Ordinance, all persons/entities engaged in service contracts with the County, including but not limited to both prime and subcontractors, shall pay a Living Wage to employees for all work performed on said service contract, as defined in the Living Wage Ordinance. Proof of such compensation must be evidenced as required in the Living Wage Ordinance.

Prevailing Wage – Any firm, individual, partnership or corporation awarded a contract by the COUNTY for the construction of, improvement, enlargement, alteration or replacement of a public work or project in excess of $500,000 and any subcontractors of such public work or project in excess of $100,000 ("Recipient") shall be required to pay local prevailing wages and benefits for laborers, mechanics, or other listed classifications as defined by the Tennessee Department of Labor. The prevailing wage rate shall be the most current State of Tennessee prevailing wage established by the Tennessee Department of Labor For Region 1 (Shelby County). The benefit rates shall be the most current rates described in the published schedule by the Memphis and West Tennessee Building and Construction Trades Council, except as otherwise provided in the Shelby County Code of Ordinances. The applicable rate shall be determined at the time that the project is awarded. In instances where Prevailing wage applies, Prevailing Wage will override the Living Wage requirement.

## I. Non-discrimination and Title VI

The contractor hereby agrees, warrants, and assures compliance with the provisions of Title VI and VII of the Civil Rights Act of 1964 and all other federal statutory laws which provide in whole or in part that no person shall be excluded from participation or be denied benefits of or be otherwise subjected to discrimination in the performance of this Contract or in the employment practices of the contractor on the grounds of handicap and/or disability, age, race, color, religion, sex, national origin, or any other classification protected by federal, Tennessee State Constitutional or statutory law. The contractor shall upon request show proof of such non-discrimination and shall post in conspicuous places available to all employees and applicants notices of non-discrimination.

Any recipient entity shall be subject to the requirements of Title VI of the Civil Rights Act of 1964, 42 U.S.C. 2000d et seq., and regulations promulgated pursuant thereto. It shall develop a Title VI implementation plan with participation by protected beneficiaries as may

be required by such law or regulations. To the extent applicable, such plan shall include Title VI implementation plans sub-recipients of federal funds through the entity. The contractor shall produce the plan upon request of Shelby County Government. Failure to provide same shall constitute a material breach of contract.

**J. LOSB**

**SHELBY COUNTY GOVERNMENT**
**LOCALLY OWNED SMALL BUSINESS (LOSB) PROGRAM**
**FOR CONSTRUCTION SERVICES**

## FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT

**General**

Shelby County Government is committed to a policy of non-discrimination pursuant to the Equal Protection provisions of the United States Constitution. It is further the policy of Shelby County that it's purchasing and contracting practices encourage the use of Locally-Owned Small Businesses (LOSB's) in all solicitations. In furtherance of these policy objectives, Shelby County seeks to afford all citizens equal opportunities to do business on county contracts and to ensure that all bidders, or Contractors doing business with Shelby County provide to LOSB's, maximum practicable opportunities, commensurate with availability, price and capabilities required, to participate on contracts which are paid for, in whole or in part, with monetary appropriations from Shelby County.

Shelby County seeks to prevent discrimination against any person or business in pursuit of these opportunities on the basis of race or gender. Shelby County will conduct its contracting and purchasing programs to discourage any discrimination and will actively seek to resolve all claims of discrimination brought against Shelby County or any Contractors involved in such contracting and purchasing programs.

Shelby County has determined that **20%** of the contract sum will be contracted with LOSB vendors. For assistance and information regarding LOSB participation, Bidders shall contact:

Ms. Carolyn Griffin
Office of Equal Opportunity Compliance
Board of Commissioners of Shelby County
160 North Main Street, Suite 969
Memphis, Tennessee 38103
Phone: 901-222-1100
Fax: 901-222-1101
E-mail: Carolyn.Griffin@shelbycountytn.gov

## Definitions

The definitions used in this document are as follows:

1. **"Bidder"** means any person, firm, partnership, association, or joint venture seeking to be awarded a contract or subcontract to provide goods, commodities, or services.
2. **"Certification"** or **"Certified"** means a Business that is certified by Shelby County Government under the LOSB program.
3. **"Commercially useful function"** means being responsible for the management and performance of a distinct element of the total work.
4. **"Contractor"** shall mean any person or business enterprise that submits a bid or proposal to provide labor, goods, or services to Shelby County by contract for profit in the area of construction or construction-related activities; and, any person or firm who supplies or provides labor, goods, or services to Shelby County by contract for profit.
5. **"Efforts to Achieve LOSB Participation"** means that the Contractor will solicit LOSB Participation with respect to the procurement and will consider all sub-bids and quotations received from LOSB's. When a subcontract is not awarded to the LOSB, the Contractor must document the reason(s) the award was not made and substantiate that documentation in writing pursuant to the provisions of this Program.
6. **"Locally Owned Small Business (LOSB)"** means a business whose home office is located in Shelby County, whose annual revenues do not exceed $3,000,000 and who has been certified by Shelby County Office of Equal Opportunity Compliance.
7. **"Non-LOSB"** means a business, which is not certified as a LOSB.
8. **"Unavailable"** means either that: (1) there is no LOSB providing goods or services requested; or, (2) no LOSB submitted a bid.

## Requirements and Compliance

All firms or entities seeking to become Contractors as outlined herein are required to make good faith efforts to achieve LOSB participation when submitting a proposal or bidding on Shelby County procurements. Bidders shall not discriminate on the basis of race or gender when soliciting bids in the performance of Shelby County's procurements. Discrimination complaints brought to the attention of Shelby County Office of Equal Opportunity Compliance (or its designee) will be reviewed and investigated to the extent necessary to determine the validity of such complaints and what actions, if any, should be taken by Shelby County.

## Policies and Procedures

Shelby County may adopt policies and procedures as necessary to carry out and implement its powers and duties with regard to the LOSB Program. It is the goal of Shelby County to encourage participation by LOSB's and to adopt rules and regulations which achieve to the greatest extent possible a level of participation by LOSB's taking into account the total number of all Contractors and suppliers. Therefore, Shelby County will review each procurement request to determine the maximum potential for utilization of LOSB's. This review is based on the availability of qualified LOSB's providing goods or services as it relates to the scope of the bid or procurement process. The following procedures may be utilized during the procurement process.

**1. Pre-Bid Activity**

a. Bid Language

Shelby County may insert language into each bid specification describing the LOSB Program to assure that all prospective bidders are aware of the requirements to make efforts to utilize LOSB's.

b. Notification

Shelby County may provide written notification to Contractors and LOSB's regarding pre-bid conferences; technical assistance to LOSB's; LOSB Program procedures and required documentation; and, provide a list of LOSB's who have expressed an interest in competing for the bid or in performing as a subcontractor.

**2. Contractor's Responsibilities**

a. Efforts to Achieve LOSB Participation

All entities seeking to become Contractors are required to make efforts to achieve maximum LOSB participation, as outlined in this LOSB Program, when submitting a response to a bid or negotiated proposal in response to a Shelby County procurement opportunity. Such Efforts should be documented on **LOSB Form "A."** and submitted with your bid.

b. Utilization

Contractors are required to utilize legitimate LOSB's in order to receive credit for the utilization of a LOSB. Contractors must document all LOSB's to be utilized, the percentage of utilization and the intended scope of work. Such information should be submitted on **LOSB Form "B."** This documentation must be submitted with the bid or negotiated proposal document.

c. Commercially Useful Functions

All LOSB's identified on **LOSB Form "C"** or **LOSB Form "D"** shall perform a Commercially Useful Function.

d. Unavailability

If a potential Contractor's efforts to obtain LOSB participation are unsuccessful due to the unavailability of a LOSB, the Contractor will submit a statement of unavailability. **LOSB Form "A**."

e. Pre-Work Conference

Any Contractor who is the successful bidder shall be required to attend a conference with Shelby County prior to beginning the work. The primary purpose of this conference is to review the project scope and review LOSB participation as outlined in **LOSB Form "B."** Shelby County will also review the Statement of Intent to Perform as a Subcontractor or Provide Supplies or Services as documented on **LOSB Form "C."**

f. Post-Award Change

Any Contractor who determines that a LOSB identified on **LOSB Form "B"** cannot perform shall request approval from Shelby County to contract with an alternate subcontractor pursuant to this LOSB Program. Such request will be reviewed and approved only after adequate documentation for the proposed change is presented.

g. LOSB Certification

Each month the Contractor shall submit **LOSB Form "D"** certifying all payments made to LOSB's.

**3. LOSB Responsibilities**

a. Commercially Useful Function

It is the responsibility of each LOSB providing subcontracted goods and/or services to submit **LOSB Form "C"** certifying that it is performing the work and that it is a Commercially Useful Function.

**Written Agreement**

Shelby County policies and procedures on LOSB participation are designed to create contractual relationships between Contractors and LOSB's. Therefore, a Contractor may utilize the services of a LOSB in estimating and satisfying the scope of work, provided that a written contract/agreement is executed between the Contractor and the LOSB.

**Certification**

To ensure that the ownership and control over decision-making and day-to-day operations of a Certified LOSB is legitimate, Shelby County reserves the right to verify the ownership and control of each LOSB utilized.

**Monitoring LOSB Utilization**

Shelby County intends to monitor and enforce this LOSB Program. Shelby County reserves the right to conduct random audits of each of its Contractor's/ LOSB's. Shelby County reserves the right to reevaluate a LOSB's certification at any time.

**Efforts to Achieve LOSB Participation**

The Contractor shall consider all bids and/or quotations received from LOSB's. When a subcontract is not awarded by a Contractor to any of the competing LOSB's, the Contractor must document the reason(s) the award was not made to the LOSB's. It is the responsibility of the Contractor to prove that it employed Efforts to Achieve LOSB participation. Evidence supporting the Contractor's Efforts must be documented on **LOSB Form "A,"** which must include, but is not limited to, the following:

1. Contractor must submit proof that it solicited LOSB participation through reasonable and available means including, but not limited to:
   a. Written notices to LOSB's who have the capability to perform the work of the contract or provide the service;
   b. Direct mailing, electronic mailing, facsimile or telephone requests.
2. Contractor must submit proof that it provided interested LOSB's with adequate information about plans, requirements and specifications of the contract in a timely manner to assist them in responding to a solicitation.
3. Contractor must submit proof that it made Efforts to Achieve LOSB Participation including, but not limited to, proof that it made opportunities available to LOSB

suppliers and identified opportunities commensurate with opportunities made available and identified to Non LOSB's. Such proof will include~~s~~ the names of businesses, contact person(s), addresses, telephone numbers, and, a description of the specifications for the work selected for subcontracting.

4. Contractor must submit proof that it allowed LOSB's the opportunity to review bid specifications, blue prints and all other bid related items at no charge. The Contractor must allow sufficient time for review prior to the bid deadline.
5. Contractor must submit proof that it made Efforts to Achieve LOSB Participation by not rejecting a LOSB as unqualified or unacceptable without sound reasons based on a thorough investigation of their capabilities. Contractor must submit proof of the basis for rejecting any LOSB deemed unqualified or unacceptable by the Contractor. The Contractor will not impose unrealistic conditions of performance on LOSB's seeking subcontracting opportunities.

   The Contractor must fully cooperate with Shelby County in its post-contract award LOSB Program audit and compliance efforts.

**Substitution of LOSB's after Contract Award**

In order to make a substitution of a LOSB, a Contractor must make a request to Shelby County. This request must be submitted in writing to Shelby County. Shelby County reserves the right to approve any substitution of a LOSB. The Contractor has the responsibility to provide Shelby County with a reasonable basis for the substitution. If the Contractor desires to substitute the LOSB with a Non-LOSB, then the Contractor must comply with the Effort to Achieve LOSB Participation provisions set forth herein.

**Noncompliance with LOSB Program**

Any of the following reasons, individually or collectively, may result in suspension from bidding, prohibition from contracting, or cancellation of contracts:

1. The failure to perform according to contract provisions relating to this LOSB Program;
2. Violation of, circumvention of, or failure to comply with the LOSB Program; and/or, other reasons deemed appropriate by Shelby County **Questions and Information**

Questions regarding this LOSB Program and requests for information should be directed to:

Ms. Carolyn Griffin
Office of Equal Opportunity Compliance
Board of Commissioners of Shelby County
160 North Main Street, Suite 969
Memphis, Tennessee 38103
Phone: 901-222-1100
Fax: 901-222-1101
E-mail: Carolyn.Griffin@shelbycountytn.gov

**Construction**

This LOSB Program is consistent with Shelby County Policies and Procedures. Wherever conflicts exist, the provision in the Shelby County Policies and Procedures will prevail.

**LOSB Program Forms Description**

- **LOSB Form A -- Certification of Efforts**

Contractors are required to submit **LOSB Form "A"** with proposals as evidence and documentation of efforts that have been made to contact LOSB's for participation as subcontractors, joint venture partners, or suppliers of goods and services. Contractors are required to contact LOSB's and solicit quotes for goods and services. All responses to the Contractor's solicitation should be recorded and reported.

- **LOSB Form B -- LOSB Utilization Plan**

A Contractor is required to submit **LOSB Form "B"** with its Proposal in order to identify all LOSB's they propose to utilize in providing the goods and services included in the Proposal. Contractors may only include a proposed provider of goods or services on **LOSB Form "B,"** if the entity is a legitimate LOSB. Additionally, if such entity will provide services, Contractors may only list LOSB's on **LOSB Form "B"** if the entity will perform a Commercially Useful Function. The Successful Contractor will be required to finalize and submit **LOSB Form "B"** prior to award of a contract. **LOSB Form "B"** will be incorporated into the contract and will become a contractual obligation of the Successful Contractor. **LOSB Form "B"** shall not be changed or altered after award of a contract without approval from Shelby County. The Contractor is required to provide written notice describing the reasons for any proposed change to Shelby County and to obtain approval from Shelby County of any changes to **LOSB Form "B."**

**LOSB Form C –Statement of Intent to Perform as a Subcontractor or Provide Supplies or Services.**

Contractors are required to have each subcontracted LOSB providing services complete **LOSB Form "C**" certifying that it is performing the work and that it is a Commercially Useful Function.

- **LOSB Form D – Statement of Payments to LOSB's**

Contractors are required to record and maintain information regarding the utilization of LOSB's and all other information during the performance of awarded contracts. This information shall be recorded and maintained on **LOSB Form "D."** The form is required to be submitted to Shelby County each month. **LOSB Form "D"** must be completed in its entirety with information regarding the types of goods purchased from LOSB's or the types of services rendered by LOSB's and dollars amounts paid for their goods or services.

**Shelby County**
**LOSB Program**
**LOSB FORM A**
**CERTIFICATION OF EFFORTS TO ACHIEVE LOSB PARTICIPATION**
(To Be Submitted with the Bid/Proposal)

**Company Name:** _____
**Bid No.:** _____

I certify that the following efforts where made to achieve LOSB participation: **YES NO**

A Provided written notices to LOSB's who have the capability to perform the work of the contract or provide the service
B Direct mailing, electronic mailing, facsimile or telephone requests
C Provided interested LOSB's with adequate information about plans, requirements and specifications of the contract in a timely manner to assist them in responding to a solicitation
D Allowed LOSB's the opportunity to review bid specifications, blue prints and all other bid/RFP related items at no charge, and allowed sufficient time for review prior to the bid deadline
E Acted in good faith with interested LOSB's, and did not reject LOSB's as unqualified or unacceptable without sound reasons based on a thorough investigation of their capabilities
F Did not impose unrealistic conditions of performance on LOSB's seeking subcontracting opportunities

Additionally, I contacted the referenced LOSB's and requested a bid/proposal. The responses I received were as follows:

| Name and Address of LOSB | Type of Work And Contract Items, Supplies or Services to be Performed | Response | Reason for Not Accepting Bid/Proposal |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*(If additional space is required, this form maybe duplicated)*

**If applicable, please complete the following:**

I hereby certify that LOSB's were "Unavailable" as defined in the LOSB Program to submit bids to provide goods and services for this RFP/Bid's purpose.

Reasons for the “Unavailability”

_____

_____

Submitted by:

_____ _____

Authorized Representative Signature Title

_____

Date

**Shelby County**
**LOSB Program**

**LOSB FORM B**

**LOSB UTILIZATION PLAN**
(To Be Submitted with the Bid/Proposal)

**Company:** _____

**Bid No.:** _____

I, _____, do certify that on the following procurement opportunity,
(Contractor)
_____, the following LOSB's will be utilized as sub-contractors,
(Opportunity)
suppliers, or to provide professional services:

| Name | Description of Work | Contract Value | LOSB Number |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

***(If additional space is needed this form may be duplicated)***

TOTAL CONTRACT VALUE: _____

TOTAL % OF LOSB PARTICIPATION: _____

*The successful bidder is required to finalize and submit this form prior to award of a contract. Joint Venture Agreements, partnering agreements and all pertinent information must be presented prior to contract award. This information will be incorporated into the contract and will become a contractual obligation of the successful bidder. The finalized LOSB Form B shall not be changed or altered after award of a contract without approval from Shelby County. The successful bidder is required to provide written notice describing the reasons for the change to Shelby County to obtain approval of any changes to LOSB Form B.*

Submitted by:

_____
Authorized Representative Signature

_____
Title

_____
Date

**Shelby County**
**LOSB Program**
**LOSB FORM C**

**STATEMENT OF INTENT TO PERFORM AS A SUBCONTRACTOR OR PROVIDE SUPPLIES OR SERVICES**
(To Be Submitted Prior to Contract Award)

**Company Name: _____**
**Bid No.:_____**

I, _____, intend to provide supplies or services in connection with the
(Subcontractor/Provider)
above **bid/proposal** request as a LOSB.

I am prepared to perform a **"Commercially Useful Function"** in connection with the above project.

The following are the work items to be performed:

_____

_____

at the following price: $_____.

**If applicable, please complete the following:**

I have or will enter into a formal agreement with _____ for the above-
(Company)
described scope of work, supplies, or services conditioned upon the execution of a contract

with Shelby County.

I hereby certify that this statement is true and correct:

Business Information: Submitted by: _____

Business: _____ Authorized Representative (Print):

Address: _____ _____

Title: _____

Phone: _____ Authorized Representative's Signature:

_____

Facsimile: _____ Date: _____

**Shelby County**
**LOSB Program**

**LOSB FORM D**

**STATEMENT OF PAYMENTS TO LOSB'S**
(To Be Submitted Monthly and with Final Payment Request)

**Company Name: _____**
**Name/Contract No.: _____**
**Payment Request Number: _____**

| Name of Firm | Description of work | Total Amount Due This Month | Total Dollars Paid To Date | % of Contract Completed | Start Date of Contract | End Date of Contract |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

*(If additional space is needed this form may be duplicated)*

I hereby certify that this statement is true and that above payments have been made.

Business Information: Submitted by:

Business: _____ Authorized Representative (Print):

Address: _____ _____

_____ Title: _____

Phone: _____ Authorized Representative's Signature:

_____

Facsimile: _____ Date: _____

**LOCALLY OWNED SMALL BUSINESS PURCHASING PROGRAM RULES AND REGULATIONS:**

1. The Administrator of Purchasing in conjunction with the Administrator of EOC shall identify certain goods and services required by the County to be set aside for special purchasing procedures for locally owned small businesses.

2. Only certified locally owned small businesses will be allowed to submit competitive bids on the goods or services identified under paragraph (i) above.

3. The Administrator of Purchasing shall, in conjunction with the Administrator of EOC, annually review the Shelby County Capital Improvement Program to determine those projects with a construction cost of $250,000 or more. Contracts amounting to at least ten (10%) of the construction costs of such project shall be awarded to locally owned small businesses as defined herein, except as set forth in sub-paragraph (vi) of this section, either as part of the conditions of the solicitation for general contractors bidding on these projects, or as separate bids issued by the County for subcontracts that may be assigned to general contractors.

4. After adhering to all other bidding and purchasing requirements of the County, not inconsistent with this part, if no bids are received from locally owned small businesses, then the County may solicit bids for the goods or services from all other sources.

5. On all purchases and/or contracts entered into by the County, the Purchasing Administrator or his or her designee shall have the right to negotiate with any supplier of goods or services to the County for the inclusion of locally owned small business subcontractors and/or suppliers in the contract award.

6. Failure by a supplier or contractor to include locally owned small business sub-contractors or suppliers in its bid or contract may be grounds for rejection of said bid or contract unless the supplier or contractor can show documented evidence of good cause why none were included.

7. Any locally owned small business awarded a contract or purchase order under this section shall not sublet, subcontract, or assign any work or services awarded to it without the prior written consent of the Mayor or the Purchasing Administrator.

8. As to those purchases below the requirement for a formal bid solicitation (currently, under $15,000) and not included in the locally owned small business set aside, the Administrator of Purchasing shall determine if any locally owned small business offers that product or service. If so, at least one such eligible locally owned small business should be included in the vendors contacted for an opportunity to bid, and the Administrator of Purchasing may, at his discretion, designate in a purchase order the purchase of such goods and services from the identified locally owned small business.

9. In those situations where a locally owned small business as defined herein, engages in open competitive bidding for County contracts, the Administrator of Purchasing shall provide for a preference for the locally owned small business where responsibility and quality are equal.

Said preferences shall not exceed five percent (5%) of the lowest possible bidder meeting specifications. The preference shall be applied on a sliding scale in the following manner:

a. A preference of up to five percent (5%) shall be allowed for contracts up to $ 500,000.00;
b. A preference of up to three and five-tenths percent (3.5%) shall be allowed for contracts up to $750,000.00;
c. A preference of two and one-half percent (2.5%) shall be allowed for contracts up to $1,000,000.00;
d. A preference of two percent (2%) shall be allowed for contracts that exceed $1,000,000.00.

10. For construction contracts over $2,000,000.00, the Administrator of Purchasing shall provide for a preference of two percent (2%) to general contractors meeting the requirements of Section 1, Subparagraph B, if fifty percent (50%) or more of the total work comprising the bid has been or will be awarded to certified locally owned small businesses. The fifty percent subcontracting threshold must be met prior to contract execution.

11. The Administrator of Purchasing may divide a single bid package for any purchase of goods and services into two or more smaller bid packages in any case that the Administrator of Purchasing reasonably believes that the smaller bid packages will result in a greater number of bids by locally owned small businesses.

12. The Administrator of Purchasing, upon approval of the County Mayor, may establish special insurance and bonding requirements for certified locally owned small businesses so long as they are not in conflict with the laws of the State of Tennessee.

13. The Administrator of Purchasing, with the approval of the County Mayor, shall adopt and promulgate, and may from time to time, amend rules and regulations not inconsistent with the provisions of this ordinance, governing the purchase of goods and services from locally owned small business concerns to effectuate and implement the Locally Owned Small Business Purchasing Program within the intent of this ordinance.

14. The Administrator of EOC shall, in conjunction with the Administrator of Purchasing, provide a written quarterly report to the Mayor and Board of Commissioners which shall include a summary of the purchases selected for this program, a listing of the contracts awarded to locally owned small businesses for the period, and the dollar amounts of each such contract, and the percentage which such contracts bear to the total amount of purchases for the period.

## K. DRUG-FREE WORKPLACE AFFIDAVIT

**STATE OF_____**

**COUNTY OF_____**

The undersigned, principal officer of _____, an employer of five (5) or more employees contracting with _____County government to provide construction services, here states under oath as follows:

1. The undersigned is a principal officer of _____ (hereinafter referred to as the "Company"), and is duly authorized to execute this Affidavit on behalf of the Company.

2. The Company submits this Affidavit pursuant to T.C.A. § 50-9-113, which requires each employer with no less than five (5) employees receiving pay who contracts with the state or any local government to provide construction services to submit an affidavit stating that such employer has a drug-free workplace program that complies with Title *50*, Chapter 9, of the *Tennessee Code Annotated.*

3. The Company is in compliance with T.C.A. ~ 50-9-113. Further affiant smith not.

Principal Officer

**STATE OF_____**

**COUNTY OF_____**

Before me personally appeared with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence), and who acknowledged that such person executed the foregoing affidavit for the purposes therein contained. Witness my hand and seal at office this day of _____.

Notary Public
My commission expires:

## L. GRATUITY DISCLOSURE FORM:

**CODE OF ETHICS**
**Section 18-59**

**SHELBY COUNTY GOVERNMENT**
**GRATUITY DISCLOSURE FORM**

**INSTRUCTIONS:** *This form is for all persons receiving any Shelby County Government contract, subcontract, land use approval or financial grant of money to report any gratuity that has been given, directly or indirectly, to any elected official, employee or appointee (including their spouses and immediate family members) who is involved in the decision regarding the contract, land use approval, or financial grant of money.*

**1. NAME:**

_____

**2. DATE OF GRATUITY:**

_____

**3. NATURE AND PURPOSE OF THE GRATUITY:**

_____

_____

_____

**4. NAME OF THE OFFICIAL, EMPLOYEE, APPOINTEE, OR FAMILY MEMBER WHO RECEIVED THE GRATUITY:**

_____

**5. NAME OF THE PERSON OR ENTITY THAT PROVIDED THE GRATUITY:**

_____

**6. ADDRESS OF THE PERSON OR ENTITY THAT PROVIDED THE GRATUITY:**

_____

_____

**7. DESCRIPTION OF THE GRATUITY:**

_____

_____

_____

**8. COST OF THE GRATUITY:** (If cost is unknown and not reasonably discernible by the person giving the gratuity, then the person giving the gratuity shall report a good faith estimate of the cost of the gratuity.)

_____

**9. AFFIDAVIT:**

The information contained in this Gratuity Disclosure Form, and any supporting documentation or materials referenced herein or submitted herewith, is true and correct to the best of my knowledge, information and belief and affirm that I have not given, directly or indirectly, any gratuity to any elected official, employee or appointee (including spouse and immediate family members) that has not been disclosed and I affirm that I have not violated the provisions of the Shelby County Government Code of Ethics.

_____ _____

**Signature** **Date**

_____

**Print Name**

*A copy of your completed form will be placed on the Shelby County Internet Website.*

**M. FORMS TO BE SUBMITTED:**

**LOSB FORM A: MUST BE COMPLETED AND SUBMITTED IN YOUR BID ENVELOPE.**

**LOSB FORM B: MUST BE COMPLETED, SUBMITTED WITH YOUR BID AND ATTACHED TO THE OUTSIDE OF THE ENVELOPE DOCUMENTING ALL LOSB'S TO BE UTILIZED, THE PERCENTAGE OF UTILIZATION AND THE INTENDED SCOPE OF THE WORK.**

**LOSB FORM C- MUST BE COMPLETED AND SUBMITTED BY EACH LOSB PROVIDING SUBCONTRACTED GOODS AND OR SERVICES CERTIFYING THAT THEY ARE PERFORMING THE WORK AND THAT IT IS A COMMERCIALLY USEFUL FUNCTION. ONLY REQUIRED AFTER THE AWARD OF THE BID.**

**LOSB FORM D-MUST BE COMPLETED AND SUBMITTED BY THE SUCCESSFUL CONTRACTOR EACH MONTH CERTIFYING ALL PAYMENTS MADE TO LOSB'S.**

**DRUG FREE WORKPLACE AFFIDAVIT – MUST BE COMPLETED AND SUBMITTED WITH YOUR BID.**

**BID BOND – ALL BIDS MUST BE ACCOMPANIED BY A BANK CERTIFIED CHECK OF BANK DRAFT, LETTER OF CREDIT ISSUED BY ANY NATIONAL BANK OR APPROVED BID BOND FOR NOT LESS THAN 5% (PERCENT) OF THE AMOUNT OF THE BID. ALL PROPOSAL GUARANTEES SHALL BE MADE OUT TO THE COUNTY OF SHELBY.**

**<u>NOTE:</u> THE SUCCESSFUL CONTRACTOR WILL SUBMIT LOSB FORM C AND D.**

**FAILURE TO SUBMIT THE REQUIRED FORMS MAY RESULT IN YOUR BID BEING REJECTED AS BEING IN NON-COMPLIANCE WITH BID REQUIREMENTS.**

## VII. GENERAL REQUIREMENTS:

### A. Scope of Work

The County wishes to engage in a contractual relationship with the lowest responsive Contractor selected through a low bid process.

### B. Project Time Frame

The Provider must be prepared to begin immediately upon receipt of a Notice to Proceed. The work under this contract shall be substantially complete within one thousand ninety five (1,095) calendar days.

### C. Reservation of Rights

The County reserves the right, for any reason to accept or reject any one or more proposals, to negotiate the term and specifications for the services provided, to modify any part of the SBI, or to issue a new SBI.

### D. Selection Criteria

Contract(s) will be awarded based on the lowest responsive proposals received. The contents of the proposal of the successful Bidders will become contractual obligations and failure to accept these obligations in a contractual agreement may result in cancellation of the award.

### E. Additional Information and References

Any additional information that would be helpful to the County evaluating your proposal, including a list of current and former clients with a similar profile to Shelby County should be submitted.

## VIII. AWARD OF CONTRACT:

Bidders are advised that the lowest responsive proposal per set will be awarded the contract.

## IX. NOTICE TO BIDDERS

**Time and Place of Opening of Bids:**

Sealed bids for the improvements described herein will be received and opened at THE OFFICE OF THE SHELBY COUNTY ADMINISTRATOR OF PURCHASING, ROOM 550, SHELBY COUNTY ADMINISTRATION BUILDING, 160 NORTH MAIN, MEMPHIS, TENNESSEE 38103, at **2:30 pm, July 15, 2013.** All interested bidders are invited to attend our bid opening at the above place and time.

**Description of Work:**

(a) The proposed work is officially known as: **FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT.**

**Pre-Bid Meeting:**

Bidders are encouraged to attend a voluntary pre-bid meeting to be held on June 25, 2013 at 9 am, at the Shelby County Road, Bridges, and Engineering Department Office, Conference Room at 6449 Haley Road, Memphis, Tennessee 38134.

**Instruction to Bidders:**

(a) The SEALED BID MUST BE DOWNLOADED FROM THE SHELBY COUNTY GOVERNMENT WEBSITE at www.shelbycountytn.gov and click the link "Department" at the top, then P for the Purchasing Department, then click on the link "Bids."

(b) All bids must be accompanied by a bank cashier's check or bank draft, letter of credit issued by any national bank or certificate of deposit therein, duly assigned, or certified check or approved bid bond for not less than five (5) percent of the amount of the bid. All proposal guarantees shall be made out to the COUNTY OF SHELBY.

(c) All bidders must be licensed by the Tennessee State Board of Licensing

(d) General Contractors Evidence of this license must appear on the title page of the Proposal in the space provided, and also on the exterior of the sealed envelope. The envelope enclosing each bid must show the Contractor's name, license number, expiration date thereof, and license classification of the contractor(s) bidding for the prime contract and for the masonry, electrical, plumbing, heating, ventilation, and air conditioning subcontracts in accordance with TCA 62-6-119. Lacking all of this information, the bid shall be rejected and returned to the bidder unopened.

**EOC Requirements:**

As a condition precedent to bidding, bidders shall have received a current "Equal Opportunity Compliance Eligibility Number" which must be attached to each bid submission. To receive an E.O.C. Eligibility Number, specific information must be

received by the E.O.C. Department at least 48 hours prior to the bid opening. To verify your E.O.C. Number or to receive information for obtaining a number, contact the E.O.C. Department, **901-222-1100.**

Use of Locally Owned Small Business (LOSB) participation on County projects is mandatory.

Bidders are encouraged to contact County-certified LOSB firms from the listing that can be obtained from Shelby County EOC department. Bidders may also provide the names of firms they believe would qualify as LOSB firms, by notifying the E.O.C. Department and filing the required forms at least five (5) working days prior to the bid opening

A Locally Owned Small Business is defined as a sole proprietorship, corporation, partnership, or joint venture located within Shelby County and at least 51% owned, operated and managed by a Shelby County resident and having an average annual sale of $5,000,000.00 or less over the past three (3) years.

**Rejection of Bids:**

The **COUNTY OF SHELBY** reserves the right to reject any and all proposals and to waive technicalities in any proposal.

**BY ORDER OF: CLIFTON DAVIS**

**PURCHASING ADMINISTRATOR**
**SHELBY COUNTY GOVERNMENT**

_____, 2013

# PROPOSAL

TO THE SHELBY COUNTY ADMINISTRATOR OF PURCHASING, SHELBY COUNTY, the site of the work described herein, has become familiar with the local conditions and the character and extent of the work; has carefully examined the Plans, the most current version of the Standard Specifications for Road and Bridge Construction and the Standard Roadway and Structures Drawings adopted by the State of Tennessee, Department of Transportation, with subsequent revisions which are acknowledged to be a part of this Proposal, the Special Provisions, the Proposal Form, the Form of Contract, and the Form of Contract Payment and Performance Bond; and thoroughly understands their stipulations, requirements, and provisions.

The undersigned bidder has determined the quality and quantity of materials required; has investigated the location and determined the sources of supply of the materials required; has investigated labor conditions; and, has arranged for the continuous prosecution of the work herein described.

1. Name of Bidder: _____

   Business Address: _____

   Federal I.D. Number _____

   Phone Number: _____

PROJECT NAME: **FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT**

2. Specifications: The term "plans" for this project refers to the submittal of design furnished by or under the supervision of the SHELBY COUNTY ENGINEER and approved for construction by the Engineer. All construction shall conform to the latest edition of the Shelby County Government General Requirements and Conditions or the special provisions included in the Bid Documents. Please see General Conditions Section 4.01 for additional information.

3. Interested Parties:
   In submitting this proposal, the undersigned Contractor or bidder declares that the only persons or parties interested in the proposal as principals are those named herein; and that the proposal is made without collusion with any person, firm or corporation.

4. Bidder Familiar with the Plans, Specifications and the Site:
   The undersigned further declares that the proposal, plans and specifications, general requirements and conditions, form of contract and contract bond, and special provisions have been carefully examined and the site of the proposed work has been inspected in detail. The undersigned further declares to be familiar with all the local conditions affecting the contract and the detailed requirements of construction, and understands that, in making this proposal, all rights to plead any misunderstanding regarding the same are waived. The Bidder declares that the wording herein, which may contain changes from similar documents from previous projects of Shelby County Government, has been reviewed. The Bidder further declares that the instructions regarding the Shelby County Equal Opportunity Compliance, which is bound with this proposal, have been examined, and agrees that these documents are an integral part of this bid.

5. Bidder to Furnish:
   The undersigned further understands and agrees to furnish and provide all necessary materials, equipment, labor and incidentals required to produce and install the items as listed in this proposal upon acceptance of the proposal by Shelby County Government, except such materials as are to be furnished by the County, in the manner and at the time therein prescribed, and in accordance with the requirements therein set forth.

6. Quantities and Payment:
The undersigned understands that the quantities provided herein by the County are approximate only and that they are subject to increase or decrease; that the undersigned shall take in full payment therefore the amount of the total bid as shown on the bid form, after accounting for any and all bid alternates made and accepted by the County.

7. Unit Prices:
The undersigned further agrees that the unit prices submitted herewith are for the purpose of obtaining a gross sum, and for the use in computing the values of extras and deductions; that if there is any
discrepancy between the gross sum bid and that resulting from the summation of the quantities multiplied by the respective unit prices, the latter shall apply..

8. Alteration of Work:
The undersigned further agrees that if the County decides to extend or shorten the improvement, or otherwise alter the work by extras or deductions, including the elimination of any one or more of the items, by an amount not to exceed twenty-five (25%) percent of the total money value of the original contract price or contract price corrected as provided in the general conditions, the undersigned shall perform the work as altered, increased or decreased at the contract unit prices.

9. Extra Work or Changes:
The undersigned further agrees that the Engineer may at any time during the progress of the work covered by this contract, order other work or materials incidental thereto and that all such work and materials as do not appear in the proposal or contract as a specific item accompanied by a unit price, and which are not included under the bid price for other items in this contract, shall be performed as extra work, and that the undersigned accepts as full compensation for the extra work, payment as provided for in the general conditions.

10. Time of Execution of Contract:
The undersigned further agrees to execute a contract for the contract work and present same to the County within fourteen (14) days after the date of notice of award of the contract.

11. Contract Bond:
The undersigned further agrees that within fourteen (14) days after the date of notice of the award of the contract, the undersigned, along with an appropriate surety shall execute a contract bond satisfactory to and in the form prescribed by the County in the penal sum of the full amount of the contract, guaranteeing the faithful performance of the work in accordance with the terms of the contract.

12. Term:
The undersigned further agrees to begin work on the project not later than ten (10) days after the execution and approval of the contract and contract bond and on receipt of a notice to commence work, unless otherwise provided, and to prosecute the work in such manner and with sufficient materials, equipment and labor as will insure completion of the work within the time limit specified herein, it being understood and agreed that the completion within the time limit is an essential part of the contract. The undersigned agrees to complete the work within **1,095** calendar days, unless additional time shall be granted by the Engineer in accordance with the provisions of the general conditions. In case of failure to complete the work within the time described herein or within such extra time as may have been allowed by extensions, the undersigned agrees that the County shall withhold, from such sums as may be due under the items of his contract, the costs as set forth in Section 8 of the General Conditions, which costs shall be considered and treated not as a penalty but as damages due the County from the undersigned by reason of inconvenience to the public, added cost of engineering, supervision, maintenance of detours, and other items which have caused an expenditure of funds resulting from the failure of the undersigned to complete the work within the time specified in the contract.

13. Clean-Up of Construction Site:

The undersigned further agrees to provide necessary clean up of construction areas, such as collection of debris, construction materials, dirt piles, etc., and any other unsightly and unnecessary items. In the event it is determined by the Engineer that necessary clean up is not being provided by the undersigned, the Engineer shall officially notify the undersigned of the problem. If the undersigned has not begun to provide satisfactory clean-up of the area within fifteen (15) days after the notice, then the Engineer shall take the necessary steps to eliminate the problem including, but not limited to, performing the work with County forces, or contracting with outside forces at the Engineer's option, documenting all expenses incurred performing the work. Prior to releasing any securities covering this contract, all expenses incurred by the County in said clean-up operation shall be paid in full by the undersigned.

14. Forfeiture of Bid Bond:

The undersigned further agrees that in the event of failure to provide required licensure to execute the contract and to present a contract bond to the County within fourteen (14) days as per Paragraph #10 above, the Contractor's bid bond shall be forfeited as damages for project delay and the notice of award shall be automatically cancelled. The contract shall then be awarded to the next lowest qualified bidder.

15. Bid Bond:

Accompanying this proposal shall be a bank cashier's check, certified check, letter of credit issued by any national bank or a duly assigned certificate of deposit, bank draft or approved bid bond, complying with the requirements of the general conditions and/or as shown on the Notice to Contractors, made payable to THE COUNTY OF SHELBY. The amount of the check, draft, letter of credit issued by any national bank or certificate of deposit therein, duly assigned, or approved bid bond shall be no less than five percent (5%) of the total bid. If this proposal is accepted and the undersigned fails to execute a contract and contract bond as required herein, it is hereby agreed that the amount of the check, draft, letter of credit issued by any national bank or certificate of deposit therein, duly assigned, or approved bid bond shall be considered as payment of damages due to delay and other causes suffered by the County because of failure to execute the contract and contract bond. Otherwise, said check, draft, letter of credit, issued by any national bank or certificate of deposit therein, duly assigned or approved bid bond shall be returned to the undersigned.

ATTACH BANK DRAFT, BANK CASHIER'S CHECK, LETTER OF CREDIT

ISSUED BY ANY NATIONAL BANK OR CERTIFICATE OF DEPOSIT THEREIN,

DULY ASSIGNED, APPROVED BID BOND OR CERTIFIED CHECK HERE.

THE UNDERSIGNED SHALL PROVIDE BELOW THE FOLLOWING INFORMATION

TOTAL AMOUNT OF BID BOND $ _____

In the event that one check, draft or approved bid bond or other indemnity as set out above is intended to cover two or more proposals, the amount must be equal to the sum of proposal guarantees required for the projects covered. If this check, draft or approved bid bond, or other indemnity as set out above, is placed in another proposal, the undersigned shall provide below, the name of said proposal.

LOCATION OF BID BOND _____.

16. Schedule of Prices:

The undersigned shall complete and submit a Schedule of Prices covering the work performed under this contract. Unit prices shall be bid for each of the items in the schedule and extensions showing the total contract price shall be provided. Failure to provide said unit prices in their entirety or to provide extensions, including the total contract price, may result in rejection of this proposal as informal or irregular.

17. Joint Ventures:

Each contractor or contracting firm who is a member of a joint venture shall provide a current license number prior to the execution of the final contract. Each contractor or contracting firm who is a member of a joint venture shall sign the contract holding each, both jointly and severally liable to the total project. In a joint venture, each member's classification limits shall be equal to or greater than those classifications' proportionate share of the total cost of the project. A joint venture shall allow the members to combine their license limits in order to undertake a larger project than each would normally be able to perform with their individual license. The classification of each member in the joint venture shall be a necessary and integral part of the total project.

18. Acceptance or Rejection of Bid(s):

The Shelby County Government reserves the right to reject any and all bids. The Shelby County Government also reserves the right to select the lowest responsible bidder for any one project to the rejection of all other bidders or award any or all projects to the lowest responsible bidder or bidders.

19. Failure to Complete the Work on Time:

For each calendar day over and above the stipulated completion date on which any portion of the Work remains incomplete, a sum of money shall be deducted from monies due the Contractor, not as a penalty but as liquidated damages. The amounts to be deducted shall be as set forth below.

| **Original contract amount** | **Daily Charge** |
|---|---|
| $0 - $500,000.00 | $170.00 |
| >500,000 – 1,000,000 | $420.00 |
| >1,000,000 – 2,000,000 | $740.00 |
| >2,000,000 – 10,000,000 | $1,000.00 |
| >10,000,000 – 20,000,000 | $1,600.00 |
| >20,000,000 | $1,800.00 |

Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Department of any of its rights under the Contract.

# BID FORM

**FITE ROAD** **6/17/2013**

**ROADWAY ITEMS**

| ITEM NO. | DESCRIPTION | UNIT | QTY | UNIT COST | TOTAL |
|---|---|---|---|---|---|
| 105-01 | CONSTRUCTION STAKES, LINES AND GRADES | L.S. | 1 | | |
| 201-01 | CLEARING AND GRUBBING | L.S. | 1 | | |
| 202-01 | REMOVAL OF STRUCTURES AND OBSTRUCTIONS | L.S. | 1 | | |
| 203-03.10 | SELECT GRANULAR MATERIAL | TON | 7,000 | | |
| 203-04 | PLACING AND SPREADING TOPSOIL | C.Y. | 5,000 | | |
| 203-05 | UNDERCUTTING | C.Y. | 20,000 | | |
| 203-06 | WATER | M.G. | 2,500 | | |
| 203-10 | EMBANKMENT (COMPACTED IN PLACE) | C.Y. | 340,706 | | |
| | | | | | |
| 204-08 | FOUNDATION FILL MATERIAL | C.Y. | 388 | | |
| 204-08.01 | BACK FILL MATERIAL (FLOWABLE FILL) | C.Y. | 200 | | |
| | | | | | |
| 209-02.03 | 8" TEMPORARY SLOPE DRAIN | L.F. | 1,700 | | |
| 209-02.05 | 12" TEMPORARY SLOPE DRAIN | L.F. | 500 | | |
| 209-05 | SEDIMENT REMOVAL | C.Y. | 1,000 | | |
| 209-08.02 | TEMPORARY SILT FENCE (WITH BACKING) | L.F. | 15,723 | | |
| 209-08.03 | TEMPORARY SILT FENCE (WITHOUT BACKING) | L.F. | 11,495 | | |
| 209-08.07 | ROCK CHECK DAM PER | EACH | 24 | | |
| 209-08.08 | ENHANCED ROCK CHECK DAM | EACH | 52 | | |
| 209-09.01 | SANDBAGS | BAG | 13,000 | | |
| 209-09.03 | SEDIMENT FILTER BAG (15' X 15') | EACH | 25 | | |
| 209-10.20 | TEMPORARY SEDIMENT TRAP | C.Y. | 300 | | |
| 209-20.03 | POLYETHYLENE SHEETING (6 MIL. MINIMUM) | S.Y. | 5,000 | | |
| 209-40.30 | CATCH BASIN PROTECTION (TYPE A) | EACH | 2 | | |
| 209-40.33 | CATCH BASIN PROTECTION (TYPE D) | EACH | 2 | | |
| 209-40.34 | CATCH BASIN PROTECTION (TYPE E) | EACH | 4 | | |
| 209-40.41 | CATCH BASIN FILTER ASSEMBLY (TYPE 1) | EACH | 2 | | |
| 209-65.03 | TEMPORARY DIVERSION CHANNEL | L.F. | 950 | | |
| | | | | | |
| 303-01 | MINERAL AGGREGATE, TYPE A BASE, GRADING D | TON | 41,643 | | |
| 303-01.01 | GRANULAR BACKFILL (ROADWAY) | TON | 4,121 | | |
| 303-10.01 | MINERAL AGGREGATE (SIZE 57) | TON | 900 | | |
| | | | | | |
| 307-01.01 | ASPHALT CONCRETE MIX (PG64-22) (BPMB-HM) GRADING A | TON | 5,212 | | |
| 307-01.08 | ASPHALT CONCRETE MIX (PG64-22) (BPMB-HM) GRADING B-M2 | TON | 5,413 | | |
| 307-02.01 | ASPHALT CONCRETE MIX (PG70-22) (BPMB-HM) GRADING A | TON | 347 | | |
| 307-02.02 | ASPHALT CEMENT (PG70-22) (BPMB-HM) GRADING A-S | TON | 9 | | |
| 307-02.03 | AGGREGATE (BPMB-HM) GRADING A-S | TON | 268 | | |
| 307-02.08 | ASPHALT CONCRETE MIX (PG70-22) (BPMB-HM) GRADING B-M2 | TON | 341 | | |
| | | | | | |
| 402-01 | BITUMINOUS MATERIAL FOR PRIME COAT (PC) | TON | 68 | | |
| 403-01 | BITUMINOUS MATERIAL FOR TACK COAT (TC) | TON | 29 | | |
| | | | | | |
| 407-02.13 | REMOVAL & DISPOSAL OF EXISTING ASPHALT PAVEMENT | S.Y. | 345 | | |
| | | | | | |
| 411-01.07 | ACS MIX(PG64-22) GRADING E SHOULDER | TON | 488 | | |
| 411-01.10 | ACS MIX(PG64-22) GRADING D | TON | 2,748 | | |
| 411-02.10 | ACS MIX(PG70-22) GRADING D | TON | 167 | | |
| | | | | | |
| 415-01.02 | COLD PLANING BITUMINOUS PAVEMENT | S.Y. | 500 | | |
| | | | | | |
| 604-01.01 | CLASS A CONCRETE (ROADWAY) | C.Y. | 347 | | |
| 604-01.02 | STEEL BAR REINFORCEMENT (ROADWAY) | LB. | 55,830 | | |
| 604-02.01 | CLASS A CONCRETE (BOX BRIDGES) | C.Y. | 755 | | |
| 604-02.02 | STEEL BAR REINFORCEMENT (BOX BRIDGES) | LB. | 117,790 | | |
| 604-07.01 | RETAINING WALL (WALL NO. 1) | S.F. | 4,421 | | |
| 604-07.02 | RETAINING WALL (WALL NO. 2) | S.F. | 12,722 | | |
| 604-07.03 | RETAINING WALL (WALL NO. 3) | S.F. | 5,896 | | |
| 604-09.10 | CLASS A CONCRETE (GENERAL USE) | C.Y. | 100 | | |

| ITEM NO. | DESCRIPTION | UNIT | QTY | UNIT COST | TOTAL |
|---|---|---|---|---|---|
| | | | | | |
| 606-24.10 | SHEET PILES | S.F. | 1,800 | | |
| 606-24.12 | TEMPORARY SHEET PILES | S.F. | 3,750 | | |
| | | | | | |
| 607-03.02 | 18" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 449 | | |
| 607-05.02 | 24" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 324 | | |
| 607-05.03 | 24" CONCRETE PIPE CULVERT (CLASS IV) | L.F. | 244 | | |
| 607-06.02 | 30" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 68 | | |
| 607-07.02 | 36" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 69 | | |
| 607-08.02 | 42" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 67 | | |
| 607-09.02 | 48" CONCRETE PIPE CULVERT (CLASS III) | L.F. | 50 | | |
| 607-39.02 | 18" PIPE CULVERT (SIDE DRAIN) | L.F. | 92 | | |
| 607-39.02 | 24" PIPE CULVERT (SIDE DRAIN) | L.F. | 70 | | |
| 607-57.04 | REINFORCED CONCRETE PIPE ARCH (44"X27") | L.F. | 41 | | |
| | | | | | |
| 610-07.03 | 18" PIPE DRAIN (BRIDGE DRAIN) | L.F. | 295 | | |
| | | | | | |
| 611-01.20 | ADJUSTMENT OF EXISTING MANHOLE | EACH | 8 | | |
| 611-02.10 | JUNCTION BOX, TYPE 1 | EACH | 1 | | |
| 611-02.13 | JUNCTION BOX, TYPE 4 | EACH | 1 | | |
| | | | | | |
| 611-07.01 | CLASS A CONCRETE (PIPE ENDWALLS) | C.Y. | 36.4 | | |
| 611-07.02 | STEEL BAR REINFORCEMENT (PIPE ENDWALLS) | LB. | 3,091 | | |
| 611-07.03 | STRUCTURAL STEEL (PIPE ENDWALLS) | LB. | 1,837 | | |
| 611-14.02 | CATCH BASINS, TYPE 14, > 4' - 8' DEPTH | EACH | 4 | | |
| 611-42.01 | CATCH BASINS, TYPE 42, 0' - 4' DEPTH | EACH | 1 | | |
| 611-42.02 | CATCH BASINS, TYPE 42, >4' - 8' DEPTH | EACH | 1 | | |
| | | | | | |
| 620-01 | ALUMINUM RAILING (RETAINING WALLS) | L.F. | 230 | | |
| | | | | | |
| 621-01.10 | TEMPORARY STRUCTURE (3-84"PIPES) | L.S. | 1 | | |
| 621-03.02 | 18" TEMPORARY DRAINAGE PIPE | L.F. | 30 | | |
| 621-03.03 | 24" TEMPORARY DRAINAGE PIPE | L.F. | 140 | | |
| 621-03.04 | 30" TEMPORARY DRAINAGE PIPE | L.F. | 100 | | |
| 621-03.06 | 42" TEMPORARY DRAINAGE PIPE | L.F. | 30 | | |
| | | | | | |
| 702-03 | CONCRETE COMBINED CURB & GUTTER | C.Y. | 7 | | |
| | | | | | |
| 703-01 | CEMENT CONCRETE DITCH PAVING | C.Y. | 70 | | |
| | | | | | |
| 705-01.01 | GUARDRAIL AT BRIDGE ENDS | L.F. | 108 | | |
| 705-02.02 | SINGLE GUARDRAIL (TYPE 2) | L.F. | 4,514 | | |
| 705-04.03 | GUARDRAIL TERMINAL (TYPE 13) | EACH | 1 | | |
| 705-04.04 | GUARDRAIL TERMINAL (TYPE 21) | EACH | 5 | | |
| 705-04.07 | TAN ENERGY ABSORBING TERM (NCHRP 350, TL3) | EACH | 10 | | |
| 705-04.09 | EARTH PAD FOR TYPE 38 GR END TREATMENT | EACH | 10 | | |
| 705-08.51 | PORTABLE IMPACT ATTENUATOR NCHRP350 TL-3 | EACH | 8 | | |
| | | | | | |
| 709-01.01 | RUBBLE STONE RIP-RAP | C.Y. | 11 | | |
| 709-05.05 | MACHINED RIP-RAP (CLASS A-3) | TON | 5,705 | | |
| 709-05.06 | MACHINED RIP-RAP (CLASS A-1) | TON | 3,224 | | |
| 709-05.08 | MACHINED RIP-RAP (CLASS B) | TON | 2,120 | | |
| 709-05.09 | MACHINED RIP-RAP (CLASS C) | TON | 2,555 | | |
| | | | | | |
| 710-02 | AGGREGATE UNDERDRAINS (WITH PIPE) | L.F. | 1,100 | | |
| 710-05 | LATERAL UNDERDRAIN | L.F. | 120 | | |
| 710-06.13 | LATERAL UNDERDRAIN ENDWALL (4:1) | EACH | 5 | | |
| | | | | | |
| 712-01 | TRAFFIC CONTROL | L.S. | 1 | | |
| 712-02.02 | INTERCONNECTED PORTABLE BARRIER RAIL | L.F. | 1,360 | | |
| 712-04.01 | FLEXIBLE DRUMS (CHANNELIZING) | EACH | 400 | | |

| ITEM NO. | DESCRIPTION | UNIT | QTY | UNIT COST | TOTAL |
|---|---|---|---|---|---|
| 712-05.03 | WARNING LIGHTS (TYPE C) | EACH | 134 | | |
| 712-06 | SIGNS (CONSTRUCTION) | S.F. | 1,590 | | |
| 712-07.03 | TEMPORARY BARRICADES (TYPE III) | L.F. | 220 | | |
| 712-08.03 | ARROW BOARD (TYPE C) | EACH | 2 | | |
| | | | | | |
| 713-11.01 | "U" SECTION STEEL POSTS | LB. | 1,400 | | |
| 713-11.02 | PERFORATED/KNOCKOUT SQUARE TUBE POST | LB. | 690 | | |
| 713-13.02 | FLAT SHEET ALUMINUM SIGNS (0.080" THICK) | S.F. | 220 | | |
| 713-13.03 | FLAT SHEET ALUMINUM SIGNS (0.100" THICK) | S.F. | 225 | | |
| 713-16.07 | END OF ROADWAY SIGN AND SUPPORT | EACH | 4 | | |
| 713-16.20 | SIGN (R3-5R RIGHT TURN ONLY) | EACH | 3 | | |
| 713-16.21 | SIGN (R3-5L LEFT TURN ONLY) | EACH | 3 | | |
| 713-16.22 | SIGN (D3-3 HWY 51) | EACH | 1 | | |
| 713-16.23 | SIGN (D3-3 FITE ROAD) | EACH | 2 | | |
| 713-16.24 | SIGN (R10-10L LEFT TURN SIGNAL) | EACH | 1 | | |
| | | | | | |
| 716-02.04 | PLASTIC PAVEMENT MARKING(CHANNELIZATION STRIPING) | S.Y. | 93 | | |
| 716-02.05 | PLASTIC PAVEMENT MARKING (STOP LINE) | L.F. | 305 | | |
| 716-02.06 | PLASTIC PAVEMENT MARKING (TURN LANE ARROW) | EACH | 20 | | |
| 716-02.08 | PLASTIC PAVEMENT MARKING (8" DOTTED LINE) | L.F. | 65 | | |
| 716-02.10 | PLASTIC PAVEMENT MARKING (6" LINE) | L.M. | 2.4 | | |
| 716-02.12 | PLASTIC PAVEMENT MARKING (8" LINE) | L.M. | 0.2 | | |
| 716-03.01 | PLASTIC WORD PAVEMENT MARKING (ONLY) | EACH | 8 | | |
| 716-05.01 | PAINTED PAVEMENT MARKING (4" LINE) | L.M. | 4 | | |
| 716-05.02 | PAINTED PAVEMENT MARKING (8" LINE) | L.F. | 6,320 | | |
| 716-05.20 | PAINTED PAVEMENT MARKING (6" LINE) | L.F. | 423 | | |
| 716-06.01 | REMOVAL OF PAVEMENT MARKING (LINE) | L.F. | 8,239 | | |
| 716-08.02 | REMOVAL OF PAVEMENT MARKING (8" BARRIER LINE) | L.F. | 5,888 | | |
| 716-12.01 | ENHANCED FLATLINE THERMO PVMT MRKNG (4IN LINE) | L.M. | 1.3 | | |
| 716-12.04 | ENHANCED FLATLINE THERMO PVMT MRKNG (4IN DOTTED LINE) | L.F. | 45 | | |
| 716-12.05 | ENHANCED FLATLINE THERMO PVMT MRKNG (6IN DOTTED LINE) | L.F. | 127 | | |
| 716-13.06 | SPRAY THERMO PVMT. MRKNG (40 mil) (4IN LINE) | L.M. | 4.7 | | |
| | | | | | |
| 717-01 | MOBILIZATION | L.S. | 1 | | |
| | | | | | |
| 730-02.09 | SIGNAL HEAD ASSEMBLY (130 WITH BACKPLATE) | EACH | 6 | | |
| 730-02.30 | SIGNAL HEAD ASSEMBLY (130A3 WITH BACKPLATE) | EACH | 1 | | |
| 730-03.21 | INSTALL PULL BOX (TYPE B) | EACH | 6 | | |
| 730-05.01 | ELECTRICAL SERVICE CONNECTION | ALLOW. | 1 | $10,000.00 | $10,000.00 |
| 730-08.03 | SIGNAL CABLE - 7 CONDUCTOR | L.F. | 590 | | |
| 730-08.05 | SIGNAL CABLE - 12 CONDUCTOR | L.F. | 280 | | |
| 730-08.07 | SIGNAL CABLE - 16 CONDUCTOR | L.F. | 230 | | |
| 730-09.01 | SPAN WIRE ASSEMBLY(20,800 LBS.MIN.BRK STRENGTH) | L.F. | 508 | | |
| 730-10.01 | TETHER WIRE ASSEMBLY - 1/4" DIAMETER | L.F. | 508 | | |
| 730-12.01 | CONDUIT 1" DIAMETER (PVC) | L.F. | 900 | | |
| 730-12.02 | CONDUIT 2" DIAMETER (PVC) | L.F. | 40 | | |
| 730-12.03 | CONDUIT 3" DIAMETER (PVC) | L.F. | 30 | | |
| 730-12.13 | CONDUIT 2" DIAMETER (JACK AND BORE) | L.F. | 90 | | |
| 730-13.01 | VEHICLE LOOP DETECTOR (SHELF MOUNT) | EACH | 7 | | |
| 730-13.06 | VEHICLE DECTOR (OPTICALLY ACTIVATED PRIORITY CONTROL) | EACH | 1 | | |
| 730-14.01 | SHIELDED DETECTOR CABLE | L.F. | 1,550 | | |
| 730-14.02 | SAW SLOT | L.F. | 920 | | |
| 730-14.03 | LOOP WIRE | L.F. | 2,500 | | |
| 730-15.07 | CABINET EIGHT PHASE BASE MOUNTED | EACH | 1 | | |
| 730-16.02 | EIGHT PHASE ACTUATED CONTROLLER | EACH | 1 | | |
| 730-23.02 | STEEL STRAIN POLE (SIGNAL SUPPORT POLES #1-4) | EACH | 4 | | |
| 730-23.03 | STEEL STRAIN POLE (OVERHEAD SIGN POLES - 30) | EACH | 2 | | |
| | | | | | |
| 740-10.03 | GEOTEXTILE (TYPE III)(EROSION CONTROL) | S.Y. | 9,746 | | |
| 740-10.04 | GEOTEXTILE (TYPE IV) (STABILIZATION) | S.Y. | 10,000 | | |
| 740-11.02 | TEMPORARY SEDIMENT TUBE (12 INCH) | L.F. | 20,550 | | |

| ITEM NO. | DESCRIPTION | UNIT | QTY | UNIT COST | TOTAL |
|---|---|---|---|---|---|
| 740-11.04 | TEMPORARY SEDIMENT TUBE (20IN) | L.F. | 1,000 | | |
| | | | | | |
| 797-05.30 | 30 IN DUCTILE IRON PIPE GRAVITY SEWER (6FT-12FT) DEPTH | L.F. | 360 | | |
| 797-11.38 | BY-PASS PUMPING | L.S. | 1 | | |
| 797-06.97 | OPEN CUT 42 IN STEEL CASING PIPE | L.F. | 360 | | |
| 797-07.27 | 72 IN MANHOLE 10FT-12FT DEPTH | EACH | 1 | | |
| 797-07.29 | 72 IN MANHOLE 14FT-16FT DEPTH | EACH | 1 | | |
| | | | | | |
| 801-01 | SEEDING (WITH MULCH) | UNIT | 219 | | |
| 801-01.05 | SEEDING (SPECIAL MIXTURE - SHADE MIX) | UNIT | 31 | | |
| 801-01.06 | SEEDING (SPECIAL MIXTURE - SUN MIX) | UNIT | 31 | | |
| 801-01.07 | TEMPORARY SEEDING (WITH MULCH) | UNIT | 35 | | |
| 801-01.10 | SEEDING (WITH BONDED FIBER MATRIX) | UNIT | 61 | | |
| 801-01.13 | BONDED FIBER MATRIX HYDROMULCH (WO/SEED) | UNIT | 100 | | |
| 801-01.34 | GRASS SEED MIX (RIPZN/FLPL) | UNIT | 81 | | |
| 801-02 | SEEDING (WITHOUT MULCH) | UNIT | 622 | | |
| 801-02.08 | TEMPORARY SEEDING (WITHOUT MULCH) | UNIT | 35 | | |
| 801-03 | WATER (SEEDING & SODDING) | M.G. | 50 | | |
| | | | | | |
| 802-12.07 | BETULA NIGRA (RIVER BIRCH SEEDLNG B.R.) | EACH | 89 | | |
| 802-12.33 | QUERCUS MICHAUXII (SWMP CHSTNT OAK SEEDLNG B.R.) | EACH | 89 | | |
| 802-12.35 | QUERCUS NIGRA (WATER OAK SEEDLNG B.R.) | EACH | 131 | | |
| 802-12.36 | QUERCUS NUTTALLII (NUTTALL OAK SEEDLNG B.R.) | EACH | 131 | | |
| 802-12.42 | TAXODIUM DISTICHUM (BALD CYPRESS SEEDLNG B.R.) | EACH | 89 | | |
| 802-12.59 | PRUNUS AMERICANA (AMERICAN PLUM SEEDLING B.R.) | EACH | 131 | | |
| | | | | | |
| 803-01 | SODDING (NEW SOD) | S.Y. | 25,010 | | |
| | | | | | |
| 805-01.03 | TURF REINFORCEMENT MAT (CLASS III) | S.Y. | 6,680 | | |
| 805-12.02 | EROSION CONTROL BLANKET (TYPE II) | S.Y. | 76,566 | | |
| 805-12.03 | EROSION CONTROL BLANKET (TYPE III) | S.Y. | 3,733 | | |
| | | | | | |
| 920-10 | ICRR FLAGMAN ALLOWANCE | ALLOW. | 1 | $300,000.00 | $300,000.00 |
| **SUBTOTAL COSTS (FOR ROADWAY ITEMS)** | | | | | |

| ITEM NO. | DESCRIPTION | UNIT | QTY | UNIT COST | TOTAL |
|---|---|---|---|---|---|
| **BRIDGE ITEMS** | | | | | |
| 204-02.01 | DRY EXCAVATION (BRIDGES) | C.Y. | 418 | | |
| | | | | | |
| 303-01.02 | GRANULAR BACKFILL (BRIDGES) | TON | 44 | | |
| | | | | | |
| 604-02.03 | EPOXY COATED REINFORCING STEEL | LB. | 85,961 | | |
| 604-03.01 | CLASS A CONCRETE (BRIDGES) | C.Y. | 298 | | |
| 604-03.02 | STEEL BAR REINFORCEMENT (BRIDGES) | LB. | 58,797 | | |
| 604-03.04 | PAVEMENT @ BRIDGE ENDS | S.Y. | 315 | | |
| 604-03.09 | CLASS D CONCRETE (BRIDGE DECK) | C.Y. | 320 | | |
| 604-04.01 | APPLIED TEXTURE FINISH (NEW STRUCTURES) | S.Y. | 1,022 | | |
| 604-05.31 | BRIDGE DECK GROOVING (MECHANICAL) | S.Y. | 1,075 | | |
| | | | | | |
| 606-09.01 | TEST PILES (PRECAST CONCRETE, SIZE 1) | L.F. | 305 | | |
| 606-09.02 | LOADING TEST (PRECAST CONCRETE, SIZE 1) | EACH | 1 | | |
| 606-09.03 | PRECAST CONCRETE PILES (SIZE 1) | L.F. | 3,775 | | |
| 606-12.01 | PILE ANCHORAGE SYSTEM (SEISMIC) | EACH | 66 | | |
| | | | | | |
| 615-01.03 | PRESTRESSED CONCRETE I-BEAM (TYPE III) | L.F. | 933 | | |
| | | | | | |
| 620-05 | CONCRETE PARAPET(MODIFIED PARAPET) | L.F. | 388 | | |
| | | | | | |
| 709-05.05 | MACHINED RIP-RAP (CLASS A-3) | TON | 286 | | |
| | | | | | |
| 710-04 | FILTER CLOTH UNDERDRAIN (WITH PIPE) | L.F. | 240 | | |
| 710-09.01 | 6" PERFORATED PIPE WITH VERTICAL DRAIN SYSTEM | L.F. | 180 | | |
| 710-09.02 | 6" PIPE UNDERDRAIN | L.F. | 210 | | |
| | | | | | |
| **SUBTOTAL COSTS (FOR BRIDGE ITEMS)** | | | | | |
| | | | | | |
| **SUBTOTAL COSTS (ROADWAY ITEMS)** | | | | | |
| **SUBTOTAL COSTS (BRIDGE ITEMS)** | | | | | |
| **TOTAL COSTS** | | | | | |

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:

1. The contract between the parties consists of the following " Contract Documents" all of which constitute one instrument:
   (a.) The Instruction to Bidders
   (b.) The Proposal
   (c.) All conditions and terms of this Contract form
   (d.) The Contract Payment & Performance Bond and/or Letter of Credit, where applicable
   (e.) The most current version of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction (herein referred to as TDOT Standard Specifications)
   (f.) Supplemental Specifications
   (g.) Revisions and Additions
   (h.) Special Provisions
   (i.) Addenda
   (j.) The most current version of the TDOT Standard Drawings
   (k.) The Contract Plans,
   (l.) The Work Order
   (m.)Construction Changes
   (n.) Supplemental Agreements

   All of the provisions contained in the listed Contract Documents are incorporated herein by reference with the same force and effect as though set out in full.

2. The Contract Documents are intended to be complementary and to describe and provide for a complete work. Requirements in one of these are as binding as if occurring in all of them. In case of discrepancy, Supplemental Specifications will govern over TDOT Standard Specifications; the TDOT Standard Specifications will govern over the local governmental standard specifications; the Contract Plans will govern over both Supplemental and Standard Specifications, and Special Provisions will govern over both Plans and Specifications. In interpreting Plans, calculated dimensions will govern over scaled dimensions. Contract Plans, typical cross sections and approved working drawings will govern over Standard Drawings.

3. The Contractor agrees to furnish all materials, equipment, machinery, tools and labor and to perform the work required to complete the project in a thorough and workmanlike manner, to the satisfaction of the appropriate official of the County.

4. The County agrees to pay to the Contractor such unit prices for the work actually done as are set out in the accompanying proposal, in the manner provided for in TDOT Standard Specifications, Supplemental Specifications and applicable Special Provisions.

5. The Contractor shall, at all times, observe and comply with all applicable federal, state and local laws, ordinances and regulations and shall indemnify and hold harmless the County and all of its officers, agents and servants against any claim of liability or assessment of fines or penalties arising from or based upon the Contractor's and/or its employees' violations of any such law, ordinance or regulation. The Contractor shall maintain documentation for all charges against the County under this Contract. The books, records and documents of the Contractor insofar as they relate to the work performed or money received under this contract shall be maintained for a period of three (3) full years from the date of the final payment and shall be subject to audit at any reasonable time and upon reasonable notice by the County, the State, the Comptroller of the Treasury, the Tennessee Department of Transportation, or their duly appointed representatives.

6. The Contractor shall be responsible for any and all injury or damage to persons or to property arising from the prosecution of the work and due to any act, omission, neglect or misconduct in its manner or method of prosecuting the work or due to its non-execution of the work or due to defective work or materials. The Contractor shall provide proof of adequate and appropriate

general liability insurance providing liability coverage in an amount not less that $1 million dollars per occurrence and $300,000 per claimant, naming the County as an additional insured.

7. The Contractor shall indemnify and hold harmless the County and all of its officers, agents and employees from all suits, actions or claims of any character arising from the Contractor's acts or omissions in the prosecution of the work, use of unacceptable materials in constructing the work, infringement of patent, trade mark or copyright, or claims for Workers' Compensation. If any such suit, action or claim is filed, the County may retain from the monies due to the Contractor under this Contract a sum deemed sufficient by the County to protect the County from loss therefrom. Upon resolution of the suit, action or claim, any remaining retained funds will be released.

8. Upon execution of this Contract, the Contractor shall be prepared to begin the work to be performed under the Contract, but will not proceed until it has received official "Notice to Proceed". This official notice will stipulate the date upon which it is expected that the Contractor will begin his work, and from which date the working days tabulated against its time limit will begin. All other requirements in regard to the beginning of construction set forth in the Proposal and Special Provisions will date from the official notice.

IF AN INDIVIDUAL:

SIGNATURE OF BIDDER: _____

BUSINESS ADDRESS: _____

---

IF A CO-PARTNERSHIP:

FIRM NAME: _____

BY: _____

BUSINESS ADDRESS: _____

NAME AND ADDRESS
OF ALL MEMBERS OF
FIRM _____

_____

_____

_____

---

IF A CORPORATION:

CORPORATE NAME _____

SIGNED BY: _____
President

BUSINESS ADDRESS: _____

_____

(Corporate Seal)

NAME OF OFFICERS _____
President

_____
Secretary

_____
Treasurer

ATTEST: _____
Secretary

**ATTACHMENT**

Proposal Response Sheet

## FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT

Name of firm: _____
Firm's Website: _____

Mailing Address:
_____
_____
Phone: _____
Fax: _____

Remit Address:
_____
_____
Phone: _____
Fax: _____
Payment Terms: _____

Authorized Representative:_____ Print: _____
Signature (Person Authorized to negotiate with the County on behalf of the organization/firm)
Email address: _____

Authorized Representative:_____ Print: _____
Signature (Person Authorized to negotiate with the County on behalf of the organization/firm)
Email address: _____

The signature(s) above certifies that:

i. The Proposer's signatory is an agent authorized to submit proposals on behalf of the organization/firm;
ii. All declarations in the proposal and attachments are true to the best of reasonable knowledge;
iii. All aspects of the proposal, including cost, have been determined independently, without consultation with any other prospective Proposer or competitor for the purpose of restricting competition;
iv. The offer made in the proposal is firm and binding for 90 days after receipt of the proposal by the County; and
v. All aspects of this SEALED BID and the proposal submitted are binding for the duration if this proposal is selected and a contract awarded.

EOC#: _____ (If you do not have a valid EOC#, please contact the EOC office at 901-222-1100)

_____ Check here if you qualify as MBE_____, or WBE _____
(Minority or Woman owned Business Enterprise) If so, please indicate the classification below:
African-American Hispanic American Asian American Native American Other _____

_____ Check here if you qualify as an LOSB (Locally Owned Small Business)

_____ Check here if you qualify as an DBE (Disadvantaged Business Enterprise)

**This page MUST be printed on your company letterhead or stationery.**

**CONTRACT**
**by and between**
**SHELBY COUNTY GOVERNMENT**
**And**

**FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT**

This contract (the "Contract") entered into this _____ day of _____, 2013, and between SHELBY COUNTY GOVERNMENT, hereinafter referred to as "COUNTY" and _____., hereinafter referred to as "CONTRACTOR".

**WITNESSETH**

**WHEREAS,** the COUNTY has the need for resurfacing improvements; and

**WHEREAS**, the COUNTY issued a Sealed Bid ("SBI") Number SBI-000222, Fite Road and Bridge Improvements Project and CONTRACTOR responded to said Sealed Bid by the required deadline of _____; and

**WHEREAS**, the CONTRACTOR has the knowledge and expertise to provide such products and services; and

**WHEREAS**, the COUNTY awarded the contract to CONTRACTOR on or about _____, 2013; and

**WHEREAS**, the parties are desirous of entering into a new contract setting forth the terms and conditions under which the CONTRACTOR will provide said services.

**NOW THEREFORE**, for and in consideration of mutual promises and covenants herein contained, the parties hereto agree as follows:

I. **SCOPE OF WORK**

1. The CONTRACTOR shall provide the services as outlined within the County's Sealed Bid Number SBI-000222 Fite Road and Bridge Improvements Project and CONTRACTOR'S response thereto which are attached hereto as Exhibits "A" and incorporated herein by reference as if stated verbatim (the "Services").

II. **TERM AND COMPENSATION**

1. The term of this Contract (the "Term") will commence upon execution of this Contract and continue for **1,095 days** or until project completion, but in no event shall this Contract extend beyond ninety days after completion and acceptance of the construction.

2. The COUNTY agrees to compensate the CONTRACTOR for the provision of the Services the sum total amount not to exceed $_____ Dollars ("the Fee") during the term of this Contract which shall include all reimbursable expenses. In any event, the sum total of the total for the services provided by consultant shall not to exceed $_____ during any term of this Contract which shall include all reimbursable expenses. It is the duty of the CONTRACTOR to monitor such fees, costs, and expenses to ensure the CONTRACTOR does not exceed this total dollar amount. The COUNTY expressly reserves the right to deny payment of any amount billed in excess of $_____.

3. The CONTRACTOR shall submit invoices to the COUNTY on a monthly basis. Invoices shall be submitted in duplicate to the address set forth in the NOTICE section of this Contract to the attention of Mr. Darren Sanders, P.E., Administrator of Roads, Bridges, and Engineering. The COUNTY shall pay such invoices within sixty (60) days of its receipt and approval of said invoices. The COUNTY is not obligated to pay, and will withhold from payment, any amounts the COUNTY has in dispute with the CONTRACTOR based on CONTRACTOR'S non-performance or negligent performance of any of the Services under this Contract. In the event any invoice contains errors, the CONTRACTOR shall correct same and resubmit the invoice to the COUNTY. The COUNTY will have sixty (60) days from the date of the receipt of the corrected invoice to remit payment for same.

4. The contractor shall give a Performance Bond and Labor and Material Bond in addition to the required insurance set forth below. The Performance Bond and Labor and Material Bond shall each be equal to 100% of the amount of the amount of the Contract, with surety to be approved by the COUNTY, conditioned upon the full and faithful performance of all the terms and conditions of the Contract with special reference to paying in full in lawful money of the United States, all just and valid claims for material and labor entered into for the said work covered by this Contract. That further, this Contract shall not take effect until these Bonds have been executed and approved by the County.

## III. **GENERAL CONDITIONS**

The parties further agree as follows:

1. CONTROL

All Services by the CONTRACTOR will be performed in a manner satisfactory to the COUNTY, and in accordance with the generally accepted business practices and procedures of the COUNTY.

2. CONTRACTOR'S PERSONNEL

The CONTRACTOR certifies that it presently has adequate qualified personnel to perform all Services required under this Contract. All work performed during the Term of this Contract will be supervised by the CONTRACTOR. The CONTRACTOR further certifies that all of its employees assigned to serve the COUNTY have such knowledge and experience as required to perform the duties assigned to them. Any employee of the CONTRACTOR who, in the opinion of the COUNTY, is incompetent, or whose conduct becomes detrimental to the work, shall immediately be removed from association with the Services under this Contract.

3. INDEPENDENT STATUS

a. Nothing in this Contract shall be deemed to represent that the CONTRACTOR, or any of the CONTRACTOR's employees or agents, are the agents, representatives, or employees of the COUNTY. The CONTRACTOR will be an independent CONTRACTOR over the details and means for performing the Services under

this Contract. Anything in this Contract which may appear to give the COUNTY the right to direct the CONTRACTOR as to the details of the performance of the Services under this Contract or to exercise a measure of control over the CONTRACTOR is solely for purposes of compliance with local, state and federal regulations and means that the CONTRACTOR will follow the desires of the COUNTY only as to the intended results of the scope of this Contract.

b. It is further expressly agreed and understood by CONTRACTOR that neither it nor its employees or agents are entitled to any benefits which normally accrue to employees of the COUNTY; that CONTRACTOR has been retained by the COUNTY to perform the Services specified herein (not hired) and that the remuneration specified herein is considered fees for the Services performed (not wages) and that invoices submitted to the COUNTY by CONTRACTOR for the Services performed shall be on the CONTRACTOR's letterhead.

4. REPORTS

CONTRACTOR shall prepare and submit quarterly reports of its activities, funded under this Contract, to the originating department and the Contract Administration Department of the COUNTY. The reports shall include an itemization of the use of COUNTY's funds, pertinent information pursuant to the applicable Living Wage Ordinance, and shall be inclusive of specific Services delivered. Any such reports provided to the COUNTY shall be prepared with the understanding that the COUNTY may make such reports available to the public. The quarterly reports and all books of account and financial records that are specific to the work performed in accordance with this Contract may be subject to audit by the Director of the Division of Administration and Finance of the COUNTY. The COUNTY shall have the right to withhold future disbursement of funds under this Contract and any future Contracts until this provision has been met.

5. TERMINATION OR ABANDONMENT

a. It shall be cause for the immediate termination of this Contract if, after its execution, the COUNTY determines that:

i) Either the CONTRACTOR or any of its principals, partners or corporate officers, if a corporation, including the corporation itself, has pled nolo contendere, or has pled or been found guilty of a criminal violation, whether state or federal, involving, but not limited to, governmental sales or purchases, including but not limited to the rigging of bids, price fixing, or any other collusive and illegal activity pertaining to bidding and governmental contracting; or

ii) CONTRACTOR has subcontracted, assigned, delegated, transferred its rights, obligations or interests under this Contract without the COUNTY's consent or approval; or

iii) CONTRACTOR has filed bankruptcy, become insolvent or made an assignment for the benefit of creditors, or a receiver, or similar officer has been appointed to take charge of all or part of CONTRACTOR assets.

b. The COUNTY may terminate the Contract upon five (5) days written notice by the COUNTY or its authorized agent to the CONTRACTOR for CONTRACTOR's failure to provide the Services specified under this Contract.

c. This Contract may be terminated by either party by giving thirty (30) days written notice to the other, before the effective date of termination (the "Termination Date"). In the event of such termination, the CONTRACTOR shall be paid for all Services rendered prior to the Termination Date, provided the CONTRACTOR shall have delivered to COUNTY such statements, accounts, reports and other materials as required under this Contract; however, CONTRACTOR shall not be compensated for any anticipatory profits that have not been earned as of the date of the Termination Date. All Services completed by CONTRACTOR prior to the Termination Date shall be documented and tangible work documents shall be transferred to and become the sole property of the COUNTY prior to payment for the Services rendered.

d. Notwithstanding the above or any section herein to the contrary, CONTRACTOR shall not be relieved of liability to the COUNTY for damages sustained by the COUNTY by virtue of any breach of the Contract by CONTRACTOR and the COUNTY may withhold any payments to CONTRACTOR for the purpose of setoff until such time as the exact amount of damages due the COUNTY from CONTRACTOR is determined.

e. The COUNTY has the option to cancel the Agreement and/or any Renewals if the County is put on notice of legal problems with CONTRACTOR or any of its principals, partners, corporate officers, or agents, involving allegations of dishonesty, improper business conduct, or criminal activity. Cancellation under this provision shall be immediate and effective upon notice. The COUNTY reserves the right to exercise this provision at its discretion and any decision rendered by the COUNTY under this provision constitutes a final determination of the matter the public welfare requiring it.

6. COMPENSATION FOR CORRECTIONS

No compensation shall be due or payable to CONTRACTOR pursuant to this Contract for any CONTRACTOR's Services performed by the CONTRACTOR in connection with effecting of corrections to the design of the Services, when such corrections are required as a direct result of negligence by the CONTRACTOR to properly fulfill any of his obligations as set forth in this Contract.

7. SUBCONTRACTING, ASSIGNMENT OR TRANSFER

a. Any subcontracting, assignment, delegation or transfer of all or part of the rights, responsibilities, or interest of either party to this Contract is prohibited unless by written consent of the other party. No subcontracting, assignment, delegation or transfer shall relieve the CONTRACTOR from performance of the Services under

this Contract. The COUNTY shall not be responsible for the fulfillment of the CONTRACTOR's obligations to its transferors or subcontractors.

b. Upon the request of the other party, the subcontracting, assigning, delegating or transferring party shall provide all documents evidencing the subcontract, assignment, delegation or transfer.

8. CONFLICT OF INTEREST

The CONTRACTOR covenants that it has no public or private interest, and will not acquire directly or indirectly any interest which would conflict in any manner with the performance of the Services. The CONTRACTOR warrants that no part of the total Contract Fee shall be paid directly or indirectly to any officer or employee of the COUNTY as wages, compensation, or gifts in exchange for acting as officer, agent, employee, subcontractor or consultant to the CONTRACTOR in connection with any work contemplated or performed relative to this Contract.

9. CONTINGENT FEES

The CONTRACTOR warrants that it has not employed or retained any company or person other than a bona fide employee working solely for the CONTRACTOR, to solicit or secure this Contract, and that it has not paid or agreed to pay any company or person, other than a bona fide employee working solely for the CONTRACTOR any fee, commission, percentage, brokerage fee, gift, or any other consideration contingent upon or resulting from the award or making of this Contract. For breach or violation of this warranty, the COUNTY will have the right to recover the full amount of such fee, commission, percentage, brokerage fee, gift, or other consideration.

10. EMPLOYMENT OF COUNTY WORKERS

The CONTRACTOR will not engage, on a full, part-time, or any other basis during the Term of the Contract, any professional or technical personnel who are or have been at any time during the Term of the Contract in the employ of the COUNTY.

11. ACCESS TO RECORDS

During all phases of the work and Services to be provided hereunder, CONTRACTOR agrees to permit duly authorized agents and employees of the COUNTY to enter CONTRACTOR's offices for the purpose of inspections, reviews and audits during normal working hours. Reviews may also be accomplished at meetings that are arranged at mutually agreeable times and places. The CONTRACTOR will maintain all books, documents, papers, accounting records, and other evidence pertaining to the Fee paid under this Contract and make such materials available at their offices at all reasonable times during the Term of this Contract and for three (3) years from the date of payment under this Contract for inspection by the COUNTY or by any other governmental entity or agency participating in the funding of this Contract, or any authorized agents thereof. Copies of said records shall be furnished to the COUNTY upon request.

12. ARBITRATION

Any dispute concerning a question of fact in connection with the work not disposed of by agreement between the CONTRACTOR and the COUNTY will be referred to the Shelby County Contract Administrator or its duly authorized representative, whose decision regarding same will be final.

13. RESPONSIBILITIES FOR CLAIMS AND LIABILITIES

a. CONTRACTOR shall indemnify, defend, save and hold harmless the COUNTY, and its elected officials, officers, employees, agents, assigns, and instrumentalities from and against any and all claims, liability, losses or damages—including but not limited to Title VII and 42 USC 1983 prohibited acts—arising out of or resulting from any conduct; whether actions or omissions; whether intentional, unintentional, or negligent; whether legal or illegal; or otherwise that occur in connection with or in breach of this Contract or in the performance of the Services hereunder, whether performed by the CONTRACTOR its subcontractors, agents, employees or assigns. This indemnification shall survive the termination or conclusion of this Contract.

b. CONTRACTOR expressly understands and agrees that any insurance protection required by this Contract or otherwise provided by the CONTRACTOR shall in no way limit the responsibility to indemnify, defend, save and hold harmless the COUNTY or its elected officials, officers, employees, agents, assigns, and instrumentalities as herein provided.

c. The COUNTY has no obligation to provide legal counsel or defense to CONTRACTOR or its subcontractors in the event that a suit, claim or action of any character is brought by any person not a party to this agreement against CONTRACTOR as a result of or relating to performance of the Services under this Contract.

d. Except as expressly provided herein, the COUNTY has no obligation for the payment of any judgment or the settlement of any claims against CONTRACTOR as a result of or relating to performance of the Services under this Contract.

e. CONTRACTOR shall immediately notify the COUNTY of any claim or suit made or filed against CONSULTANT or its subcontractors regarding any matter resulting from or relating to CONTRACTOR's performance of the Services under this Contract and will cooperate, assist and consult with the COUNTY in the defense or investigation thereof.

14. GENERAL COMPLIANCE WITH LAWS

a. The CONTRACTOR certifies that it is qualified or will take steps necessary to qualify to do business in the State of Tennessee and that it will take such action as, from time to time, may be necessary to remain so qualified and it shall obtain, at its expense all licenses, permits, insurance, and governmental approvals, if any, necessary to the performance of the Services under this Contract.

b. The CONTRACTOR is assumed to be familiar with and agrees that at all times it will observe and comply with all federal, state, and local laws, ordinances, and regulations in any manner affecting the performance of the Services. The preceding shall include, but is not limited to, compliance with all Equal Employment Opportunity laws, the Fair Labor Standards Act, Occupational Safety and Health Administration (OSHA) requirements, and the Americans with Disabilities Act (ADA).

c. This Contract will be interpreted in accordance with the laws of the State of Tennessee. By execution of this Contract, the CONTRACTOR agrees that all actions, whether sounding in contract or in tort, relating to the validity, construction, interpretation and enforcement of this Contract will be instituted and litigated in the courts of the State of Tennessee, located in Shelby County, Tennessee, and in no other. In accordance herewith, the parties to this Contract submit to the jurisdiction of the courts of the State of Tennessee located in Shelby County, Tennessee.

15. NON-DISCRIMINATION

The CONTRACTOR hereby agrees, warrants, and assures compliance with the provisions of Title VI and VII of the Civil Rights Act of 1964 and all other federal statutory laws which provide in whole or in part that no person shall be excluded from participation or be denied benefits of or be otherwise subjected to discrimination in the performance of this Contract or in the employment practices of the CONTRACTOR on the grounds of handicap and/or disability, age, race, color, religion, sex, national origin, or any other classification protected by federal, Tennessee State Constitutional or statutory law. The CONTRACTOR shall upon request show proof of such non-discrimination and shall post in conspicuous places available to all employees and applicants notices of non-discrimination.

Any recipient entity shall be subject to the requirements of Title VI of the Civil Rights Act of 1964, 42 U.S.C. 2000d et seq., and regulations promulgated pursuant thereto. It shall develop a Title VI implementation plan with participation by protected beneficiaries as may be required by such law or regulations. To the extent applicable, such plan shall include Title VI implementation plans subrecipients of federal funds through the entity. The contractor shall produce the plan upon request of Shelby County Government. Failure to provide same shall constitute a material breach of contract.

16. ENTIRE AGREEMENT

This Contract represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations or agreements, whether oral or written.

17. AMENDMENT

This Contract may be modified or amended only by written instrument signed by both parties.

18. SEVERABILITY

If any provision of this Contract is held to be unlawful, invalid or unenforceable under any present or future laws, such provision shall be fully severable; and this Contract shall then be construed and enforced as if such unlawful, invalid or unenforceable provision had not been a part hereof. The remaining provisions of this Contract shall remain in full force and effect and shall not be affected by such unlawful, invalid or unenforceable provision or by its severance here from. Furthermore, in lieu of such unlawful, invalid, or unenforceable provision, there shall be added automatically as a part of this Contract a legal, valid and enforceable provision as similar in terms to such unlawful, invalid or unenforceable provision as possible.

19. NO WAIVER OF CONTRACTUAL RIGHT

No waiver of any term, condition, default, or breach of this Contract, or of any document executed pursuant hereto, shall be effective unless in writing and executed by the party making such waiver; and no such waiver shall operate as a waiver of either (a) such term, condition, default, or breach on any other occasion or (b) any other term, condition, default, or breach of this Contract or of such document. No delay or failure to enforce any provision in this Contract or in any document executed pursuant hereto shall operate as a waiver of such provision or any other provision herein or in any document related hereto. The enforcement by any party of any right or remedy it may have under this Contract or applicable law shall not be deemed an election of remedies or otherwise prevent such party from enforcement of one or more other remedies at any time.

20. MATTERS TO BE DISREGARDED

The titles of the several sections, subsections, and paragraphs set forth in this contract are inserted for convenience of reference only and shall be disregarded in construing or interpreting any of the provisions of this Contract.

21. SUBJECT TO FUNDING

This Contract is subject to annual appropriations of funds by the Shelby County Government. In the event sufficient funds for this Contract are not appropriated by Shelby County Government for any of its fiscal period during the Term hereof, then this Contract will be terminated. In the event of such termination, the CONSULTANT shall be entitled to receive just and equitable compensation for any satisfactory work performed as of the Termination Date.

22. TRAVEL EXPENSES

All travel expenses payable under this Contract shall be in accordance with the County Travel Policy and Procedures. This includes advance written travel authorization, submission of travel claims, documentation requirements, and reimbursement rates. No travel advances will be made by the County.

23. PREVAILING WAGE ORDINANCE

Any firm, individual, partnership or corporation awarded a contract by the COUNTY for the construction of, improvement, enlargement, alteration or replacement of a public work or project in excess of $500,000 and any subcontractors of such public work or project in excess of $100,000 ("Recipient") shall be required to pay local prevailing wages and benefits for laborers, mechanics, or other listed classifications as defined by the Tennessee Department of Labor. The prevailing wage rate shall be the most current State of Tennessee prevailing wage established by the Tennessee Department of Labor for Region 1 (Shelby County). The benefit rates shall be the most current rates described in the published schedule by the Memphis and West Tennessee Building and Construction Trades Council, except as otherwise provided in the Shelby County Code of Ordinances. The applicable rate shall be determined at the time that the project is awarded. In instances where Prevailing wage applies, Prevailing Wage will override the Living Wage requirement.

24. NON-LIABILITY FOR CONSULTANT EMPLOYEE TAXES

Neither CONTRACTOR nor its personnel are COUNTY's employees, and COUNTY shall not take any action or provide CONTRACTOR's personnel with any benefits and shall have no liability for the following:

a. Withholding FICA (Social Security) from CONTRACTOR's payments;
b. Making state or federal unemployment insurance contributions on behalf of CONTRACTOR or its personnel;
c. Withholding state and federal income tax from payment to CONTRACTOR;
d. Making disability insurance contributions on behalf of CONTRACTOR;
e. Obtaining workers' compensation insurance on behalf of CONTRACTOR or CONTRACTOR's personnel.

25. INCORPORATION OF OTHER DOCUMENTS

a. CONTRACTOR shall provide Services pursuant to this Contract in accordance with the terms and conditions set forth within the Shelby County Request for Proposals/Bids as well as the Response of CONTRACTOR thereto, all of which are maintained on file within the Shelby County Purchasing Department and incorporated herein by reference.

b. It is understood and agreed between the parties that in the event of a variance between the terms and conditions of this Contract and any amendment thereto and the terms and conditions contained either within the Sealed Bid Documents or the Response thereto, the terms and conditions of this Contract as well as any amendment shall take precedence and control the relationship and understanding of the parties.

26. CONTRACTING WITH LOCALLY OWNED SMALL BUSINESSES

The CONTRACTOR shall take affirmative action to assure that Locally Owned Small Businesses that have been certified by the COUNTY are utilized when possible as sources of supplies and equipment, construction and services.

27. LIVING WAGE ORDINANCE AND PREVAILING WAGE ORDINANCE

Living Wage - In accordance with Ordinance Number 328, commonly referred to as the Living Wage Ordinance, all persons/entities engaged in service contracts with the County, including but not limited to both prime and subcontractors, shall pay a Living Wage to employees for all work performed on said service contract, as defined in the Living Wage Ordinance. Proof of such compensation must be evidenced as required in the Living Wage Ordinance.

28. RIGHT TO REQUEST REMOVAL OF CONTRACTOR's EMPLOYEES

The COUNTY may interview the personnel CONTRACTOR assigns to COUNTY's work. COUNTY shall have the right, at any time, to request removal of any employee(s) of CONTRACTOR, whom COUNTY deems to be unsatisfactory for any reason. Upon such request, CONTRACTOR shall use all reasonable efforts to promptly replace such employee(s) with substitute employee(s) having appropriate skills and training.

29. INCORPORATION OF WHEREAS CLAUSES

The foregoing whereas clauses are hereby incorporated into this Contract and made a part hereof.

30. DISCLOSURE OF REPORTS, DATA OR OTHER INFORMATION

Notwithstanding anything to the contrary contained herein or within any other document supplied to COUNTY by CONTRACTOR, CONTRACTOR understands and acknowledges that COUNTY is a governmental entity subject to the laws of the State of Tennessee and that any reports, data or other information supplied to COUNTY by CONTRACTOR due to Services performed pursuant to this Contract is subject to being disclosed as a public record in accordance with the laws of the State of Tennessee.

31. CONFIDENTAL INFORMATION

a. CONTRACTOR acknowledges that, in dealing with individuals in the provision of the Services for COUNTY, any information gathered for the provision of the Services is confidential information. CONTRACTOR agrees to hold all confidential information in strict confidence, and except as expressly set forth herein, will not disclose such confidential information to any third party(s), including but not limited to any corporation, company, group, partnership, agency or individual. CONTRACTOR shall:

i) use the confidential information only in connection with the provision of the Services;

ii) disclose the confidential information only to its officers, directors, and employees who need to know the confidential information to accomplish the preparation of the audits and/or auditing process; and

iii) safeguard the confidential information with the same or greater degree of care to avoid unauthorized disclosure as the CONTRACTOR uses to protect its own confidential information.

b. In the event that the CONTRACTOR or anyone to whom it transmits confidential information becomes legally compelled to disclose any of the confidential information, the CONTRACTOR will provide the COUNTY with prompt written notice before such confidential information is disclosed so that the COUNTY can seek a protective order or other appropriate remedy. Unauthorized disclosure of confidential information by the CONTRACTOR shall result in immediate termination of the Contract.

32. ORGANIZATION STATUS AND AUTHORITY

a. CONSULTANT represents and warrants that it is a corporation, limited liability company, partnership, or other entity duly organized, validly existing and in good standing under the laws of the state of Tennessee; it has the power and authority to own its properties and assets and is duly qualified to carry on its business in every jurisdiction wherein such qualification is necessary.

b. The execution, delivery and performance of this Contract by the CONTRACTOR has been duly authorized by all requisite action and will not violate any provision of law, any order of any court or other agency of government, the organizational documents of CONTRACTOR, any provision of any indenture, agreement or other instrument to which CONTRACTOR is a party, or by which CONTRACTOR's respective properties or assets are bound, or be in conflict with, result in a breach of, or constitute (with due notice or lapse of time or both) a default under any such indenture, agreement or other instrument, or result in the creation or imposition of any lien , charge or encumbrance of any nature whatsoever upon any of the properties or assets.

33. INSURANCE REQUIREMENTS

a. The CONTRACTOR shall purchase and maintain, in a company or companies licensed to do business in the State of Tennessee, such insurance as will protect the COUNTY from claims which may arise out of or result from the CONTRACTOR'S operations under the Contract, whether such operations are performed by himself or by any subcontractors or by anyone directly or indirectly employed by any of them, or by anyone for whose acts the CONTRACTOR or subcontractor may be liable.

b. The insurance required shall be written for not less than any limits of liability specified or required by law, whichever is greater. Shelby County Government, its elected officials, appointees and employees will be named as additional insured. The CONTRACTOR will maintain throughout the life of this Contract insurance, through insurers rated A- or better by A.M. Best, in the following minimum requirements. All policies shall provide for thirty (30) days written notice to COUNTY of cancellation or material change in coverage provided:

i) Professional Liability Insurance - $1,000,000.00 per claim/$3,000,000.00 annual aggregate, indicating if coverage is on occurrence basis or claims-made.

ii) Commercial General Liability Insurance - $1,000,000.00 limit per occurrence bodily injury and property damage/$1,000,000.00 personal and advertising injury/$2,000,000.00 General Aggregate/$2,000,000.00 Products-completed Operations Aggregate, indicating the coverage is provided on a claims-made or on an occurrence basis. The insurance shall include coverage for the following:

a. Premises/Operation;
b. XCU coverage, where applicable;
c. Products/Completed Operations;
d. Contractual Liability;
e. Independent Contractors;
f. Broad Form Property Coverage;
g. Personal Injury.

iii) Workers Compensation and Employers' Liability Insurance – Workers Compensation statutory limits as required by Tennessee. This policy should include Employers' Liability Coverage for $1,000,000.00 per accident.

iv) Business Automobile Liability Insurance - $1,000,000.00 each accident for property damage and personal injury. Coverage is to be provided on all owned/leased autos, non-owned autos and hired autos.

c. CONTRACTOR shall provide County with a current copy of the Certificate of Insurance at the time of contracting and shall maintain said insurance during the entire Contract period as well as provide renewal copies on each anniversary date. The certificate holder is to read:

Shelby County Government
Purchasing Department
160 N. Main, Suite 550
Memphis, TN 38103

d. Upon termination or cancellation of insurance currently in effect under this Contract, the CONTRACTOR shall purchase an extended reporting endorsement and furnish evidence of same to the County.

e. The CONTRACTOR shall review the "**Special Provisions For Protection Of Railway Interest**" which is included within the Special Provisions section of this Bid Book **for additional insurance requirements** which must be satisfied prior to work commencing within the railroad Right-Of-Way.

34. NOTICE

Any notices required or permitted to be given under the provisions of this Contract shall be effective only if in writing and delivered either in person to the COUNTY's authorized agent or by First Class or U.S. Mail to the addresses set forth below, or to such other person or address as either party may designate in writing and deliver as herein provided:

COUNTY: Shelby County Government
Roads and Bridges Department
6449 Haley Road
Memphis, Tennessee 38134
Attn.: Mr. Darren Sanders, P.E.

*and*

Shelby County Government
Contract Administration
160 N. Main St., Suite 550
Memphis, Tennessee 38103

VENDOR:

**IN WITNESS WHEREOF**, the parties hereto have set their signatures for the purposes contained herein, on the day and date first above written.

**APPROVED AS TO FORM AND LEGALITY:**

_____
Contract Administrator/
Assistant County Attorney

**SHELBY COUNTY GOVERNMENT**

_____
Mark H. Luttrell, Jr. Mayor

**VENDOR**

BY: _____

TITLE: _____

CORPORATE ACKNOWLEDGMENT

STATE OF _____

COUNTY OF _____

Before me, the undersigned Notary Public, in and for the State and County aforesaid, personally appeared _____, with whom I am personally acquainted or proved to me on the basis of satisfactory evidence, and who, upon oath, acknowledged himself/herself to be president or other officer authorized by appropriate Corporate action and/or Resolution to execute the preceding instrument of the _____, the within named bargainor, a corporation, and that he as such _____, executed the foregoing instrument for the purpose herein contained, by signing the name of the corporation by himself/herself as _____.

Witness my hand and official seal at office this _____ day of _____, 2013.

_____
Notary Public

**CONTRACT BOND** (Corporation)

KNOW ALL MEN BY THESE PRESENTS, That we _____ a corporation organized under the laws of the State of _____and licensed to do business in the State of Tennessee, as Principal, and _____ a corporation organized and existing under the laws of the State of _____ with authority to do business in the State of Tennessee, as Surety, are held and firmly bound unto THE COUNTY OF SHELBY, TENNESSEE, in the penal sum of _____ DOLLARS ($_____), lawful money of the United States, well and truly to be paid unto said SHELBY COUNTY, TENNESSEE, for the payment of which we bind ourselves, our successors and assigns, jointly, severally, and firmly by the presents.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH that whereas, the said Principal has entered into a written contract with THE COUNTY OF SHELBY, TENNESSEE, for the construction of the work designated FITE ROAD AND BRIDGE IMPROVEMENTS PROJECT which contract is hereby referred to and made a part hereof, as if written herein at length, and whereby the said Principal has promised and agreed to perform to pay all sums of money due for any labor, materials, apparatus, fixtures or machinery furnished to such Principal for the purposes of performing such work and has further agreed to pay all direct and indirect damages to any person, firm, company or corporation suffered or sustained on account of the performance of such work during the time thereof and until such work is completed and accepted; and has further agreed that this bond shall insure to the benefit of any person, firm, company or corporation, to whom any money may be due from the Principal, sub-contractor or otherwise, for any such labor, materials, apparatus, fixtures or machinery so furnished and that suit may be maintained on such bond by any such person, firm company or corporation, for the recovery of any such money ON OR BEFORE THE EXPIRATION OF ANY GUARANTEE PERIOD AND/OR THE REQUIRED ADVERTISEMENT PERIOD.

NOW, THEREFORE, if the said Principal shall well and truly perform said work in accordance with the terms of said contract, and shall pay all sums of money due or to become due to any labor, materials, apparatus, fixtures or machinery furnished to him for the purpose of constructing such work, and shall commence and complete the work within the time prescribed in said contract, and shall pay and discharge all damages, direct and indirect, that may be suffered or sustained on account of such work during the time of the performance thereof and until the said work shall have been accepted and shall hold THE COUNTY OF SHELBY, TENNESSEE, harmless, its officials, agents, and employees in account of any such damages, and shall in all respects full and faithfully comply with all the provisions, conditions, and requirements of said contract, then this obligation to be void; otherwise to remain in full force and effect.

Approved this _____ day of _____, A.D. 2013.

IN WITNESS WHEREOF, We have duly executed the foregoing obligation this _____ day of _____A.D.2013

FOR SHELBY COUNTY GOVERNMENT:

Corporate Name: _____
President

_____
Mayor of Shelby County, TN

Attest: _____ _____
Secretary Director of Public Works

SURETY _____(Seal)

BY: _____(Seal) APPROVED AS TO FORM:
Attorney in Fact

BY: _____(Seal) _____
Attorney in Fact County Attorney

State of _____

County of _____

I, _____, a Notary Public in and for said County, in the State aforesaid, do hereby certify that _____who is to me personally known to be the same person who signed the above and foregoing instrument as the Attorney in Fact for _____, appeared before me this day in person and acknowledged that he signed the name of _____thereto, as his Principal and his own name as Attorney in Fact, as the free and voluntary act of his said Principal for the uses and purposes therein set forth, and that he executed the said instrument under authority given him by said Principal.

Given under my hand and Notarial Seal the _____ day of _____A.D. 2013.

_____
Notary Public

REMAINDER OF PAGE INTENTIONALLY LEFT BLANK

# SECTIONS C AND D

SHELBY COUNTY SPECIAL PROVISIONS

SHELBY COUNTY, TENNESSEE
SPECIAL PROVISION 105.07A
DAMAGE TO SERVICE LINES

The Contractor shall immediately stop all work to repair any service lines that are damaged during construction. The construction process shall not commence until the damaged lines are satisfactorily repaired and the repair approved by the Engineer or his representative.

The Contractor shall also be responsible for any plumbing damage caused by foreign objects entering a broken water line.

The Contractor shall also be responsible for other damage caused by broken service lines including, but not limited to damage to equipment due to interrupted service. This does not apply to cable television deemed by the Engineer to have been incorrectly installed.

SHELBY COUNTY, TENNESSEE
SPECIAL PROVISION 107.15
COMPLAINTS

The Contractor shall ensure that all complaints are resolved promptly. Upon notification by the Engineer or his representative, the Contractor shall respond immediately to correct the problem, regardless of severity.

The Contractor shall inform the Engineer in writing as to when and how the complaint was resolved.

If any complaint is not resolved to the satisfaction of the Engineer, within 48 hours of receipt of the complaint by the Contractor, then all other work shall cease upon order of the Engineer or his representative until the complaint is resolved to the satisfaction of the Engineer.

It will be the Engineer's responsibility to handle all communication with the private property owners and residents.

The Engineer will have the authority to schedule a conference involving the Contractor, the property owner, and the Engineer for the purpose of clarifying the nature of the complaint

The Engineer will mediate all disputes and his decision will be final. Under no circumstances shall the Contractor negotiate directly with the property owner.

# PHASE II
# ENVIRONMENTAL SITE ASSESSMENT

## PROPERTY ACQUISITION ASSESSMENTS
## SELECTED PROPERTIES
## FITE ROAD REALIGNMENT PROJECT
## SHELBY COUNTY, TN
## VOAP # 79-865

**for**

**Shelby County Government**
**160 North Main Street, Suite 350**
**Memphis, TN 38103**

**Prepared By:**
**Fisher & Arnold Environmental**
**A Division of Fisher & Arnold, Inc.**
**9180 Crestwyn Hills**
**Memphis, Tennessee 38135**
**1-888-583-9724**

**Date:**
**November 20, 2009**
**Amended May 3, 2012**

## TABLE OF CONTENTS


**1.0 INTRODUCTION ..... 1**
1.1 Limiting Conditions ..... 1
1.2 User Reliance ..... 2

**2.0 BACKGROUND ..... 2**
2.1 Chromasco ..... 2
2.2 W. R. Grace ..... 3

**3.0 AREAS OF CONCERN ..... 4**
3.1 Proposed Fite Road Right-of-Way ..... 4
3.2 New Ditch Alignment ..... 5
3.3 Existing Drainage Ditch ..... 5
3.4 Sewer Line Improvement ..... 5
3.5 W.R. Grace Right-of-Way ..... 6

**4.0 SAMPLING METHODOLOGY ..... 6**
4.1 Soil Sampling Methodology ..... 6
4.2 Ground Water Sampling Methodology ..... 6
4.3 Ditch Sediment Sampling Methodology ..... 6
4.4 Surface Water Sampling Methodology ..... 7
4.5 Laboratory Analysis ..... 7
4.6 Sample Label Methodology ..... 7

**5.0 FIELD ACTIVITIES ..... 8**
5.1 Preliminary Activities ..... 8
5.2 Subsurface Sampling Activities ..... 8
5.2.1 Right-of-Way Sampling ..... 8
5.2.2 New Ditch Alignment Sampling ..... 9
5.2.3 Sewer Line Relocation Sampling ..... 9
5.2.4 MLGW Containment Outfall Sampling ..... 10
5.3 Surface Sampling Activities ..... 10
5.4 Deviations from the Approved Work Plan ..... 10

**6.0 FINDINGS ..... 11**
6.1 Local Geology ..... 11
6.2 Soil Sampling Results ..... 11
6.3 Sediment Sampling Results ..... 12
6.4 Ground Water Sampling Results ..... 12
6.5 Surface Water Sampling Results ..... 13
6.6 W.R. Grace Right-of-Way ..... 14
6.7 Data Quality Objectives ..... 14

**7.0 CONCLUSIONS/RECOMMENDATIONS ..... 15**

# APPENDICES

A. Figures

B. Geologic Boring Logs

C. Tables

D. Laboratory Analytical Reports

# EXECUTIVE SUMMARY

F&A has conducted a Phase II Environmental Site Assessment (ESA) on portions of six tracts of land in preparation for the acquisition of right-of-way (ROW) for the realignment of Fite Road in northern Shelby County, Tennessee. The Phase II ESA was conducted in accordance with a Phase II Work Plan dated May 22, 2009, and approved by the Tennessee Department of Environment and Conservation (TDEC) by letter dated June 1, 2009. The report on the Phase II ESA was reviewed and amended in April 2012. The screening values used to evaluate the analytical results from the sampling were updated with any available more recently published screening values. The report tables were amended to include the more recent screening values shown in "blue" font numerals and any new or revised findings are discussed within the report using "blue" font text. The figures have been amended to reflect the current engineering typical roadway section details.

During the Phase II ESA, fourteen soil borings were advanced using direct push technology (DPT) in select locations based on planned ROW acquisition and construction activities on and adjacent to the former Chromium Mining and Smelting Corporation (Chromasco) site located at 3328 Fite Road. Soil samples from each boring were submitted for laboratory analysis of cyanide, hexavalent chromium, target analyte list (TAL) metals, and PCBs. Ground water samples were also collected from temporary wells installed in each soil boring during the assessment. Additionally, sediment and surface water samples were collected from six locations in a drainage ditch due to potential runoff from the Chromasco site, and historical PCB impacts to the ditch from the neighboring W.R. Grace facility.

Laboratory analytical results detected cyanide [0.41 parts per million (ppm)] in one soil sample collected from 1-foot below ground surface (bgs) and hexavalent chromium (2.3 ppm) in an additional sample location (1-foot bgs) on the former Chromasco property. Both results are below the EPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (May 20, 2008) of 20,000 ppm and 1,400 ppm, respectively. TAL metals analysis indicated several metals concentrations in all soil samples submitted to the laboratory. Each of the positive results was below the RSL, with the exception of arsenic (RSL: 1.6 ppm), which ranged from below detection limits to 15 ppm. Arsenic (As) concentrations detected in the soil samples are within range of naturally occurring background arsenic levels in the Memphis, TN, area. According to a Tennessee Division of Superfund Survey cited in the "Hazardous Trace Elements in Tennessee Soils and Other Regolith" completed by the TDEC Division of Geology in 2001, the naturally occurring background level of arsenic in Tennessee is 10 ppm. Furthermore, a TDEC Solid Waste Management memo, dated July 18, 2006, stated that natural levels up to 20 ppm of As are not uncommon in Tennessee soils. Therefore, the arsenic concentrations observed during the original Phase II ESA do not appear to be a concern to the subject properties.

Sediment sample analysis indicated cyanide (0.26 ppm) in one sampling location in the existing ditch on the City of Memphis property (Tract No. 7), but no screening level for cyanide is found on the EPA Region 4 Ecological Screening Values (ESVs) for sediment that were used for analysis of sediment samples. Several TAL metals constituents were detected in the sediment

samples; however, all concentrations were below the ESV with the exception of nickel. Two concentrations of nickel were above the ESV of 15.9 ppm, however, the concentrations were within the expected background range for the area.

Laboratory analytical results for cyanide and PCBs were below laboratory detection limits in each of the ground water samples submitted to the laboratory for analysis. Hexavalent chromium (0.012 ppm) was detected in the ground water sample collected from CR-2; however, there is no established Maximum Contaminant Level (MCL) for hexavalent chromium for comparison of this result. Several TAL metal constituents exceeded the MCLs in unfiltered ground water samples analyzed by the laboratory; however, when the sediment was filtered from the ground water, the metal constituents were below the MCLs in each sample collected.

Surface water samples collected from the existing ditch exhibited concentrations of aluminum and iron that exceeded the ESVs, however, these concentrations are believed to be background related levels.

A volatile organic compound (VOC) ground water contamination plume from the W.R. Grace site underlies a portion of the ROW to be acquired for the new Fite Rd. alignment. ROW plans indicate 5.6 acres of the W.R. Grace property (Tract No. 5) will be acquired for permanent ROW. Of this total, approximately 17,000 S.F. overlie the estimated contaminant plume. The presence of dissolved VOC concentrations in the ground water could lead to subsurface vapors that could accumulate in excavation areas during the project. If excavations near the contaminant plume are to be entered into by construction workers during the construction phase, VOC vapor monitoring will be conducted to insure safe conditions are present.

Several former monitoring wells and one current monitoring well associated with a ground water monitoring project on the W.R. Grace site are located within the ROW, slope easement, or construction easement for the Fite Rd. realignment project. Monitoring well MW-E5D is the only currently utilized monitoring well and is located within the construction easement on the south side of the proposed Fite Rd. Construction plans will be specific to insure this monitoring well is protected during the construction phase of the project. The construction plans will also specify to inspect the closed monitoring wells when encountered during construction to insure the grout is not compromised thus opening a pathway to the subsurface.

The data suggests that no widespread contamination has been identified in the selected soil, sediment, ground water, and surface water samples. Shelby County Government will seek written concurrence of these findings from the Tennessee Department of Environment and Conservation prior to property acquisitions.

# 1.0 INTRODUCTION

Fisher & Arnold Environmental (F&A), A Division of Fisher & Arnold Inc., was retained by Shelby County Government to conduct a Phase II Environmental Site Assessment (ESA) on portions of six tracts of land in preparation for the acquisition of right-of-way (ROW) for the realignment of Fite Road in northern Shelby County, Tennessee. The Phase II was conducted based on findings from several reports prepared by F&A for the proposed new ROW, including:

| | |
|---|---|
| *Categorical Exclusion for the Realignment of Fite Road* | August 20, 2007 |
| Phase I Environmental Site Assessments (ASTM 1527-05): | |
| *W.R. Grace (Tract No. 5)* | June 30, 2009 |
| *City of Memphis (Tract No. 7)* | October 28, 2009 |
| *Timminco Corporation (Tract No. 9)* | July 27, 2009 |
| Transaction Screen Process (ASTM 1528-06) | |
| *City of Memphis MLGW Substation (Tract No. 8)* | November 3, 2009 |
| *Memphis Ready Mix (Tract No. 10)* | November 2, 2009 |
| *Jimmy R. Grinder (Tract No. 11)* | July 23, 2009 |

The Categorical Exclusion that was approved by FHWA and TDOT for the realignment project identified two former Superfund sites in and adjacent to the project corridor, including the former Chromium Mining and Smelting Corporation (Chromasco) site at 3328 Fite Road and W.R. Grace & Co. site located at 5709 Old Millington Road.

The new Fite Road ROW will require the purchase of approximately 1.05 acre from the former Chromasco property (Tract No. 9, currently owned by Timminco Corp.) located at 3328 Fite Road, and will require the purchase of approximately 5.6 acres from the W.R. Grace & Co. site formerly located at 5790 Old Millington Road. The facility at 5790 Old Millington Road is now Arcadian Fertilizer; however, the parcel to be acquired for the construction of Fite Road remains owned by W.R. Grace & Co. The Fite Road realignment project and new ROW acquisition areas are shown on Figure 1 in Appendix A.

The Phase II ESA was conducted in accordance with the Phase II Work Plan dated May 22, 2009, and approved by the Tennessee Department of Environment and Conservation (TDEC) by letter dated June 1, 2009.

## 1.1 Limiting Conditions

This assessment presents Fisher & Arnold's professional interpretation and judgment of the existing site conditions based on the information gathered. Professional judgments expressed herein are based on currently available facts within the limits of the mutually agreed upon scope of work, budget, and schedule, which are not intended to be exhaustive in scope. Fisher & Arnold

accepts no liability for hidden or unknown conditions. Fisher & Arnold's work was performed in accordance with generally accepted environmental investigative procedures and in accordance with a May 22, 2009, work plan approved by TDEC. It is Fisher & Arnold's specific intent that the conclusions and recommendations presented herein be used as guidance and not necessarily as a firm course of action, except where explicitly stated as such. We make no warranties, expressed or implied, including without limitation, warranties as to marketability or fitness for a particular purpose. The information provided in this report is not to be construed as legal advice.

The project timeline required development of the Phase II Work Plan prior to completion of the preliminary environmental studies for the properties affected by the realignment of Fite Road. Assessment information noted in the work plan was believed to reflect all Recognized Environmental Conditions (RECs) associated with the properties; however, the Work Plan committed to adjusting the scope of work if preliminary findings warranted. The Phase I ESA completed for the City of Memphis property (No. 7) identified a Historic REC pertaining to evidence in aerial photography of structures on the east side of the property and general land disturbance of the portion of the property north of the creek. Representatives of the Owner did not make themselves available for interview and these conditions could not be adequately evaluated. As such, further evaluation of the subsurface in areas of the property to be acquired for Fite Road ROW were recommended to address the potential for environmental impairment. The limited scope and timeline for completion of the the Phase II ESA did not allow for additional sampling activities, thus, this is considered a limiting condition to the findings of this report.

### 1.2 User Reliance

Reliance or use of this report by anyone other than Shelby County Government, for whom it was prepared, is prohibited. Reliance or use by any third party of the report does not make said party a beneficiary to Fisher & Arnold's contract with Shelby County Government. Any such unauthorized reliance on or use of this report including any of its information or conclusions will be at the third party's risk. No warranties or representation expressed or implied in this report are made to any third party.

## 2.0 BACKGROUND

### 2.1 Chromasco

The Chromasco site is a former State Superfund site that is comprised of 92 acres located along the north ROW of Fite Road. According to the February 2001 Record of Decision (ROD), the Chromasco plant produced ferrochrome alloy, ferrosilicon alloy, and ferromanganese alloy from the 1950s until 1984. The site is home to a 6-acre industrial landfill, former sludge lagoons, and buildings/slabs

used in the production of alloys. Process material and slag reportedly remain on-site in large piles, in the landfill, and as backfill for site grading.

The ROD states the landfill contains ferrosilicate slag, ferrochrome slag, ferromanganese slag, ferrosilicate ladle cleanings, low carbon ferrochrome slag, and ferrochrome air pollution control slag along with various construction debris. The landfill was reportedly covered with 2 feet of low permeability clay.

Arsenic, chromium (total and hexavalent), and lead (total) impacts to ground water, soil, and surface water have been documented at the site. Soil samples collected from the site have exhibited relatively elevated levels of cadmium, chromium, copper, cyanide, manganese, lead, nickel, zinc, and PCBs, and surface water samples collected from a centrally located east-west drainage ditch at the facility exhibited elevated levels of chromium. The east-west drainage ditch discharges to a secondary drainage channel along the western property line that is parallel to the railroad tracks.

A Phase III Site Assessment dated May 1988 showed the process water outflow at the secondary drainage ditch along the western property line. This secondary drainage discharges to a drainage ditch located on the southwestern adjacent City of Memphis property that conveys water to the Loosahatchie River. Information reviewed for the site indicates the facility discharge permit was revoked by the Tennessee Department of Public Health in 1971 due to "inadequately treated sewer discharge." Additional permits were denied due to chromium concentrations [(up to 8.0 parts per million (ppm)] until 1974 when an on-site treatment facility was constructed. Additional permit violations were observed for hexavalent chromium in 1976 (0.25 ppm), 1977 (0.10, 0.33, and 0.08 ppm), 1978 (0.44 ppm), and 1979 (0.54 ppm).

In addition to the process water discharge and potential storm water impacts to the drainage ditch, many of the documented soil impacts were exhibited in shallow soils that have the potential to erode and discharge sediment into the drainage ditches.

## 2.2 W.R. Grace

The W.R. Grace site is a Voluntary Cleanup Oversight and Assistance Program (VOAP) site under the oversight of the State of Tennessee Department of Environment and Conservation's Division of Remediation located in the proposed Fite Road area. The facility manufactured fertilizers from 1954 through 1988. Prior to the construction of a wastewater treatment system in 1972, the plant's wastewater was held in an earthen bermed holding pond. The earthen pond was converted to a spill retention pond in 1972. An environmental site assessment conducted prior to the sale of the property in 1988 indicated that the holding pond/spill retention pond and a nearby oil/water separator/recovery system were a source area for VOC impacts to soil and ground water. Elevated PCB

concentrations were also found in the pond sludge, soils beneath the pond, and in the pond berms.

The March 2000 ROD indicates remedial action at the site included excavation of impacted sludge and soil from the pond and berm. Excavation activities were halted before complete removal of PCB impact due to concrete surface improvements. PCB impacted soil was left in place on the eastern side of the spill retention pond (110 feet long, up to 17 feet deep) along a concrete run-off ditch and adjacent to a concrete decontamination pad on the southern portion of the spill retention pond (approximately 65 feet long and 7 feet deep).

The ROD indicates confirmed PCB impact to a drainage ditch that conveys storm water from the W.R. Grace site to the Loosahatchie River. This ditch is the same drainage that discharges storm water from the Chromasco site. Models to evaluate sediment loading and PCB impact to the Loosahatchie River were prepared by Woodward-Clyde for W.R. Grace. The February 29, 1996, report titled "Addendum to Evaluation of Potential PCB Impacts to Loosahatchie River" shows discharge from the drainage ditch will not exceed PCB water quality standards.

The ROD also indicates a vacuum recovery system was operated for over three years to recover VOCs in ground water from the source area at the site. After initial reductions of TCE and PCE, it was determined the vacuum system was hindering dechlorination due to oxygenation of the ground water. The vacuum system was decommissioned and institutional controls along with monitored natural attenuation were selected as the most viable remedy for remaining contamination.

F&A reviewed the July 2008 Ground Water Sampling Results and Five-Year Natural Bioattenuation Review report prepared by URS for the W. R. Grace site at the TDEC Memphis Environmental Field Office. The report indicates two solvent plumes located to the west of the Canadian National Railroad are being monitored for natural attenuation of chlorinated solvents.

## 3.0 AREAS OF CONCERN

Construction plans for the new alignment of Fite Road will include acquisition of ROW from the former Chromasco site as well as five adjacent parcels, dredging and filling an existing ditch to allow for a bridge approach over the Canadian National Railroad, constructing a new ditch alignment on and adjacent to the former Chromasco site, and improvement of a section of sanitary sewer line adjacent to the former Chromasco site. Additionally, the new alignment will require ROW acquisition across the W.R. Grace property where a solvent plume is being monitored for natural attenuation. These tasks and their environmental concerns are further outlined in the following sections:

### 3.1 Proposed Fite Road Right-of-Way

The proposed ROW will require the acquisition of approximately 1.05 acres from the Chromasco property located along the north ROW of the existing Fite Rd. on the east end of the project corridor as shown on Figures 2 and 3. (All figures have been updated to show the current typical roadway section details) A portion of three adjacent properties located south of the existing Fite Road will also be required for the new ROW. These properties may also have been impacted by surface water runoff from the Chromasco site due to storm water conveyances beneath Fite Road and from ground water migration.

### 3.2 New Ditch Alignment

The new ditch channel will require excavation of approximately 670 L.F. of soil on the southwest corner of the Chromasco property, on the adjacent City of Memphis property, and on the City of Memphis (MLGW) property south of the existing Fite Rd. (Figure 2). The location of excavation activities is near the portion of the Chromasco property where the landfill is located, and leaching over time could have impacted soil and groundwater in the area to be disturbed for the new ditch alignment. The ground water flow direction at the site is generally to the south, and the ground water impacts observed on the Chromasco property are up-gradient from the new ditch channel, indicating there is a possibility of migration of ground water contaminants to the excavation area.

### 3.3 Existing Drainage Ditch

The drainage ditch that exhibited historical PCB impact from the W.R. Grace site and was downgradient from the Chromasco process water discharge is also a potential receptor of surface runoff and erosion from surficial contamination from the Chromasco property. Shallow impacted ground water from the Chromasco site may also discharge to the ditch. Construction plans require the relocation of approximately 600 L.F. of the ditch located on the southwest corner of the Chromasco property, the adjacent City of Memphis property, and the City of Memphis property south of the existing Fite Rd as shown on Figure 2 (Appendix A). Backfilling and compaction requirements of the ditch channel may result in removal and potential disposal of ditch bottom soils and sediments.

### 3.4 Sewer Line Improvement

Construction plans require the improvement of an underground sewer line located in the project corridor near the Canadian National Railroad. The sewer line improvement calls for excavation activities near the Chromasco property. Approximately 360 L.F. of 15-feet deep excavation will allow for an improved sewer line system near the existing lateral aligned on the west side of the rail road, terminating near the existing sanitary sewer alignment north of the proposed Fite Road.

### 3.5 W.R. Grace Right-of-Way

The new Fite Road alignment will require approximately 5.6 acres of land acquisition from the W.R. Grace & Co. property. A preliminary file review indicated one of two solvent plumes being monitored underlies a portion of the land required for ROW acquisition. The majority of the roadway plans require filling on this portion of the project; however, some shallow (<5-feet) excavation work will be required for roadside drainage improvements.

## 4.0 SAMPLING METHODOLOGY

### 4.1 Soil Sampling Methodology

Subsurface soil samples were collected using hydraulic push Geoprobe sampling equipment in accordance with the EPA Region IV Field Sampling Procedures (FSP) for Soil Sampling (SESDPROC-300-R1). Soil samples were collected continuously, utilizing a 48" long Geoprobe sampling barrel lined with a replaceable 2-inch diameter acetate sleeve that was advanced through the subsurface. The acetate sleeve was opened and a representative portion of the soil core placed into laboratory prepared sample containers. Soil from select sampling intervals was placed into plastic bags for screening of volatile organic compounds (VOCs) with a Photo-Ionization Detector (PID).

### 4.2 Ground Water Sampling Methodology

Temporary wells were installed in Geoprobe boreholes for collection of ground water samples in accordance with the EPA Region IV FSP guidelines for ground water sampling (SESDPROC-301-R1). Samples were collected using low-flow techniques with a peristaltic pump. Both filtered and non-filtered ground water samples were collected for metals analysis. Ground water filtering was conducted in the laboratory to remove suspended sediments that may provide false positive results. Samples for laboratory filtering were submitted to the laboratory, prepared, and held pending results of non-filtered samples.

### 4.3 Ditch Sediment Sampling Methodology

All ditch bottom sediment sampling activities were conducted in accordance with the EPA Region IV FSP for Sediment Sampling (SESDPROC-200-R1). A variation from the work plan was encountered due to the inability to drive the 48" long Geoprobe sampling barrel through the ditch bottom soils by hand. Very little soft sediment was encountered, and the ditch bottom was primarily comprised of firm, gray, clayey silt. A hand-auger was advanced to approximately 12" bgs for collection of ditch bottom sediment and soil.

The sediment was thoroughly mixed in a bowl in accordance with the SESCPROC-200-R1 guidelines prior to placing a representative portion into laboratory prepared containers.

## 4.4 Surface Water Sampling Methodology

Surface water sampling activities were conducted in accordance with the U.S Environmental Protection Agency (EPA) Region IV FSP for Surface Water Sampling (SESDPROC-201-R1). Samples were collected from the bank of the ditch utilizing a decanting device. Water sampling activities were conducted prior to sediment sampling activities to prevent disturbance of ditch bottom sediments.

## 4.5 Laboratory Analysis

All samples were placed into laboratory prepared containers, labeled, and immediately placed on ice. Samples were shipped on ice under chain-of-custody on a daily basis to Environmental Science Corp. (ESC) in Mt. Juliet, TN. Samples were analyzed for PCBs that have been detected on the Chromasco site and in the existing ditch, along with metals, hexavalent chromium, and cyanide that have been detected on the Chromasco property. The sample analysis includes:

- PCB's per laboratory method 8082;
- Target Analyte List (TAL) Metals per laboratory method 6010/6020/7471 (soil) - 6010/6020/7470 (water);
- CR6 (Hexavalent Chromium) per method 3060A/ 7196A (soil) - 7196A (water); and
- Cyanide per method 9012B.

## 4.6 Sample Label Methodology

Sample locations are identified by the area of concern where the sample is located, including:

| | |
|---|---|
| CR | Chromasco Right-of-Way Sample |
| ND | New Ditch Sample |
| D | Existing Ditch Sample |
| SL | Sewer Line Sample |

The sample numbering system includes information on the area of concern where the sample was collected, the media sampled, and sample location. For example, sample CRW-1 is the water sample collected from sampling location CR-1, and CRS-1 is the soil sample collected from location CR-1.

# 5.0 FIELD ACTIVITIES

## 5.1 Preliminary Activities

Prior to sampling activities, F&A, a construction sub-contractor, and F&A surveyors mobilized to the site on Thursday, October 1, 2009, to clear access to overgrown areas for sampling activities. Sampling locations for the proposed Fite Road ROW and the new ditch alignment were surveyed and marked in the field for accurate placement of soil borings. Sampling locations in the existing ditch were identified by existing landmarks and/or measured distances from Fite Road, and the proposed sewer line relocation boring located to the west of the Canadian National Railroad was identified by adjacent surface drainage features.

While surveying sampling locations, a bull-dozer was used to clear excessive growth and vegetation for drilling equipment access. Care was taken not to excessively disturb surface soil or slag identified on the former Chromasco site. No soils or other materials were removed from the site during this project.

## 5.2 Subsurface Sampling Activities

F&A representatives and a drilling subcontractor (Tri-State Testing Services, Inc.) mobilized a track-mounted hydraulic push probe to the site on October 5, 2009, to advance soil borings and collect soil and ground water samples.

### 5.2.1 Right-of-Way Sampling

On October 5-7, 2009, eight soil borings (CR-1 through CR-8, Figures 2 and 3) were advanced on the Chromasco property and three adjacent properties south of Fite Road. On October 5, 2009, Chromasco ROW borings CR-1, CR-2, and CR-3 were advanced in the proposed ROW behind the chain-link-fence along the southern border of the Chromasco property. On October 6, 2009, CR-4 was advanced in the proposed ROW on the north side of Fite Rd. on the Chromasco property adjacent to a surface drainage feature that originates on the Chromasco site, and CR-5 was advanced in the proposed ROW adjacent to the drainage feature to the south of Fite Rd. on the Grinder Fabricating property. On October 7, 2009, CR-6 was advanced in the proposed ROW on the Chromasco property south of the chain-link fence, and CR-7 and CR-8 were advanced in the proposed ROW to the south of Fite Rd. on the Grinder Fabricating and Memphis Ready Mix properties, respectively.

Two soil samples were submitted to the laboratory from soil borings conducted on the Chromasco property (CR-1, CR-2, CR-3, CR-4, and CR-6) to determine if subsurface impact is present. Shallow soil samples were collected from approximately 1-foot bgs and deeper samples were collected from the soil at the ground water interface (approximately 10-12 feet bgs). In boring CR-4, saturated

conditions were encountered at approximately 5-feet bgs, therefore; the soil from 4-feet bgs was sampled. Only shallow soil samples (approximately 1-foot bgs) were collected from soil borings conducted south of Fite Road (CR-5, CR-7, and CR-8).

Due to insufficient ground water in CR-1 on October 5, 2009, the temporary well was covered and left in place. F&A returned to the location on October 8, 2009, and collected the ground water samples at this location. Insufficient ground water also prohibited complete sampling of CR-3 on October 5, 2009. The sample for TAL metals was collected on October 5, 2009, and F&A returned to the location on October 8, 2009, to collect samples for cyanide, hexavalent chromium, and PCBs. All other water samples were collected on the date the borings/temporary wells were installed. Sampling locations are shown on Figure 2 and Figure 3.

### 5.2.2 New Ditch Alignment Sampling

Four soil borings were advanced along the surveyed alignment of the new ditch channel on October 7 and 8, 2009. New ditch sampling location ND-1 was advanced to the south of Fite Rd. on the MLGW property on October 7, 2009. ND-2, ND-3, and ND-4 were advanced along the proposed ditch alignment from east to west across the City of Memphis property and Chromasco property north of Fite Rd. ND-2 was advanced on October 7, 2009, and ND-3 and ND-4 were advanced on October 8, 2009. Two soil samples were submitted from each of the new ditch alignment sampling locations. Shallow soil samples were collected from approximately 1-foot bgs and deeper samples were collected from the soil at the expected excavation depth for the new ditch alignment (11-12 feet bgs).

Ground water was collected from the temporary well installed in boring ND-1 on October 7, 2009. Ground water in ND-2, ND-3, and ND-4 was sampled on October 8, 2009. Insufficient ground water prevented collection of cyanide and TAL metals samples from ND-3, and cyanide and hexavalent chromium were not sampled in ND-4. As with many of the sampling locations throughout the project, the wet silt collapsed into the borehole, preventing the installation of the temporary well to the full depth of the soil boring. Additional unsuccessful attempts were made to prevent the collapse in select locations; however, these attempts yielded the same results.

### 5.2.3 Sewer Line Relocation Sampling

Two soil borings were advanced along the alignment for the new sewer line on October 8, 2009. Soil boring SL-1 was advanced on the MLGW property north of Fite Rd. where the directional bore terminates and the surface excavation work begins. SL-3 was advanced on the W.R.Grace property to the west of the Canadian National Railroad where the directional bore originates. Proposed SL-2 was to be advanced at a turning point between two directional bore runs, but the location could not be accessed due to surface obstructions and the convergence of

drainage features in the area. Two soil samples were submitted to the laboratory from soil borings conducted for the sewer line relocation. Shallow soil samples were collected from approximately 1-foot bgs and deeper samples were collected from the soil at the ground water interface (7-feet bgs in SL-1, 10-feet bgs in SL-3).

Ground water samples were collected from both sewer line sampling locations (SL-1 and SL-2) on October 8, 2009.

### 5.2.4 MLGW Containment Outfall Sampling

Based on findings from the environmental study prepared for the MLGW Substation property (Tract No. 8) located south of Fite Rd., F&A used a hand auger to sample sediment located in the drainage pathway for the outfall of a storm water containment basin located on the substation property. This drainage pathway crosses a portion of property to be acquired for the access road to be constructed as part of the realignment project.

## 5.3 Surface Sampling Activities

Ditch water samples were collected from the existing ditch in six locations on October 12, 2009. D-1 and D-2 were collected south of Fite Rd., and D-3 was collected just north of Fite Rd. D-4 was collected to the west of D-3, and D-6 was collected at the confluence of the ditch and the drainage leading from the Chromasco property. D-5 was collected near the railroad where storm water conveyances along the railroad intersect the ditch. Soil was collected from the base of the existing ditch on October 13, 2009, using a hand-auger in the same six locations as the ditch water samples.

## 5.4 Deviations from the Approved Work Plan

As previously mentioned in Section 4.3, a hand auger was used to collect soil and sediment samples from the bottom of the existing ditch rather than the Geoprobe sampling barrel. Also, the easternmost sampling location along the proposed right of way shown in the Work Plan was not conducted because no additional ROW is required for construction in this area. As discussed in Section 5.2.3, sewer line sample location SL-2 was not conducted due to a lack of access to the area by surface drainage features. Insufficient ground water prevented collection of cyanide and TAL metals samples from ND-3. Cyanide and hexavalent chromium were not sampled in ND-4.

As mentioned in Section 5.2.4, an additional soil sample was collected from a containment outfall located within the access road ROW on the MLGW property (Tract No. 8).

As shown on the following table, the data completeness objective of 90 percent established in the approved work plan was achieved. The discrepancies included

the inability to access the middle sampling location along the proposed sewer line work, and a sampling location on the east end of the former Chromasco property was not required because no ROW acquisition is required in this area.

| Area of Concern | | Sediment / Soil | | Ground Water / Surface Water | | Completeness |
|---|---|---|---|---|---|---|
| | | Proposed | Actual | Proposed | Actual | |
| 1 | New ROW Sampling | 9[1] | 8 | 9[1] | 8 | 89% |
| 2 | New Ditch Channel | 4 | 4 | 4 | 4 | 100% |
| 3 | Existing Ditch | 6 | 6 | 6 | 6 | 100% |
| 4 | Sewer Line Relocation | 3 | 2 | 3 | 2 | 67% |
| QA/QC Field Duplicates | | | | 2 | 2 | 100% |
| **Project Data Completeness** | | | | | | 91% |

[1] – The approved Phase II Work Plan incorrectly listed 10 locations; however, only 9 were shown on the accompanying maps.

# 6.0 FINDINGS

## 6.1 Local Geology

In general, findings from soil borings indicate soft brown and/or gray silt from the surface to 4 to 9 feet bgs. Brown silt was present to boring termination depth in CR-5, CR-6, and SL-1. In the remaining borings, the brown silt was primarily underlain by gray and/or brown clayey silt. Gray, brown or dark gray clay was present from depths ranging from 4 to 12 feet bgs in CR-4, ND-1, ND-2, and SL-2. Geologic Boring logs are included in Appendix B.

## 6.2 Soil Sampling Results

Laboratory analytical results for PCBs in soil were below laboratory detection limits in all soil samples submitted to the laboratory. Cyanide [0.41 parts per million (ppm)] was detected in the sample collected from 1-foot bgs in soil boring CR-4, and hexavalent chromium (2.3 ppm) was detected in the sample collected from 1-foot bgs in CR-3. These results are below the EPA Regional Screening Levels (RSLs) for Industrial Soils, (November 2011) of 20,000 ppm and 5.6 ppm, respectively.

TAL metals analysis indicated several metals concentrations in all soil samples submitted to the laboratory. Each of the positive results was below the RSL, with the exception of arsenic (1.6 ppm). Arsenic concentrations ranged from below detection limits to 15 ppm. The sample containing 15 ppm arsenic was collected from 2 ft. bgs in sample location SL-1. All other arsenic concentrations ranged from below detection limits to 10 ppm. Arsenic concentrations detected in the

soil samples are within range of naturally occurring background arsenic levels in western Tennessee. According to a Tennessee Division of Superfund Survey cited in the "Hazardous Trace Elements in Tennessee Soils and Other Regolith" completed by the TDEC Division of Geology in 2001, the naturally occurring background level of arsenic in Tennessee is 10 ppm. Furthermore, a TDEC Solid Waste Management Memo, dated July 18, 2006, stated that natural levels up to 20 ppm of As are not uncommon in Tennessee soils. Therefore, the arsenic concentrations observed during the Phase II ESA do not appear to be a concern to the subject property.

Due to laboratory dilution, the laboratory detection limit (<5.0 ppm) exceeded the RSL for arsenic (1.6 ppm) in the samples collected from ND-1 (11-feet bgs), ND-2 (11-feet bgs), and ND-3 (11-feet bgs). Since this detection limit is below the naturally occurring background level of up to 20 ppm, the arsenic concentrations (if present) would be below the background concentration. Soil analytical results are summarized on Table 1, included in Appendix C. Laboratory reports (copies) are included in Appendix D.

## 6.3 Sediment Sampling Results

Laboratory analytical results for PCBs and hexavalent chromium were below laboratory detection limits in all sediment samples submitted to the laboratory. Results for the oil and PCB related constituents in the MLGW outfall were also below detection limits. Cyanide (0.26 ppm) was detected in the sediment sample collected from the existing ditch in location D-4. Laboratory results for sediment were compared with the EPA Region 4 Ecological Screening Values for Sediment (ESVs), dated November 30, 2001. As of April 26, 2012, the Sediment ESVs have not changed, based upon online searches of the EPA Region 4 website. No standard for cyanide was available, and this low concentration is not expected to present a concern to the subject property.

Several TAL metals constituents were detected in the sediment samples submitted to the laboratory; however, all concentrations were below the applicable Sediment ESVs, if established, with the exception of nickel in D-2 (24 ppm) and D-3 (22 ppm). The Sediment ESV for nickel is 15.9 ppm. The nickel concentration in the thirty soil and sediment samples collected from the area during the Phase II ranged from 5.6 ppm to 44 ppm, indicating the nickel concentrations in the D-2 and D-3 sediment samples are within the expected background levels for the area. Additionally, the Soil ESV for nickel is 30 ppm, which the ditch sediment samples are below. Sediment analytical results are summarized on Table 2, included in Appendix C. Laboratory reports (copies) are included in Appendix D.

## 6.4 Ground Water Sampling Results

Laboratory analytical results for cyanide and PCBs were below laboratory detection limits in each of the ground water samples submitted to the laboratory

for analysis. Hexavalent chromium (0.012 ppm) was detected in the sample collected from CR-2; however, there is no established Maximum Contaminant Level (MCL) for hexavalent chromium for comparison of this result. The groundwater sample concentration is below the MCL for Chromium (Total) of 0.1 ppm.

A number of metals were detected in the ground water samples submitted to the laboratory for analysis, with several of the metals concentrations exceeding the MCLs. These elevated concentrations were detected in unfiltered samples analyzed for total metals by the laboratory. Excessive sediment was present in the ground water samples due to the slow recharge rate of the ground water, the fine particle size of near-surface soils and the nature of temporary wells. Because metals tend to adsorb onto soil particles, excessive sediment could have contributed to the elevated results.

Upon review of the results, the backup samples collected in the field were filtered in the laboratory and analyzed for the select constituents that exceeded MCLs to determine if sediment interference contributed to the results. Dissolved metal concentrations for the select constituents analyzed in the filtered samples were below their respective MCLs. Since the time of the investigation, a MCL for Chromium has been established at 0.1 ppm. The Chromium concentrations in groundwater from most of the unfiltered samples exceed this MCL. Since there was not a MCL listed in the table at the time of the investigation, Chromium was not one of the reanalyzed parameters for the filtered samples, however it was analyzed in three of the filtered samples, (ND-2, duplicate of SL-1, and SL-3) where the filtered sample was analyzed for the full list of TAL metals. All of these samples showed no detectable concentration of Chromium with a detection limit one order of magnitude below the latter established Chromium MCL.

Ground water analytical results are summarized on Table 3, included in Appendix C. Laboratory reports (copies) are included in Appendix D.

## 6.5 Surface Water Sampling Results

Cyanide, hexavalent chromium, and PCB concentrations were below laboratory detection limits for the surface water samples submitted to the lab. Several TAL Metal concentrations were detected; however, the majority were below the ESV for surface water. Concentrations of aluminum exceeded the ESV of 0.087 ppm in each of the surface water samples collected (0.21 to 0.80 ppm), and iron exceeded the ESV of 1.000 ppm in sample D-2 (1.2 ppm). The aluminum and iron concentrations in the surface water are believed to be background related levels. As of April 26, 2012, the Freshwater Surface Water ESVs have not changed, based upon online searches of the EPA Region 4 website.

Surface water analytical results are summarized on Table 4, included in Appendix C. Laboratory reports (copies) are included in Appendix D.

## 6.6 W.R. Grace Right-of-Way

Fite Road ROW plans (Figure 4 and 5) show the location of several monitoring wells associated with the W.R. Grace ground water monitoring project located within the ROW, slope easement, and construction easement for the realignment project. The W.R. Grace project manager (Mr. Robert Medler) was contacted regarding these wells, and it was confirmed that all but long term monitoring well MW-E5D are out of use and have been closed. Monitoring well MW-E5D is located within the construction easement on the south side of the proposed Fite Road. Construction plans will be specific to insure this monitoring well is protected during the construction phase of the project. The construction plans will also specify to inspect the closed monitoring wells when encountered during construction to insure the grout is not compromised thus opening a pathway to the subsurface.

Results from the July 2008 Ground Water Sampling Results and Five-Year Natural Bioattenuation Review prepared by URS (December 8, 2008) were reviewed during a file review conducted at the TDEC Memphis Environmental Field Office. In addition to this report, a separate Estimated Plume Delineation, Well Identification Map dated September 8, 2008 (prepared by URS) was provided by the W.R. Grace project manager. These documents show volatile organic compound (VOC) ground water contamination from the W.R. Grace site underlies a portion of the ROW for the new Fite Rd. alignment. ROW plans indicate 5.4 acres (approximately 235,000 S.F.) of the W.R. Grace property (Tract No. 5) will be acquired for permanent ROW. Of this total, approximately 17,000 S.F. overlie the estimated contaminant plume as shown on Figure 6.

The presence of dissolved VOC concentrations in the ground water could lead to subsurface vapors. The presence of these vapors could accumulate in excavations. ROW plans indicate some minor excavation work for roadside drainage along the north side of the new Fite Rd. alignment overlying the dissolved VOC plume. If these excavations are to be entered by construction workers during the construction phase, VOC vapor monitoring will be prescribed.

## 6.7 Data Quality Objectives

In accordance with the approved work plan, two duplicate ground water samples were collected in the field and analyzed in the laboratory. The sample labeled CRW-11 is a duplicate of CRW-4. Metals were not analyzed in the duplicate because sedimentation issues can prohibit reproducibility of data; however, all other parameters were below detection limits in both the duplicate and the parent sample. NDW-5 is a duplicate of SLW-1. Cyanide, hexavalent chromium, and PCBs were below detection limits in both the duplicate and the parent sample. Metals analyzed from NDW-5 were filtered in the laboratory and metals from SL-

1 were analyzed as unfiltered samples; therefore, comparison of these results was not conducted.

Laboratory Quality Control data is included on the laboratory analytical reports included in Appendix D. Several samples were diluted due to matrix interference, which led to elevated detection limits. These elevated detection limits remained below the MCL for ground water, or the RSL for soil with the exception of antimony and thallium in ground water from CRW-4, selenium in ground water from CRW-7 and CRW-8, and arsenic in soil in NDS-1 (11 ft. bgs), NDS-2 (11 ft. bgs), and NDS-3 (11 ft. bgs). Antimony and thallium in CRW-4 and selenium in CRW-7 and CRW-8 were filtered and re-analyzed by the laboratory by method 6020B to lower the detection limit, and the new detection limit was below the respective MCLs. As stated in Section 6.2, the laboratory detection limit (<5.0 for arsenic in soil in NDS-1 (11 ft. bgs), NDS-2 (11 ft. bgs), and NDS-3 (11 ft. bgs) was above the RSL of 1.6 ppm, however, this detection limit is below the naturally occurring background level of up to 20 ppm for arsenic in Tennessee.

Surrogate recovery limits were exceeded in sample CRS-1 (1 ft. bgs) and CRS-3 (1 ft. bgs and 11 ft. bgs). The results for each of these samples was within the range of other samples collected in the area during the project; therefore, the results are expected to be representative of site conditions.

Sample matrix interference resulted in a low spike value in hexavalent chromium in CRS-5 (1 ft. bgs), NDS-3 (1 ft. bgs), and DBS-2 (0-1 ft. bgs), and cyanide in CRW-4. The associated batch QC was outside the established range for precision for hexavalent chromium in DBS-2 (0-1 ft. bgs). Each of these results was below the laboratory detection limit, which was below the respective MCL or RSL; therefore, these QC failures are not expected to significantly affect the results.

The ground water sample labeled CRW-5 did not pass laboratory QA/QC for analysis of hexavalent chromium on October 7, 2009, and was re-analyzed on October 8, 2009; thus, the sample was reportedly analyzed outside the 24-hour hold time. The sample result was below laboratory detection limits. Total chromium in the TAL metals analysis was also below laboratory detection limits; therefore, hexavalent chromium is not expected to be present above detection limits.

## 7.0 CONCLUSIONS/RECOMMENDATIONS

Findings from samples collected during the Phase II ESA do not indicate significant environmental impact to the subsurface in the areas of proposed ROW studied. Arsenic concentration in many of the soil samples exceeded the RSL; however, the results are within the range of naturally occurring background arsenic levels in Tennessee (up to 20 ppm). Several metals exceeded the MCL in unfiltered ground water samples collected; however, after filtering out sediment in the laboratory, the results were below the MCLs.

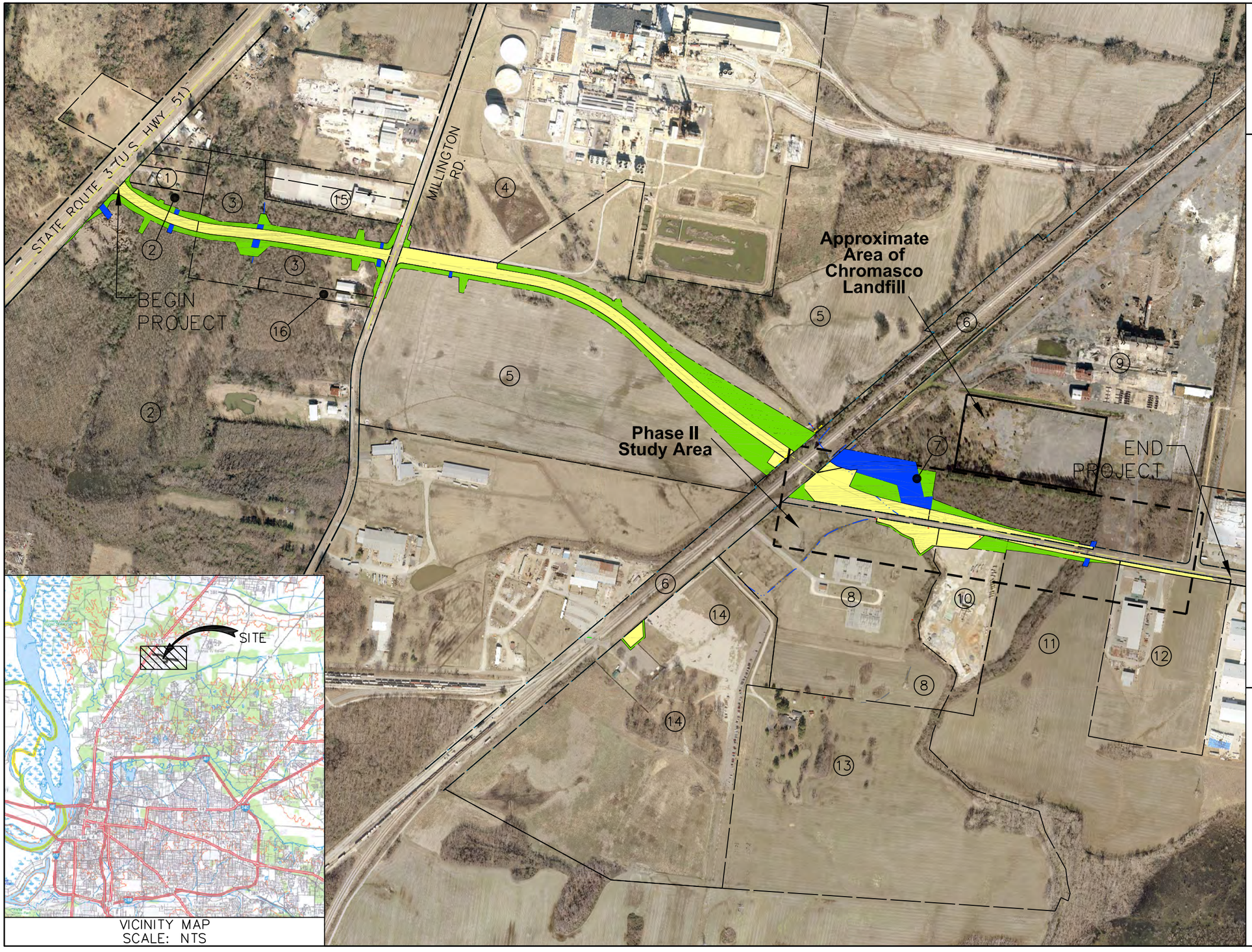
One active ground water monitoring well is located within the proposed construction easement on the W.R. Grace property (Tract No. 5). Construction plans should address the protection of this well, and construction supervisors and equipment operators should be made aware of the location to insure the integrity of the well is not compromised. Other inactive monitoring wells in the ROW that have been plugged with cement/bentonite grout should be inspected to insure the plug material is not damaged, if they are encountered during construction.

The presence of dissolved VOC concentrations in the ground water could lead to subsurface vapors. The presence of these vapors could accumulate in excavations. ROW plans indicate some minor excavation work for roadside drainage along the north side of the new Fite Rd. alignment overlying the dissolved VOC plume. If these excavations are to be entered by construction workers during the construction phase, VOC vapor monitoring will be prescribed.

The data suggests that no widespread contamination has been identified in the project area, based upon the analysis of the selected soil, sediment, and ground water samples. However, the potential exists that very localized soil or sediment samples may exhibit elevated levels of contaminants. Shelby County Government will seek written concurrence of these findings from the Tennessee Department of Environment and Conservation prior to property acquisitions.

# APPENDIX A

# FIGURES




FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists
A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive
Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115
Web: www.fisherarnold.com

# Figure 1
# FITE ROAD PROPERTY ACQUISITION STUDIES

TRANSACTION SCREEN (ASTM 1528-06)
1. LEE M. MOORE
2. E.I. DUPONT DE NeMOURS & Co.
4. ARCADIAN FERTILIZER, L.P.
8. CITY OF MEMPHIS
10. BUZZI UNICEM READY MIX LLC
11. GRINDER FABRICATORS
12. JIMMY R. GRINDER ET. AL.
13. BLAND FARMS LLC
14. ROBERT D. POOLE AND GLORIA POOLE

PHASE I ESA (ASTM 1527-05)
3. B & J MACHINE WORKS
5. W.R. GRACE & CO.
7. CITY OF MEMPHIS
9. TIMMINCO CORPORATION

PHASE II ESA
7. CITY OF MEMPHIS
9. TIMMINCO CORPORATION

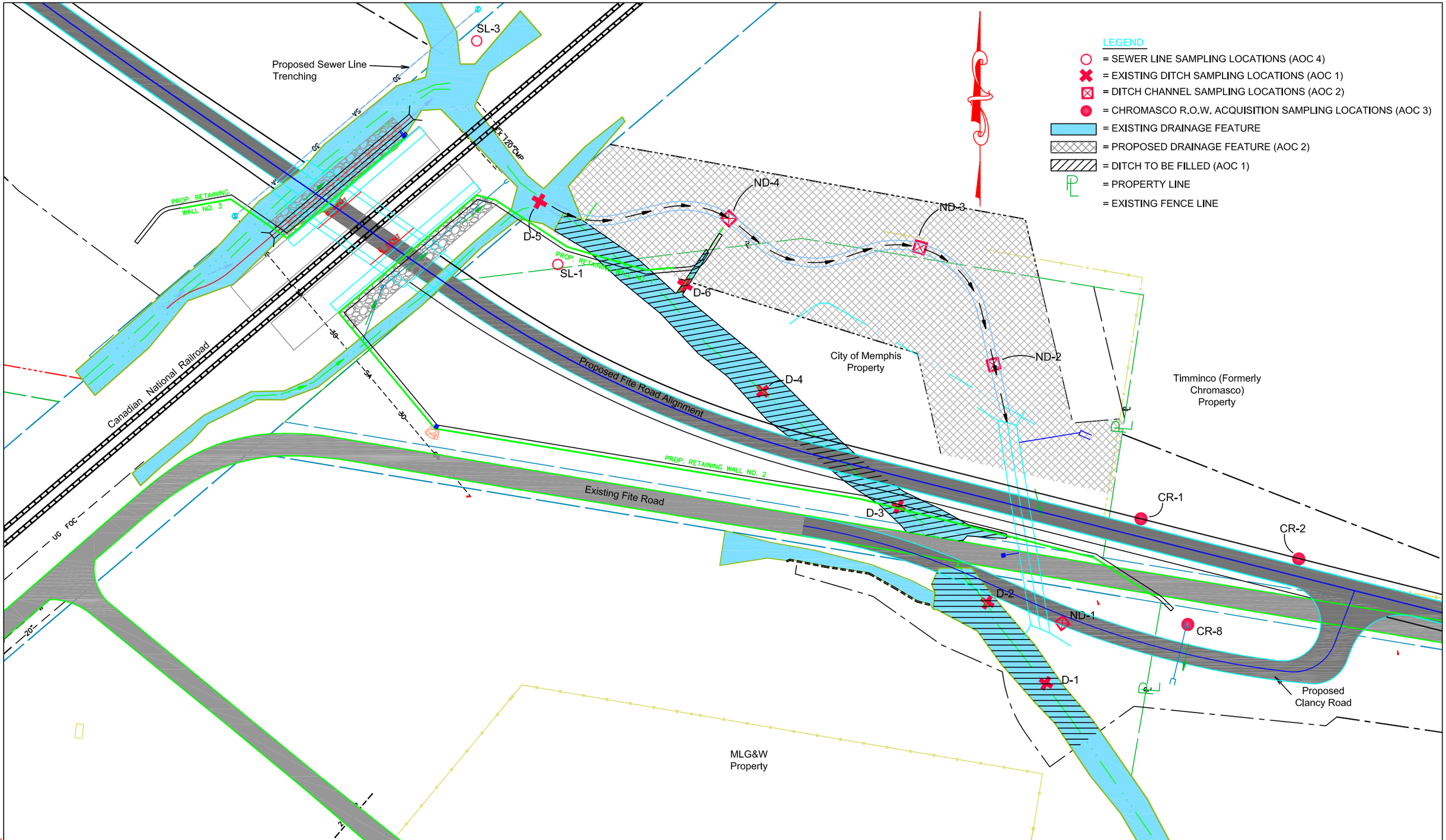
FILE REVIEW OF EXISTING ASSESSMENT & MNA DATA
5. W.R. GRACE & CO.

NO TECHNICAL STUDIES
(CONSTRUCTION EASEMENT ONLY THEREFORE NO PERMANENT ACQUISITION)
15. K&L HOLDINGS LLC
16. JAMES E. LAMB

LEGEND
- DRAINAGE FEATURES
- R.O.W. ACQUISITION
- DRAINAGE EASEMENTS
- SLOPE / CONSTRUCTION EASEMENTS

N

GRAPHIC SCALE
( IN FEET )
0 300 600
1 inch = 600 ft.




SHELBY COUNTY GOVERNMENT

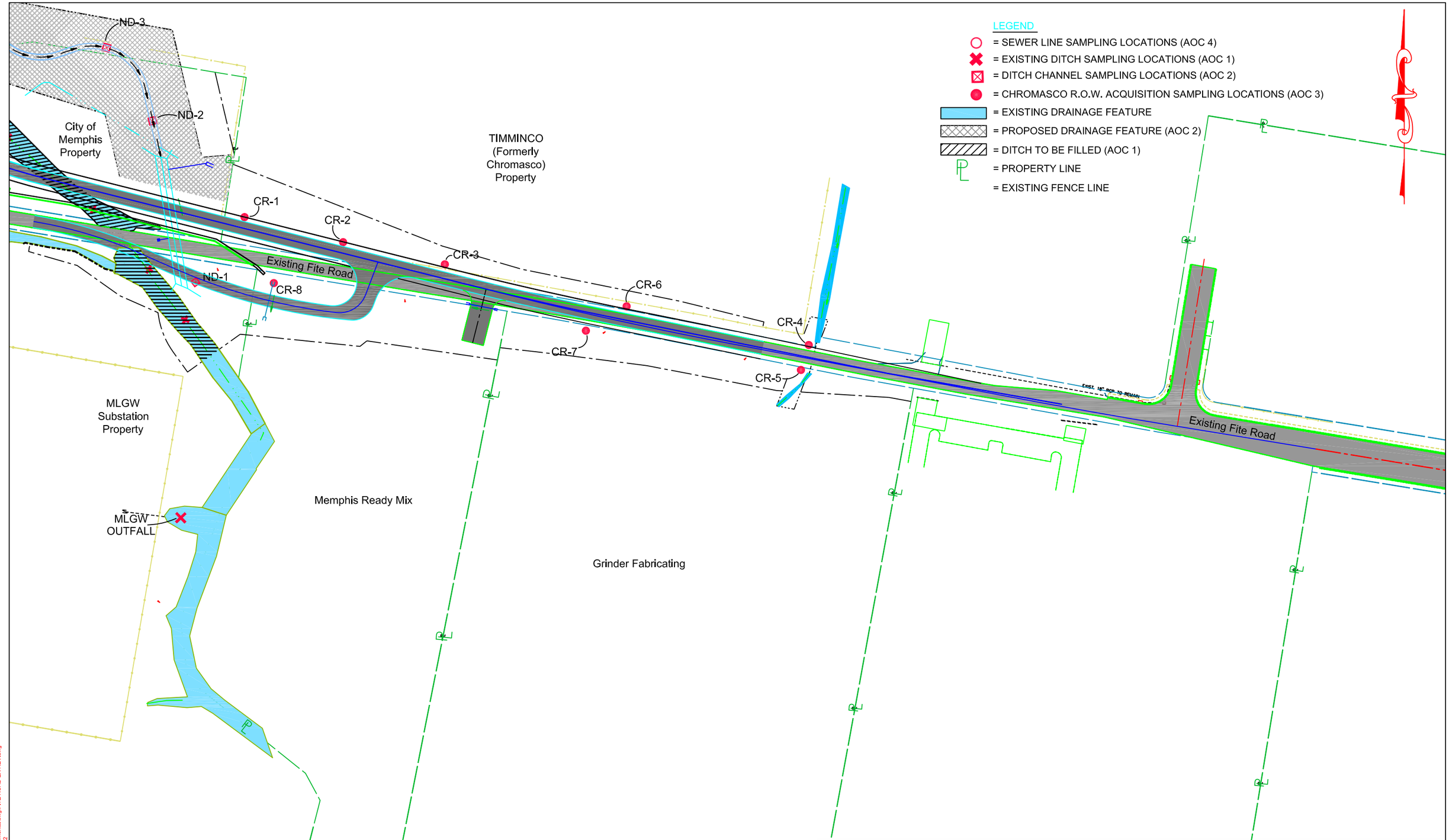
FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115 • Web: www.fisherarnold.com

PROJECT NUMBER G7193

DITCH AND SANITARY SEWER RELOCATION SAMPLING LOCATIONS
May, 2012

FIGURE 2

Filename: W:\0-Environmental\dwg\FITE ROAD EX REV.dwg
Layout: FIG 2, 5/03/2012




SHELBY COUNTY GOVERNMENT

FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115 • Web: www.fisherarnold.com

PROJECT NUMBER G7193

R.O.W. SAMPLING LOCATIONS
May, 2012

FIGURE 3

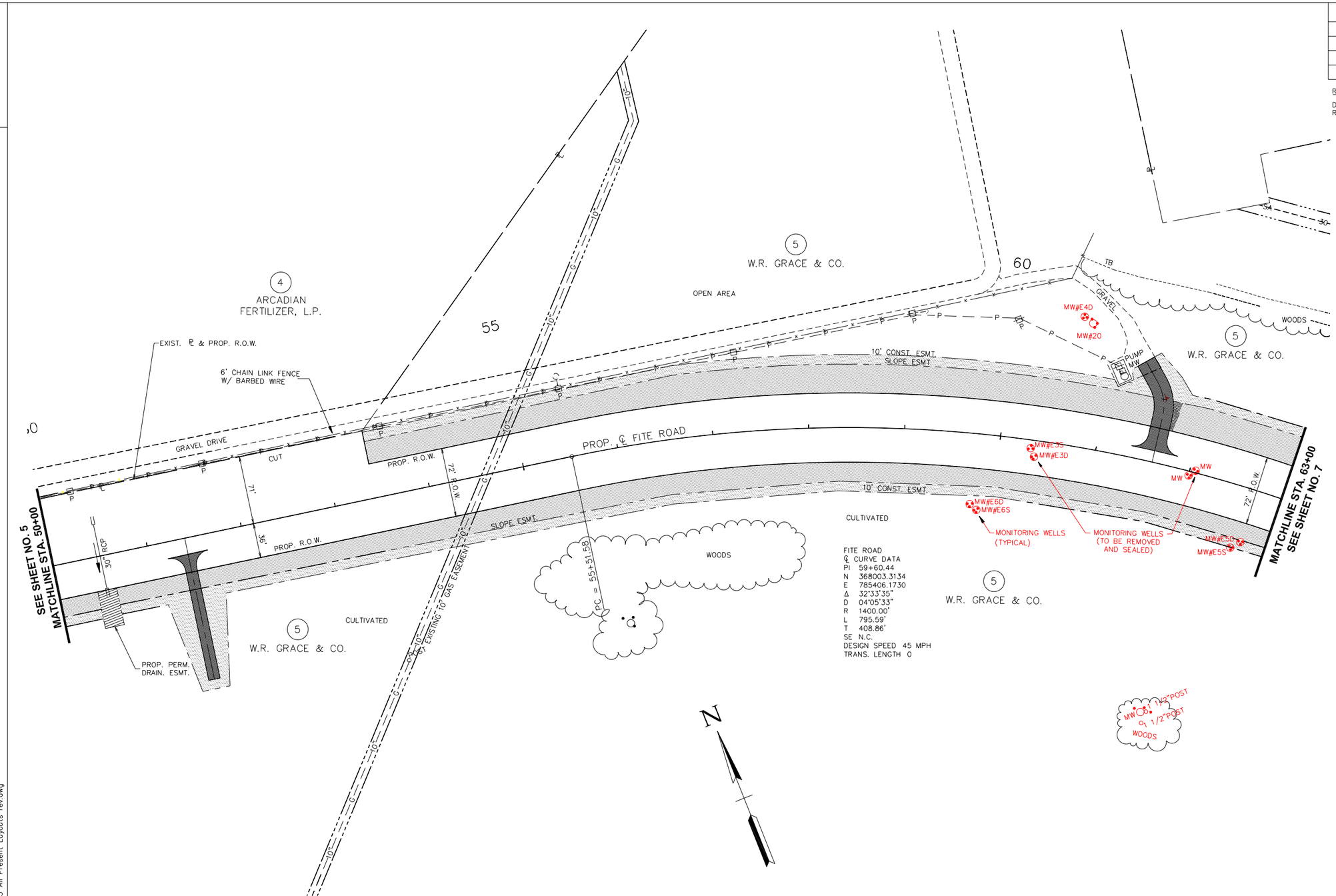
Filename: W:\00-Environmental\dwg\FITE ROAD EX REV.dwg
Layout: FIG 3, 5/03/2012

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

| TYPE | YEAR | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| R.O.W. | 2012 | STP-M-7900(29) | 4 |
| | | | |
| | | | |
| | | | |

REVISIONS:

DATE: 02/24/2012
REVISED FITE ROAD TYPICAL SECTIONS.




SHELBY COUNTY GOVERNMENT

FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115 •Web: www.fisherarnold.com

PROJECT NUMBER G7193

W.R. GRACE MONITORING WELL LOCATIONS
FITE ROAD R.O.W. & EASEMENTS
May, 2012

FIGURE 4

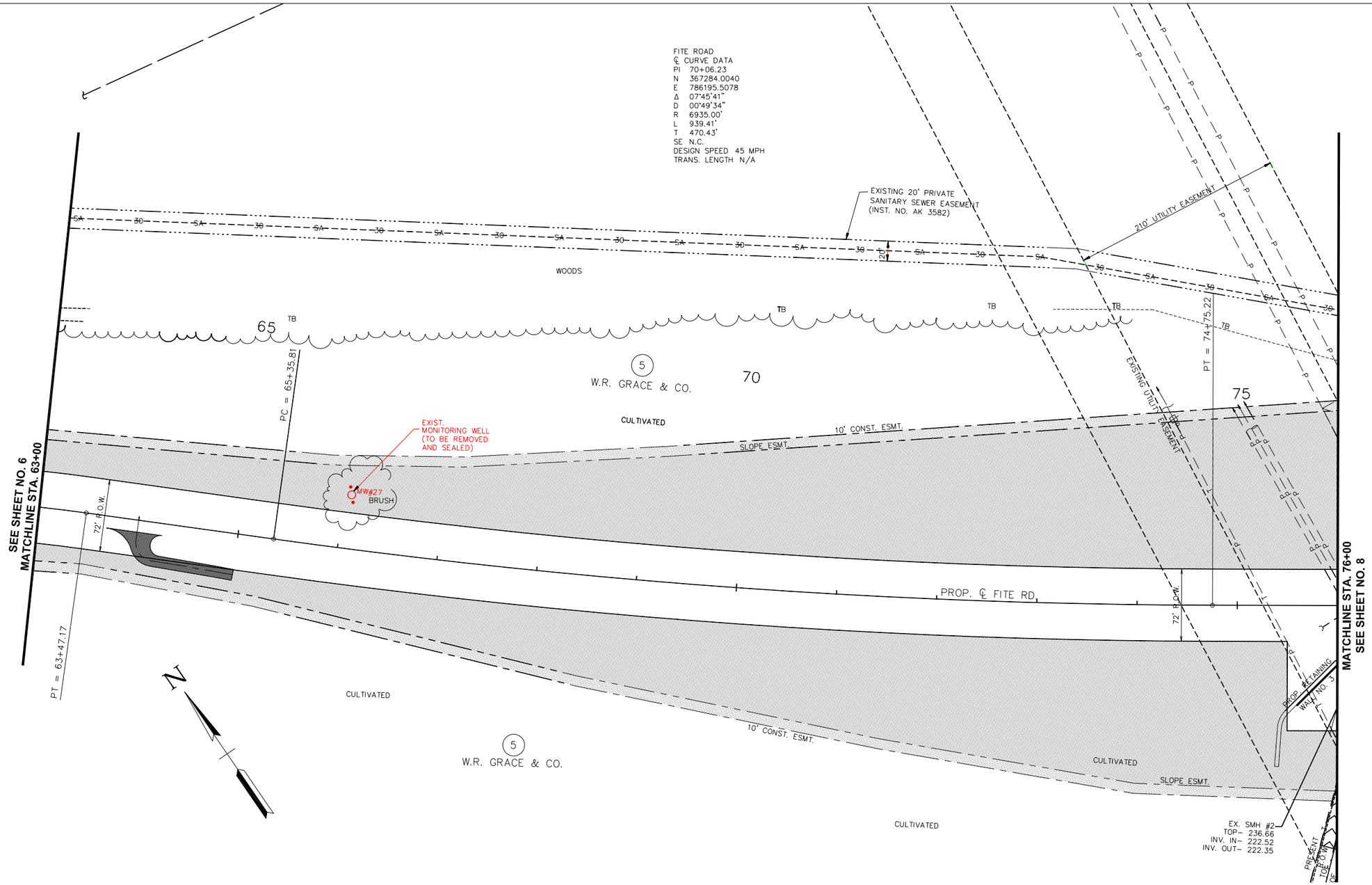
5/03/2012
W:\00-Environmental\dwg\6513 All Present Layouts rev.dwg

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

| TYPE | YEAR | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| R.O.W. | 2012 | STP-M-7900(29) | 5 |
| | | | |
| | | | |
| | | | |

REVISIONS:

DATE: 02/24/2012
REVISED FITE ROAD TYPICAL SECTIONS.




SHELBY COUNTY GOVERNMENT

FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115 •Web: www.fisherarnold.com

PROJECT NUMBER G7193

W.R. GRACE MONITORING WELL LOCATIONS
FITE ROAD R.O.W. & EASEMENTS
May, 2012

FIGURE 5

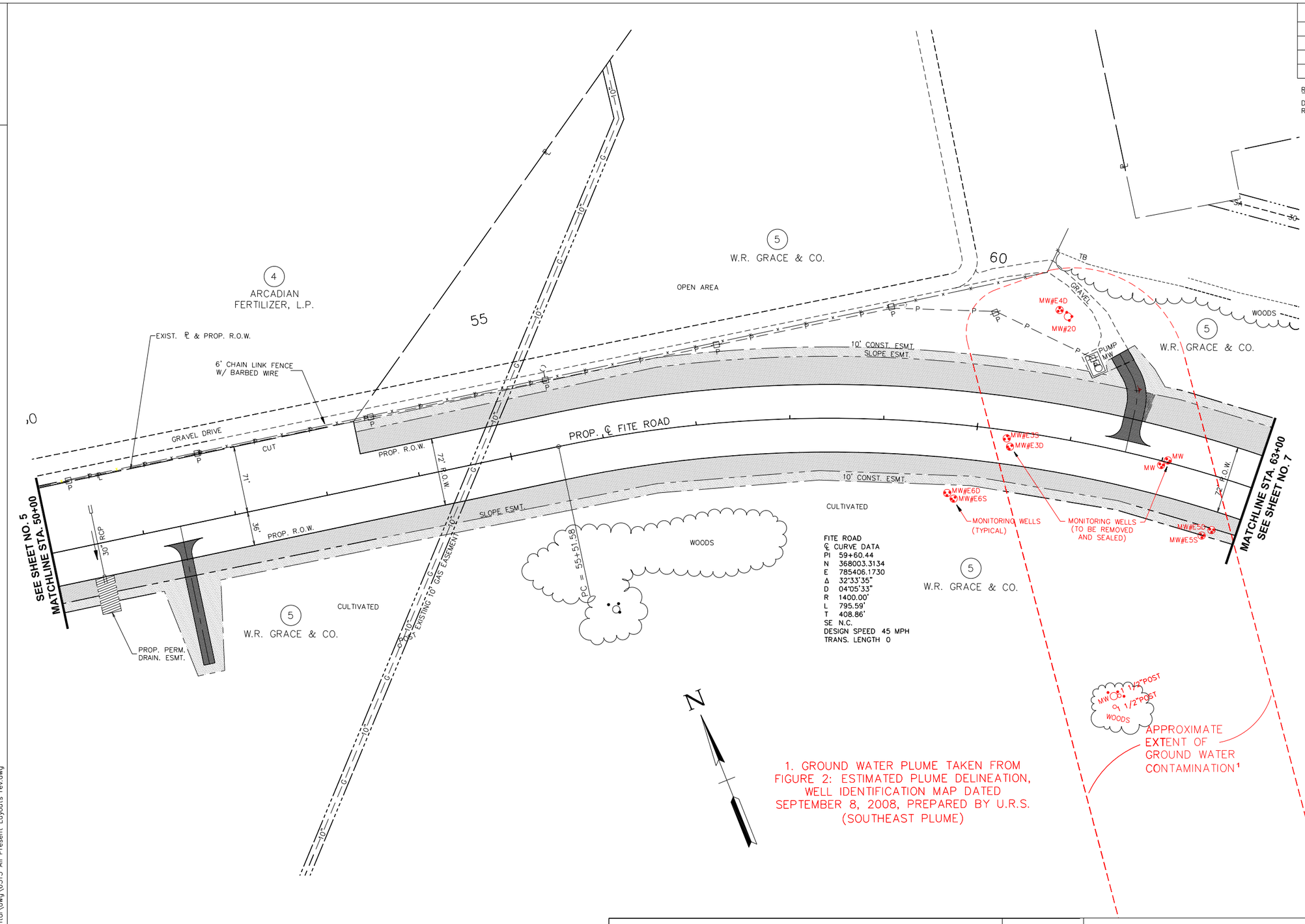
5/03/2012
W:\00-Environmental\dwg\6513 All Present Layouts rev.dwg

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

| TYPE | YEAR | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| R.O.W. | 2012 | STP-M-7900(29) | 6 |
| | | | |
| | | | |
| | | | |

REVISIONS:

DATE: 02/24/2012
REVISED FITE ROAD TYPICAL SECTIONS.




1. GROUND WATER PLUME TAKEN FROM FIGURE 2: ESTIMATED PLUME DELINEATION, WELL IDENTIFICATION MAP DATED SEPTEMBER 8, 2008, PREPARED BY U.R.S. (SOUTHEAST PLUME)

SHELBY COUNTY GOVERNMENT


FISHER & ARNOLD ENVIRONMENTAL
Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125-8538
888-583-9724 Fax: 901-748-3115 •Web: www.fisherarnold.com


PROJECT NUMBER G7193

APPROXIMATE W.R. GRACE PLUME EXTENT
May, 2012

FIGURE 6

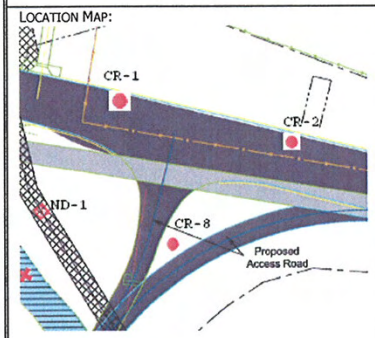
5/03/2012
W:\00-Environmental\dwg\6513 All Present Layouts rev.dwg

# APPENDIX B

# GEOLOGIC BORING LOGS

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-1 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 5, 2009

COMP DATE & TIME: October 5, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

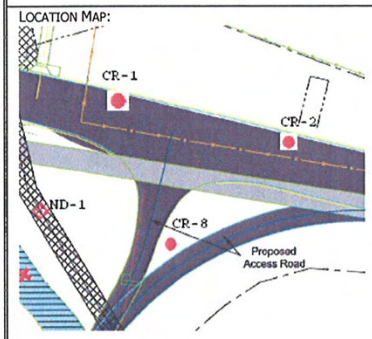
T.D. (MSL):

COMMENTS: temporary well set at 13 ft-bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0 | | | X | SILT: some clay, moist, brown |
| | | | | 5 | | | | | | CLAYEY SILT: firm, tan |
| | | | | | | | | | | soft, tan and orange |
| | | | | 10 | | | | | | light grey & orange, mottled, soft, wet |
| | | | | | | 0.0 | | | X | |
| | | | | 15 | | | | | | |
| | | | | | | | | | | mod. firm |
| | | | | 20 | | | | | | sl. wet, firm |
| | | | | | | | | | | very wet, tan |
| | | | | 25 | | | | | | CLAY: grey, firm, moist, high plasticity |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-2 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 5, 2009

COMP DATE & TIME: October 5, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

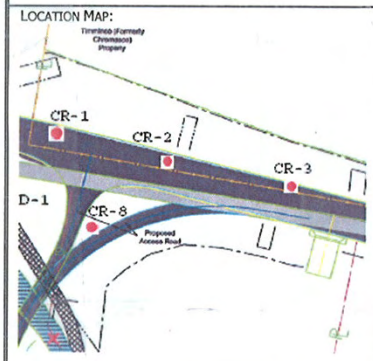
T.D. (MSL):

COMMENTS: temporary well pt. set at 20 ft-bgs
DTW: 8.65'

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0 | | | X | SILT: some clay, soft, dry, brown |
| | | | | 5 | | | | | | CLAYEY SILT: brown, soft, sl. moist |
| | | | | 10 | | | | | | lt. grey, brown, mottled, wet, soft |
| | | | | | | | | | X | SILT: some clay, soft, sl. wet |
| | | | | 15 | | | | | | |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-3 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 5, 2009

COMP DATE & TIME: October 5, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

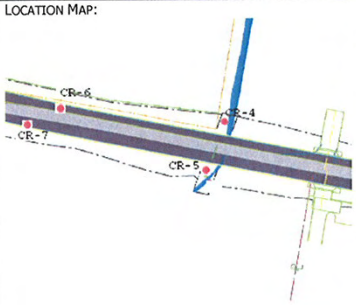
T.D. (MSL):

COMMENTS: temporary well pt. set at 20 ft-bgs
6' of water in hole

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Samples & Cores: Int/Rec | Samples & Cores: Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | X | SILT: brown-gray, soft, dry<br>sl. moist |
| | | | | 10 | | | | | | CLAYEY SILT: gray, sl. moist soft |
| | | | | 15 | | | | | X | lt. grey: brown, mottled, wet, soft |
| | | | | 20 | | | | | | brown<br>firm, moist |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME **FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN** | FAC ID# **VOAP # 79-865** | WELL# &/OR BORING CR-4 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 6, 2009

COMP DATE & TIME: October 6, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

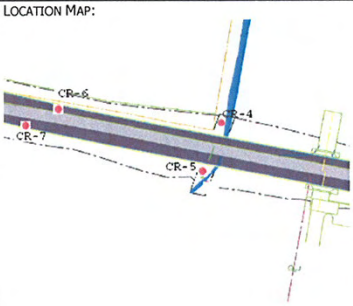
T.D. (MSL):

COMMENTS: temporary well point set at 15 ft-bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Samples & Cores: Int/Rec | Samples & Cores: Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | 0.2<br>0.0 | | | X<br>X | SILT: brown, soft, wet, 3" gravel |
| | | | | 10 | | | | | | CLAY: gray, med. soft, slightly moist firm |
| | | | | 15 | | | | | | SILTY CLAY: light grey, brown, mottled, med. soft, sl. moist |
| | | | | 20 | | | | | | firm |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME **FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN** | FAC ID# **VOAP # 79-865** | WELL# &/OR BORING CR-5 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 6, 2009

COMP DATE & TIME: October 6, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

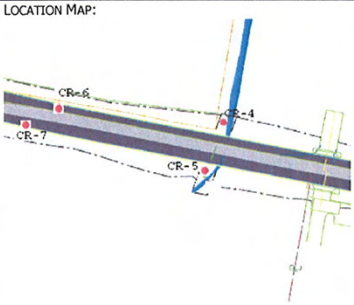
T.D. (MSL):

COMMENTS: temporary well pt. set at 12 ft-bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0 | | | X | SILT: brown, soft, dry |
| | | | | 5 | | 0.0 | | | X | |
| | | | | 10 | | | | | | grey, wet |
| | | | | 15 | | | | | | |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-6 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 7, 2009

COMP DATE & TIME: October 7, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

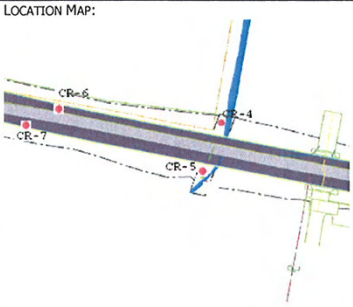
T.D. (MSL):

COMMENTS: temporary well pt. set at 24 ft bgs
DTW 16.8'

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | 0.0 | | | X | SILT: brown, soft, moist some clay |
| | | | | 10 | | 0.0 | | | X | wet |
| | | | | 15 | | | | | | some clay, very moist, brown + grey, mottled wet, brown |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-7 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 7, 2009

COMP DATE & TIME: October 7, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

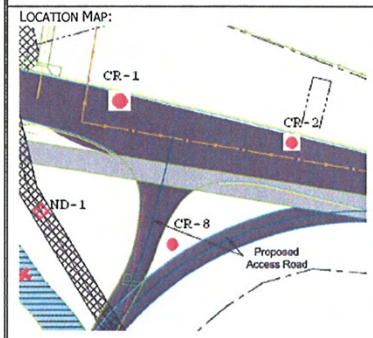
T.D. (MSL):

COMMENTS: temporary well point set at 20 ft bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | 0.0 | | | X | SILT: brown, firm, dry |
| | | | | 10 | | | | | | sl. moist<br>CLAYEY SILT: brown, soft, moist |
| | | | | 15 | | | | | | wet |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | moist |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING CR-8 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 7, 2009

COMP DATE & TIME: October 7, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

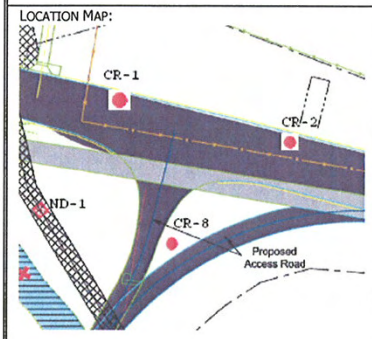
T.D. (MSL):

COMMENTS: temporary well point set at 13 ftbgs
DTW: 6.66'

| MSL | Completion Diagram / Borehole Diameter: | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0 | | | X | SILT: grey, soft, wet dry brown |
| | | | | 5 | | | | | | grey and brown, v. moist some clay |
| | | | | 10 | | | | | | CLAYEY SILT: brown, soft, v. moist - wet |
| | | | | 15 | | | | | | |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING ND-1 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 7, 2009

COMP DATE & TIME: October 7, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

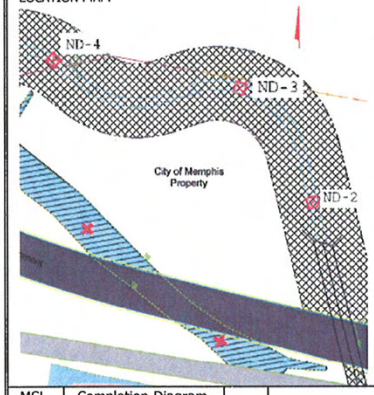
T.D. (MSL):

COMMENTS: temporary well pt. set at 13 ~~ft~~-bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | [redacted] | | | | | 0.0 | | | X | SILT: brown, dry, soft, moist |
| | | | | 5 | | | | | | CLAY: dark grey, sl. moist, hard |
| | | | | 10 | | | | | | SILT: grey, soft, moist |
| | | | | 15 | | 0.0 | | | X | |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING ND-2 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 7, 2009

COMP DATE & TIME: October 7, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

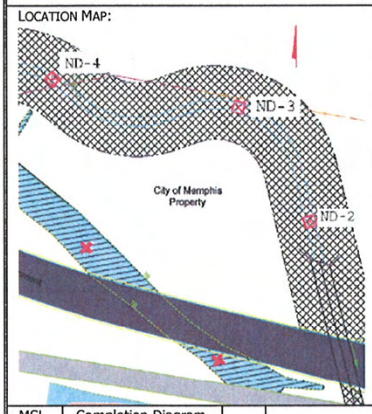
T.D. (MSL):

COMMENTS:

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | X | SILTY CLAY: brown, wet, soft |
| | | | | 10 | | | | | | CLAY: lt. brown, sl. brown, firm, moist<br>SILTY CLAY: mottled, v. moist, soft |
| | | | | 15 | | | | | X | Very wet |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING ND-3 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 8, 2009

COMP DATE & TIME: October 8, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

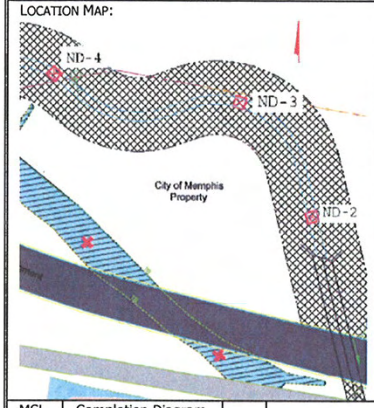
T.D. (MSL):

COMMENTS: temporary well pt. set @ 20 ft-bgs

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | X | SILT: brown, soft, moist<br>grey<br>sl. moist |
| | | | | 10 | | | | | | CLAYEY SILT: grey, sl. moist |
| | | | | 15 | | | | | X | SILT: grey, wet, soft<br>very moist |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | CLAY: grey, hard, moist |
| | | | | 30 | | | | | | |

| FACILITY NAME **FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN** | FAC ID# **VOAP # 79-865** | WELL# &/OR BORING ND-4 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 8, 2009

COMP DATE & TIME: October 8, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

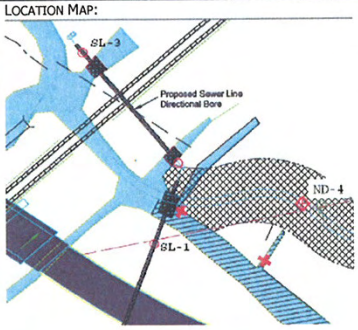
T.D. (MSL):

COMMENTS:

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Samples & Cores: Int/Rec | Samples & Cores: Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | | SILT: brown, wet, soft sl. moist, grey<br>CLAYEY SILT: brown, |
| | | | | 10 | | | | | | med. soft, sl. moist<br>grey<br>very moist |
| | | | | 15 | | | | | | SILT: brown & grey, mottled, wet, soft |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | SILTY CLAY: grey, soft, wet<br>SILTY SAND: gray, fine |
| | | | | 30 | | | | | | SILTY CLAY: grey, soft, moist |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING SL-1 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 8, 2009

COMP DATE & TIME: October 8, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

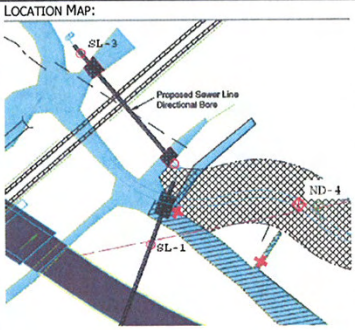
T.D. (MSL):

COMMENTS: temporary well point set

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | X | SILT: brown, soft, moist |
| | | | | 10 | | | | | X | wet |
| | | | | 15 | | | | | | |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

| FACILITY NAME FITE ROAD REALIGNMENT PROJECT, SHELBY COUNTY, TN | FAC ID# VOAP # 79-865 | WELL# &/OR BORING SL-3 | PG 1 OF 1 |
|---|---|---|---|

LOCATION MAP:




START DATE & TIME: October 8, 2009

COMP DATE & TIME: October 8, 2009

LOGGED BY: K. Yarrow, P.G.

DRILLER: Tri-State Testing Services, Inc.

DRILLING METHOD: Geoprobe

ELEV (MSL):

T.D. (MSL):

COMMENTS: temporary well pt. set

| MSL | Completion Diagram / Borehole Diameter: 2" | Water Level | Penetration Rate | Depth | Graphic Lithology | OVD | Samples & Cores: Type | Int/Rec | Anal | Description (Color, Texture, Structure, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | X | SILT: brown, soft, moist<br>gray, dry<br>brown, sl. moist<br>CLAY: dark gray-brown, hard |
| | | | | 10 | | | | | X | light brown, some silt<br>SILTY CLAY: light grey, wet, soft<br>mottled<br>lt. brown - orange<br>brown |
| | | | | 15 | | | | | | gray |
| | | | | 20 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 30 | | | | | | |

# APPENDIX C

# TABLES

**Table 1**
**Soil Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location:** | | CR-1 | | CR-2 | | CR-3 | | CR-4 | | CR-5 | CR-6 | | CR-7 | CR-8 | ND-1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **RSLs** | FITE-CRS-1 | | FITE-CRS-2 | | FITE-CRS-3 | | FITE-CRS-4 | | FITE-CRS-5 | FITE-CRS-6 | | FITE-CRS-7 | FITE-CRS-8 | FITE-NDS-1 | |
| **Depth:** | | 1ft | 12 ft | 1 ft | 10 ft | 1 ft | 11 ft | 1 ft | 4 ft | 1 ft | 1 ft | 10 ft | 1 ft | 1 ft | 1 ft | 11 ft |
| **Collect Date:** | | 10/5/2009 | 10/5/2009 | 10/5/2009 | 10/5/2009 | 10/5/2009 | 10/5/2009 | 10/6/2009 | 10/6/2009 | 10/6/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 |
| Cyanide | **20,000** | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | 0.41 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 |
| Chromium,Hexavalent | **5.6** | <2.0 | <2.0 | <2.0 | <2.0 | 2.3 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **TAL Metals** | | | | | | | | | | | | | | | | |
| Mercury | **43** | 0.025 | 0.024 | 0.034 | <0.020 | 0.022 | 0.023 | 0.081 | 0.030 | 0.033 | 0.052 | <0.020 | 0.025 | 0.023 | 0.035 | 0.022 |
| Aluminum | **990,000** | 8100 | 9200 | 19000 | 7300 | 8100 | 9300 | 10000 | 12000 | 14000 | 21000 | 9500 | 12000 | 11000 | 8700 | 10000 |
| Antimony | **410** | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <5.0 | <10 | 2.3 | <1.0 | <1.0 | 1.1 | 1.1 | <1.0 |
| Arsenic | **1.6** | **3.2** | **3.2** | **10** | **8.7** | **4.3** | **7.9** | **3.8** | **3.2** | **4.5** | <1.0 | <1.0 | <1.0 | <1.0 | **2.6** | **<5.0** |
| Barium | **190,000** | 190 | 73 | 99 | 260 | 94 | 180 | 120 | 130 | 170 | 140 | 120 | 130 | 110 | 97 | 140 |
| Beryllium | **2,000** | 0.66 | 0.53 | 0.73 | 0.46 | 0.47 | 0.56 | 0.52 | 0.62 | 0.68 | 0.59 | 0.42 | 0.49 | 0.44 | 0.35 | 0.39 |
| Cadmium | **800** | 0.27 | <0.25 | 0.30 | 0.35 | <0.25 | 0.38 | 0.36 | 0.40 | 0.55 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | 0.25 |
| Calcium | **NSA** | 760 | 7700 | 1600 | 22000 | 540 | 2100 | 1300 | 1900 | 1600 | 1700 | 1400 | 1300 | 5200 | 1900 | 2600 |
| Chromium (III) insol. Salts | **1,500,000** | 7.3 | 13 | 16 | 11 | 23 | 12 | 46 | 22 | 26 | 20 | 12 | 13 | 19 | 23 | 15 |
| Cobalt | **300** | 5.8 | 5.9 | 8.1 | 7.2 | 5 | 11 | 6.6 | 8.3 | 7.7 | 8.3 | 6.6 | 7 | 7.1 | 5.1 | 6.2 |
| Copper | **41,000** | 4.9 | 11 | 17 | 11 | 5.5 | 15 | 8.3 | 6.5 | 8.1 | 14 | 13 | 14 | 12 | 10 | 7.6 |
| Iron | **720,000** | 6600 | 12000 | 23000 | 15000 | 8000 | 15000 | 9700 | 11000 | 15000 | 20000 | 16000 | 17000 | 14000 | 9900 | 12000 |
| Lead | **800** | 6.0 | 6.9 | 12 | 5.9 | 6.5 | 9.5 | 17 | 13 | 11 | 12 | 8 | 8.9 | 12 | 11 | 6.0 |
| Magnesium | **NSA** | 970 | 5700 | 3200 | 14000 | 1300 | 2500 | 1600 | 1600 | 2200 | 3000 | 2100 | 2400 | 3500 | 1400 | 3100 |
| Manganese | **23,000** | 1100 | 300 | 370 | 2000 | 600 | 1100 | 560 | 600 | 880 | 580 | 460 | 760 | 650 | 600 | 680 |
| Nickel, soluble salts | **20,000** | 12 | 13 | 17 | 14 | 8.8 | 18 | 12 | 11 | 14 | 17 | 16 | 16 | 16 | 13 | 16 |
| Potassium | **NSA** | 660 | 1100 | 1800 | 1100 | 760 | 1100 | 930 | 1000 | 1200 | 2100 | 1300 | 1300 | 1100 | 1000 | 1100 |
| Selenium | **5,100** | <1.0 | <1.0 | <5.0 | <1.0 | <1.0 | <2.0 | <5.0 | <5.0 | <5.0 | 6.7 | 6.1 | 6.6 | 4.4 | 4.0 | 3.8 |
| Silver | **5,100** | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | 0.52 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Sodium | **NSA** | 28 | 110 | 53 | 230 | 30 | 130 | 40 | 41 | 51 | 44 | 68 | 42 | 88 | 33 | 85 |
| Thallium, soluble salts | **10** | <2.0 | <2.0 | <5.0 | <5.0 | <2.0 | <2.0 | <5.0 | <5.0 | <10 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Vanadium | **5,200** | 15 | 25 | 42 | 24 | 18 | 27 | 22 | 25 | 30 | 41 | 24 | 28 | 26 | 21 | 23 |
| Zinc | **310,000** | 23 | 36 | 56 | 26 | 26 | 46 | 41 | 42 | 40 | 49 | 37 | 41 | 35 | 43 | 41 |

**Notes:**
All results in mg/kg (parts per million)
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 3060A/7196A
RSLs - EPA Regional Screening Levels for Industrial Soils, November 2011
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
**NSA -** No Screening value Available

Mercury analyzed by method 7470A, all other metals analyzed by method 6010B.
PCB's analyzed by 8082
Benzene, Toluene, Ethylbenzene, Total Xylenes, and Naphthalene analyzed by method 8260B
NA - Not Analyzed
**Bold** result exceeds RSL

**Table 1 - continued**
**Soil Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location:** | | ND-2 | | ND-3 | | ND-4 | | SL-1 | | SL-3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **RSLs** | FITE-NDS-2 | | FITE-NDS-3 | | FITE-NDS-4 | | FITE-SLS-1 | | FITE-SLS-3 | |
| **Depth:** | | 1 ft | 11 ft | 1 ft | 11 ft | 1 ft | 11 ft | 2 ft | 7 ft | 1 ft | 10 ft |
| **Collect Date:** | | 10/7/2009 | 10/7/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 |
| Cyanide | **20,000** | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 |
| Chromium,Hexavalent | **5.6** | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **TAL Metals** | | | | | | | | | | | |
| Mercury | **43** | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | 0.023 | <0.020 |
| Aluminum | **990,000** | 3400 | 4900 | 4900 | 4600 | 6800 | 4400 | 4800 | 5500 | 6600 | 6600 |
| Antimony | **410** | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.6 | 1.1 | 1.0 | <1.0 |
| Arsenic | **1.6** | **2.5** | **<5.0** | **3.4** | **<5.0** | <1.0 | <1.0 | **15** | **1.7** | <1.0 | <1.0 |
| Barium | **190,000** | 82 | 63 | 52 | 210 | 94 | 70 | 540 | 180 | 140 | 120 |
| Beryllium | **2,000** | 0.44 | 0.27 | 0.42 | 0.33 | 0.41 | 0.41 | 1 | 0.47 | 0.54 | 0.51 |
| Cadmium | **800** | <0.25 | <0.25 | <0.25 | <0.25 | <0.25 | 0.37 | 1.5 | 0.77 | <0.25 | <0.25 |
| Calcium | **NSA** | 580 | 1900 | 360 | 1700 | 980 | 5100 | 1100 | 2400 | 3500 | 3000 |
| Chromium (III), insol.salts | **1,500,000** | 10 | 12 | 11 | 12 | 13 | 12 | 12 | 14 | 17 | 16 |
| Cobalt | **300** | 5.4 | 2.7 | 2.4 | 8.1 | 6.1 | 11 | 48 | 17 | 3.3 | 4.3 |
| Copper | **41,000** | 7.5 | 7.0 | 5.9 | 10 | 8.1 | 14 | 17 | 14 | 12 | 12 |
| Iron | **720,000** | 11000 | 9900 | 10000 | 13000 | 12000 | 17000 | 24000 | 17000 | 16000 | 15000 |
| Lead | **800** | 8.0 | 4.0 | 6.6 | 5.1 | 8.6 | 7.2 | 47 | 11 | 6.2 | 6.9 |
| Magnesium | **NSA** | 1200 | 2500 | 920 | 2600 | 1700 | 4000 | 1500 | 2800 | 3300 | 3200 |
| Manganese | **23,000** | 520 | 70 | 240 | 870 | 180 | 490 | <0.50 | 1400 | 160 | 170 |
| Nickel | **20,000** | 8.3 | 8.2 | 5.6 | 14 | 8.1 | 22 | 44 | 36 | 11 | 11 |
| Potassium | **NSA** | 640 | 830 | 520 | 820 | 730 | 730 | 670 | 940 | 1000 | 910 |
| Selenium | **5,100** | 5.7 | 4.5 | 5.7 | 6.1 | 6.4 | 7.9 | 17 | 8.9 | 7.4 | 6.8 |
| Silver | **5,100** | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | 0.80 | <0.50 | <0.50 | <0.50 |
| Sodium | **NSA** | 44 | 140 | 40 | 250 | 33 | 72 | 31 | 69 | 52 | 61 |
| Thallium | **10** | <1.0 | 1.0 | <1.0 | <1.0 | <1.0 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 |
| Vanadium | **5,200** | 20 | 16 | 21 | 19 | 26 | 26 | 48 | 26 | 23 | 24 |
| Zinc | **310,000** | 22 | 36 | 17 | 39 | 26 | 38 | 37 | 41 | 50 | 48 |

**Notes:**
All results in mg/kg (parts per million)
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 3060A/7196A
RSLs - EPA Regional Screening Levels for Industrial Soils, November 2011
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
**NSA -** No Screening value Available

Mercury analyzed by method 7470A, all other metals analyzed by method 6010B.
PCB's analyzed by 8082
Benzene, Toluene, Ethylbenzene, Total Xylenes, and Naphthalene analyzed by method 8260B
NA - Not Analyzed
**Bold** result exceeds RSL

**Table 2**
**Sediment Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location:** | | D-1 | D-2 | D-3 | D-4 | D-5 | D-6 | MLGW OUTFALL |
|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **ESV** | FITE-DBS-1 | FITE-DBS-2 | FITE-DBS-3 | FITE-DBS-4 | FITE-DBS-5 | FITE-DBS-6 | OUTFALL |
| **Depth:** | | 0-1 ft. | 0-1 ft. | 0-1 ft. | 0-1 ft. | 0-1 ft. | 0-1 ft. | 0-1 ft. |
| **Collect Date:** | | 10/13/2009 | 10/13/2009 | 10/13/2009 | 10/13/2009 | 10/13/2009 | 10/13/2009 | 10/13/2009 |
| Cyanide | **NSA** | <0.25 | <0.25 | <0.25 | 0.26 | <0.25 | <0.25 | NA |
| **TAL Metals** | | | | | | | | |
| Mercury | **0.13** | 0.023 | 0.034 | 0.023 | <0.020 | 0.02 | 0.026 | NA |
| Aluminum | **NSA** | 11000 | 12000 | 14000 | 11000 | 9100 | 9400 | NA |
| Arsenic | **7.24** | 6.1 | 4.5 | 6.6 | <1.0 | 1.7 | 2.9 | NA |
| Barium | **NSA** | 120 | 200 | 290 | 72 | 88 | 110 | NA |
| Beryllium | **NSA** | 0.58 | 0.66 | 0.62 | 0.48 | 0.43 | 0.46 | NA |
| Cadmium | **1** | 0.31 | 0.54 | 0.6 | <0.25 | <0.25 | <0.25 | NA |
| Calcium | **NSA** | 3200 | 3800 | 3800 | 14000 | 1500 | 2500 | NA |
| Chromium (total) | **52.3** | 16 | 22 | 17 | 14 | 13 | 31 | NA |
| Cobalt | **NSA** | 6.4 | 12 | 11 | 5.1 | 4.8 | 5.6 | NA |
| Copper | **18.7** | 12 | 15 | 14 | 10 | 10 | 12 | NA |
| Iron | **NSA** | 17000 | 17000 | 18000 | 10000 | 11000 | 13000 | NA |
| Lead | **30.2** | 8.7 | 15 | 7.3 | 6.5 | 6.1 | 8.5 | NA |
| Magnesium | **NSA** | 2900 | 3100 | 3100 | 9800 | 2600 | 2700 | NA |
| Manganese | **NSA** | 350 | 860 | 1700 | 200 | 160 | 330 | NA |
| Nickel | **15.9** | 15 | **24** | **22** | 11 | 11 | 14 | NA |
| Potassium | **NSA** | 1300 | 1400 | 1400 | 1300 | 1200 | 1300 | NA |
| Sodium | **NSA** | 71 | 85 | 63 | 110 | 160 | 83 | NA |
| Vanadium | **NSA** | 32 | 33 | 34 | 27 | 24 | 27 | NA |
| Zinc | **124** | 52 | 64 | 54 | 36 | 45 | 49 | NA |

**Notes:**
All results in mg/kg (parts per million)
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 3060A/7196A
ESV - EPA Regional 4 Ecological Screening Values for Sediment (November 30, 2001).
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
**NSA -** No Screening value Available

Mercury analyzed by method 7470A, all other metals analyzed by method 6010B.
PCB's analyzed by 8082
Benzene, Toluene, Ethylbenzene, Total Xylenes, and Naphthalene analyzed by method 8260B
NA - Not Analyzed
**Bold** result exceeds RSL

**Table 3**
**Ground Water Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location** | | CR-1 | | CR-2 | | CR-3 | | CR-4 | | | CR-5 | | CR-6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **MCL** | FITE-CRW-1 | FITE-CRW-1 Filtered Analysis | FITE-CRW-2 | FITE-CRW-2 Filtered Analysis | FITE-CRW-3 | FITE-CRW-3 Filtered Analysis | FITE-CRW-4 | FITE-CRW-4 Filtered Analysis | FITE-CRW-11, duplicate of CRW-4 | FITE-CRW-5 | FITE-CRW-5 Filtered Analysis | FITE-CRW-6 | FITE-CRW-6 Filtered Analysis |
| **Collect Date** | | 10/8/2009 | 10/8/2009 | 10/5/2009 | 10/5/2009 | 10/5/2009 - 10/8/2009[1] | 10/5/2009 - 10/8/2009[1] | 10/6/2009 | 10/6/2009 | 10/6/2009 | 10/6/2009 | 10/6/2009 | 10/7/2009 | 10/7/2009 |
| Chromium,Hexavalent | **NSA** | <0.010 | | 0.012 | | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| **TAL Metals** | | | | | | | | | | | | | | |
| Antimony | **0.006** | 0.0014 | | <0.0010 | | 0.0020 | | **<0.010** | <0.0010 | NA | <0.0010 | <0.0010 | 0.0011 | |
| Arsenic | **0.010** | **0.20** | <0.0010 | **0.019** | <0.0010 | **0.032** | <0.0010 | **0.18** | <0.0010 | NA | 0.0023 | 0.0021 | **0.042** | <0.0010 |
| Thallium | **0.002** | **0.0087** | <0.0010 | <0.0010 | | 0.0013 | | **<0.010** | <0.0010 | NA | <0.0010 | <0.0010 | **0.0026** | <0.0010 |
| Aluminum | **NSA** | 640 | | 21 | | 62 | | 780 | | NA | 1.6 | <0.10 | 110 | |
| Barium | **2** | **6.9** | 0.060 | 0.43 | | 1.0 | | **18** | 0.28 | NA | 0.16 | 0.13 | 1.3 | |
| Beryllium | **0.004** | **0.030** | <0.0010 | <0.0020 | | 0.0036 | | **0.050** | <0.0010 | NA | <0.0020 | <0.0020 | **0.0081** | <0.0010 |
| Cadmium | **0.005** | **0.028** | <0.00050 | <0.0050 | | **0.0066** | <0.00050 | <0.025 | | NA | <0.0050 | <0.0050 | **0.011** | <0.00050 |
| Calcium | **NSA** | 520 | | 140 | | 100 | | 370 | | NA | 30 | 31 | 60 | |
| Chromium | **0.1** | **1.2** | | 0.054 | | **0.13** | | **1.4** | | NA | <0.010 | <0.010 | **0.17** | |
| Cobalt | **NSA** | 0.36 | | 0.021 | | 0.048 | | 0.35 | | NA | <0.010 | <0.010 | 0.096 | |
| Copper | **1.3** | 1.1 | | 0.039 | | 0.12 | | 1.1 | | NA | <0.020 | <0.020 | 0.13 | |
| Iron | **NSA** | 940 | | 43 | | 150 | | 940 | | NA | 2.1 | <0.10 | 180 | |
| Lead | **0.015** | **0.52** | <0.0010 | **0.023** | <0.0010 | **0.053** | <0.0010 | **0.87** | <0.0010 | NA | <0.0050 | <0.0050 | **0.098** | <0.0010 |
| Magnesium | **NSA** | 400 | | 90 | | 66 | | 180 | | NA | 9.7 | 9.5 | 47 | |
| Manganese | **NSA** | 25 | | 1.8 | | 6.4 | | 42 | | NA | 0.38 | 0.29 | 9.8 | |
| Nickel | **NSA** | 1.1 | | 0.046 | | 0.13 | | 1.2 | | NA | <0.020 | <0.020 | 0.19 | |
| Potassium | **NSA** | 48 | | 3 | | 7.7 | | 52 | | NA | 4.3 | 4.2 | 13 | |
| Selenium | **0.05** | **0.40** | <0.0010 | <0.020 | | **0.052** | <0.0010 | **0.38** | <0.0010 | NA | <0.020 | <0.020 | <0.020 | |
| Sodium | **NSA** | 20 | | 53 | | 42 | | 17 | | NA | 6.3 | 6.6 | 18 | |
| Vanadium | **NSA** | 1.4 | | 0.066 | | 0.18 | | 1.1 | | NA | <0.010 | <0.010 | 0.25 | |
| Zinc | **NSA** | 3.4 | | 0.12 | | 0.4 | | 4.4 | | NA | 0.18 | 0.12 | 0.44 | |

**Notes:**
All results in mg/l (parts per million)
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 7196A
PCB's analyzed by 8082
Metals samples were unfiltered unless otherwise noted. Filtering was conducted by the laboratory.
Mercury analyzed by method 7470A, other metals analyzed by 6010B or 6020.
**NSA -** No Screening value Available

NA - Not Analyzed
NS - Not Sampled
1 -CRW-3 Metals collected on 10/5/09; Cyanide, Hexavalent Chromium, and PCBs collected on 10/8/09
2 - Insufficient water for collection of Cyanide and Metals from NDW-3
3 - Insufficient water for collection of Cyanide and Hexavalent Chromium in NDW-4.
MCLs - Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water.
**Bold** results exceed MCL, as of November 2011

**Table 3 - continued**
**Ground Water Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location** | | CR-7 | | CR-8 | | ND-1 | ND-2 | | | ND-3 | ND-4 | SL-1 | | | SL-3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **MCL** | FITE-CRW-7 | FITE-CRW-7 Filtered Analysis | FITE-CRW-8 | FITE-CRW-8 Filtered Analysis | FITE-NDW-1 | FITE-NDW-2 | FITE-NDW-2 Filtered Analysis | FITE-NDW-2 6020 Analysis | FITE-NDW-3[2] | FITE-NDW-4[3] Filtered Analysis | FITE-SLW-1 | FITE-SLW-1 Filtered Analysis | NDW-5, dup. of SLW-1, Filtered Analysis | FITE-SLW-3 | FITE-SLW-3 Filtered Analysis |
| **Collect Date** | | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/7/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 | 10/8/2009 |
| Chromium,Hexavalent | **NSA** | <0.010 | | <0.010 | | <0.010 | <0.010 | | | <0.010 | NS[3] | <0.010 | | <0.010 | <0.010 | |
| **TAL Metals** | | | | | | | | | | | | | | | | |
| Antimony | **0.006** | <0.0050 | | <0.0050 | | <0.0010 | <0.0010 | <0.0010 | | NS[2] | <0.0010 | 0.0014 | | <0.0010 | 0.0013 | <0.0010 |
| Arsenic | **0.010** | **0.31** | <0.0010 | **0.22** | <0.0010 | 0.0017 | **0.031** | 0.0010 | | NS[2] | 0.0045 | **0.015** | <0.0010 | <0.0010 | **0.029** | <0.0010 |
| Thallium | **0.002** | **0.0075** | <0.0010 | **0.0090** | <0.0010 | <0.0010 | **0.0041** | <0.0010 | | NS[2] | <0.0010 | 0.0011 | | <0.0010 | **0.0020** | <0.0010 |
| Aluminum | **NSA** | 290 | | 370 | | 2.8 | 150 | <0.10 | | NS[2] | 6.3 | 39 | | <0.10 | 97 | <0.10 |
| Barium | **2** | **3.2** | 0.056 | **5.4** | 0.19 | 0.26 | 1.5 | 0.044 | | NS[2] | 0.19 | 0.53 | | 0.090 | 1.2 | 0.12 |
| Beryllium | **0.004** | **0.019** | <0.0010 | **0.021** | <0.0010 | <0.0020 | **0.012** | <0.0020 | | NS[2] | <0.0020 | 0.0026 | | <0.0020 | **0.0058** | <0.0020 |
| Cadmium | **0.005** | **0.026** | <0.00050 | **0.033** | <0.00050 | <0.0050 | **0.0077** | <0.0050 | | NS[2] | <0.0050 | <0.0050 | | <0.0050 | **0.0051** | <0.0050 |
| Calcium | **NSA** | 95 | | 160 | | 57 | 220 | 71 | | NS[2] | 88 | 100 | | 69 | 100 | 68 |
| Chromium | **0.1** | **0.45** | | **0.61** | | <0.010 | **0.23** | <0.010 | | NS[2] | 0.012 | 0.053 | | <0.010 | **0.12** | <0.010 |
| Cobalt | **NSA** | 0.25 | | 0.23 | | <0.010 | 0.11 | <0.010 | | NS[2] | <0.010 | 0.024 | | <0.010 | 0.047 | <0.010 |
| Copper | **1.3** | 0.32 | | 0.56 | | <0.020 | 0.34 | <0.020 | | NS[2] | <0.020 | 0.064 | | <0.020 | 0.14 | <0.020 |
| Iron | **NSA** | 500 | | 650 | | 4.5 | 310 | <0.10 | | NS[2] | 12 | 72 | | <0.10 | 170 | <0.10 |
| Lead | **0.015** | **0.27** | <0.0010 | **0.28** | <0.0010 | 0.011 | 0.13 | <0.0050 | | NS[2] | <0.0050 | **0.021** | <0.0010 | <0.0050 | **0.052** | <0.0050 |
| Magnesium | **NSA** | 92 | | 160 | | 29 | 160 | 49 | | NS[2] | 52 | 62 | | 34 | 66 | 30 |
| Manganese | **NSA** | 19 | | 15 | | 0.33 | 3.6 | 0.024 | | NS[2] | 1.0 | 0.82 | | 0.15 | 1.8 | 0.034 |
| Nickel | **NSA** | 0.46 | | 0.62 | | <0.020 | 0.30 | <0.020 | | NS[2] | <0.020 | 0.051 | | <0.020 | 0.13 | <0.020 |
| Potassium | **NSA** | 20 | | 29 | | 2.1 | 12 | 0.86 | | NS[2] | 2.2 | 4.9 | | 0.54 | 9.1 | 0.8 |
| Selenium | **0.05** | **<0.10** | <0.0010 | **<0.20** | <0.0010 | <0.020 | <0.020 | **0.064** | 0.042 | NS[2] | <0.020 | <0.020 | | <0.020 | <0.020 | 0.027 |
| Sodium | **NSA** | 13 | | 44 | | 12 | 130 | 140 | | NS[2] | 20 | 7.4 | | 7.1 | 9.0 | 8.6 |
| Vanadium | **NSA** | 0.63 | | 0.89 | | <0.010 | 0.38 | <0.010 | | NS[2] | 0.016 | 0.094 | | <0.010 | 0.21 | <0.010 |
| Zinc | **NSA** | 1.1 | | 2.1 | | 0.05 | 1.3 | <0.030 | | NS[2] | 0.041 | 0.26 | | <0.030 | 0.58 | <0.030 |

**Notes:**
All results in mg/l (parts per million)
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 7196A
PCB's analyzed by 8082
Metals samples were unfiltered unless otherwise noted. Filtering was conducted by the laboratory.
Mercury analyzed by method 7470A, other metals analyzed by 6010B or 6020.
**NSA -** No Screening value Available

NA - Not Analyzed
NS - Not Sampled
1 -CRW-3 Metals collected on 10/5/09; Cyanide, Hexavalent Chromium, and PCBs collected on 10/8/09
2 - Insufficient water for collection of Cyanide and Metals from NDW-3
3 - Insufficient water for collection of Cyanide and Hexavalent Chromium in NDW-4.
MCLs - Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water.
**Bold** results exceed MCL, as of November 2011

**Table 4**
**Surface Water Sampling Results Summary**
**Fite Road Property Acquisitions Studies**
**Fite Road Realignment Project**
**Shelby County, TN**

| **Sample Location** | | D-1 | D-2 | D-3 | D-4 | D-5 | D-6 |
|---|---|---|---|---|---|---|---|
| **Sample ID** | **ESV** | FITE-DW-1 | FITE-DW-2 | FITE-DW-3 | FITE-DW-4 | FITE-DW-5 | FITE-DW-6 |
| **Collect Date** | | 10/12/2009 | 10/12/2009 | 10/12/2009 | 10/12/2009 | 10/12/2009 | 10/12/2009 |
| **TAL Metals** | | | | | | | |
| Arsenic | **0.190** | 0.0036 | 0.0045 | 0.0048 | 0.0034 | 0.0032 | 0.0029 |
| Aluminum | **0.087** | **0.62** | **0.80** | **0.49** | **0.43** | **0.21** | **0.44** |
| Barium | **NSA** | 0.11 | 0.11 | 0.10 | 0.11 | 0.12 | 0.11 |
| Calcium | **NSA** | 40 | 40 | 40 | 41 | 48 | 40 |
| Chromium | **0.11732** | 0.012 | 0.014 | 0.010 | <0.010 | <0.010 | <0.010 |
| Iron | **1.000** | 0.97 | **1.2** | 0.67 | 0.59 | 0.30 | 0.63 |
| Magnesium | **NSA** | 16 | 16 | 16 | 17 | 16 | 18 |
| Manganese | **NSA** | 0.20 | 0.22 | 0.12 | 0.11 | 0.070 | 0.13 |
| Potassium | **NSA** | 4.3 | 4.5 | 4.3 | 3.9 | 3.7 | 4.0 |
| Sodium | **NSA** | 7 | 7.3 | 7.3 | 7.8 | 9.2 | 9.2 |
| Vanadium | **NSA** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Zinc | **0.05891** | <0.030 | <0.030 | <0.030 | <0.030 | 0.046 | <0.030 |

**Notes:**
All results in mg/l (parts per million)
Samples analyzed by Environmental Science Corp. in Mt. Juliet, TN
Cyanide analyzed by method 9012B
Hexavalent Chromium analyzed by method 7196A
PCB's analyzed by 8082
Metals samples were unfiltered unless otherwise noted. Filtering was conducted by the laboratory.
Mercury analyzed by method 7470A, other metals analyzed by 6010B or 6020.
NA - Not Analyzed
NS - Not Sampled
1 -CRW-3 Metals collected on 10/5/09; Cyanide, Hexavalent Chromium, and PCBs collected on 10/8/09
2 - Insufficient water for collection of Cyanide and Metals from NDW-3
3 - Insufficient water for collection of Cyanide and Hexavalent Chromium in NDW-4.
ESV - EPA Regional 4 Ecological Screening Values for Surface Water (November 30, 2001).
**Bold** results exceed MCL **NSA -** No Screening value Available

# SHELBY COUNTY

**Fite Road Extension**

**Soils and Geology Survey Report**

**PSI Project No.: 502-35079**

Prepared by

**PROFESSIONAL SERVICE INDUSTRIES, INC.**
**4161 Ridgemoor Avenue**
**Memphis, Tennessee 38118**
**Telephone (901) 365-1802**
**Fax (901) 366-7233**

**February 16, 2004**

Information To Build On
Engineering • Consulting • Testing

**James M. Evans, Jr., P.E.**
**Project Engineer**

**John O. Gordon, P.E.**
**Chief Engineer**

JAMES M. EVANS, JR.
REGISTERED PROFESSIONAL ENGINEER
AGRICULTURE
COMMERCE
STATE OF TENNESSEE

TDOT

## TABLE OF CONTENTS


| | Page No. |
|---|---|
| **1.0 LOCATION AND DESCRIPTION** | 1 |
| **2.0 TOPOGRAPHY AND DRAINAGE** | 3 |
| **3.0 GEOLOGY OF THE AREA** | 4 |
| **4.0 DRILLING AND SAMPLING TECHNIQUES** | 5 |
| 4.1 Drilling and Sampling | 5 |
| 4.2 Subsurface Conditions | 6 |
| 4.3 Groundwater Conditions | 7 |
| **5.0 LABORATORY TESTING** | 9 |
| 5.1 Moisture Content | 9 |
| 5.2 Atterberg Limits and Sieve Analysis | 9 |
| 5.3 pH | 9 |
| 5.4 Standard Proctor and California Bearing Ratio | 10 |
| 5.5 Consolidation Test | 10 |
| 5.6 Triaxial Compression Test | 10 |
| 5.7 Unconfined Compression Test | 11 |
| **6.0 ENGINEERING ANALYSES** | 12 |
| 6.1 Slope Stability Analyses | 12 |
| 6.1.1 Staged Construction | 13 |
| 6.1.2 Rammed Aggregate Piers (Geopiers) | 14 |
| 6.1.2.1 Case 1 | 14 |
| 6.1.2.2 Case 2 | 15 |
| 6.1.3 Sand or Wick Drains | 15 |
| 6.1.4 Temporary Slope | 16 |
| 6.2 Settlement Considerations | 16 |
| 6.2.1 In-Situ Soils | 16 |
| 6.2.2 Soils Modified with Rammed Aggregate Piers | 17 |
| 6.2.3 Fill Soils | 18 |
| 6.2.4 Time Rates of Settlements | 18 |
| **7.0 RECOMMENDATIONS** | 19 |
| 7.1 Site Preparation | 19 |
| 7.2 Fill Requirements | 20 |
| 7.3 Construction Considerations | 20 |
| 7.4 California Bearing Ratio | 22 |
| 7.5 Pile Foundations | 22 |
| 7.6 Slope Stability | 23 |

7.6.1 Staged Construction ..... 24
7.6.2 Case 1 – Rammed Aggregate Piers ..... 24
7.6.3 Case 2 – Rammed Aggregate Piers ..... 24
7.6.4 Sand or Wick Drains ..... 25
7.6.5 General Slope Recommendations ..... 25
7.7 Earth Retaining Structures ..... 26
7.8 Seismicity ..... 27
7.9 Liquefaction ..... 28
7.9.1 Liquefaction Analysis ..... 29

**REPORT LIMITATIONS** ..... 30

**APPENDIX** - I. BORING LOGS (GENERAL NOTES)
II. GRADATION CURVES, ATTERBERG LIMITS, and pH
III. MAXIMUM DRY DENSITY (STANDARD PROCTOR), CBR
IV. TRIAXIAL TEST FAILURE ENVELOPES
V. UNCONFINED COMPRESSION TEST RESULTS
VI. CONSOLIDATION TEST RESULTS
VII. SLOPE STABILITY ANALYSES RESULTS
VIII. PILE FOUNDATION CAPACITY DIAGRAMS
IX. LIQUEFACTION ANALYSES

## 1.0 LOCATION AND DESCRIPTION

The area for the proposed extension is located between an existing section of Fite Road and Highway 51 in Shelby County, Tennessee. Project information regarding the proposed construction was obtained from Fisher & Arnold, Inc. We understand that the proposed construction will consist of extending/widening Fite Road for a total project length of approximately 8,000 feet. The proposed project will span between an existing portion of Fite Road east of the existing railroad track to Highway 51. The extension of Fite Road will be mainly west of the existing railroad track, with most of the project east of the tracks consisting of widening of the existing roadway. In addition, an overpass will also be constructed over the existing railroad track. A typical cross section provided indicated the proposed extension will consist of a 44-foot wide roadway not including curb and gutter, shoulders, and cut/fill slopes. The total maximum right of way width of the project will be approximately 240 feet, which includes the lanes of traffic, curb and gutter, shoulders and fill slopes at the area of the highest fills (fill height of ~40 feet). The highest fills will be required at the ICRR tracks overpass, and these fills are proposed to be constructed at a 2H:1V side slope. A previous geotechnical exploration, for the proposed structures only, was addressed in ETS/PSI Report No. M4250/502-95013 dated June 10, 1999 prepared for Fisher & Arnold, Inc.. It is noted that at that time, ETS/PSI was not asked to perform exploration on the roadway, only on the structures.

Grading information provided indicated that grading along most of the extension will consist mainly of fill, 5 to 7 feet in thickness. However, fills up to about 40 feet in height will be required at the bridge overpass along the railroad right of way. During the construction phase, a portion of the eastern embankment will require a temporary 1H:1V slope with a maximum height of approximately 12 feet.

The proposed bridge over the ICRR tracks will be located from station 76+62.98 to station 78+24.98. Based on the preliminary bridge plans, the proposed bridge will be 162 feet in length and 62 feet in width. Bridge construction will consist of a concrete deck supported by AASHTO Type III beams. Two abutments and two bents will provide support for the proposed bridge. The proposed bents will consist of a reinforced bent cap supported on three 3-foot diameter concrete columns resting on pile caps. Preliminary plans indicate the bridge abutment slopes will be armored with riprap. The stationing and ground surface elevations are summarized in the following table:

| Structural Element | Station | Existing Ground Elevation (ft) | Bottom of Pile Cap Elevation (ft) |
|---|---|---|---|
| Abutment #1 | 76+62.98 | 232 | 268.8 |
| Bent #1 | 77+07.98 | 240 | 243.5 |
| Bent #2 | 77+79.98 | 238 | 243.5 |
| Abutment #2 | 78+24.98 | 237 | 268.8 |

The geotechnical recommendations presented in this report are based on the available project information, bridge and roadway locations, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

## 2.0 TOPOGRAPHY AND DRAINAGE

The general topography of the project area is comprised of gently rolling hills developed on the loess deposits characteristic of the area. This rolling topography is due to the erosion which occurred in the underlying tertiary deposits of sand, gravel, and clay during the time these soils were exposed. As the overlying loess soils were deposited by wind action these existing topographic features were maintained and amplified by subsequent surface erosion and deposition.

The topography at the existing railroad track area has been somewhat altered to accommodate the existing structure and track. These alterations consist of fills for the construction of the existing bridge and elevated track level.

At the time of exploration, the project area was in several distinct conditions. The area between Highway 51 and Millington Road along the centerline of the proposed road consisted of wooded areas. The trees in this area varied in age from saplings to mature trees. The area between Millington Road and the railroad track consisted of a cultivated field with several isolated patches of wooded areas. The area between the railroad track and the existing section of Fite Road was covered with weeds, and a drainage ditch (about 10 feet deep) crossed this area in a general northwest to southeast orientation. The remaining project area to the east, mostly coincided with the existing Fite Road roadway and as such was mainly an existing pavement structure.

Much of the area along the project length was relatively level with surface drainage flowing towards existing drainage swales or ditches. Based on site observations it appeared that the drainage of the site generally tended toward the east.

## 3.0 GEOLOGY OF THE AREA

This portion of Shelby County is located in a narrow band which parallels the eastern bluffs of the Mississippi River known as the "Loess Hills". This band lies in a physiographic subdivision known as the East Gulf Section of the Atlantic and Gulf Coastal Plains Province and is included in a portion of the Section called the Mississippi Embayment. The Embayment is a bell-shaped arm of the Gulf of Mexico outlined roughly by Little Rock, Arkansas on the west; Cairo, Illinois on the north; and the Lower Tennessee River on the east.

Structurally, the Mississippi Embayment is a downwarped, partly down-faulted, trough in Paleozoic rocks. The axis of the trough has migrated in past geologic time but now approximates the course of the Mississippi River. The trough has been filled with unconsolidated gravels, sands, and clays ranging in age from upper Cretaceous to Recent.

In Tennessee, the unconsolidated sediments reach their maximum thickness at Shelby County where they are from 2,700 to 3,000 feet thick. Late in the Tertiary Period and early in the Quaternary Period streams carried extensive quantities of sand and gravel into the area and formed wide-spread terraces of these materials mixed with varying amounts of silt and clay on top of the older Tertiary deposits. Aeolian, or wind-blown silts and clays (loess) comprise the presently exposed surface in the Shelby County area. In general, the thickness of the loess is 75 feet or more at the bluffs of the Mississippi River, but thins out to the east and disappears within about 50 miles.

## 4.0 DRILLING AND SAMPLING TECHNIQUES

### 4.1 Drilling and Sampling

The site subsurface conditions were explored with 13 soil test borings along the proposed roadway centerline. The borings ranged in depth from 10 to 60 feet. The boring locations and depths were selected by PSI. The borings were located in the field by PSI personnel using the staked roadway centerline as reference. In general, the borings were located along the roadway centerline. Elevations of the ground surface at the boring locations were estimated from the project drawings provided by Fisher & Arnold, Inc. The following table lists the boring station locations, depths, and existing surface elevations:

**Table 1. Boring locations, stations, depths, and elevations.**

| Boring | Station | Depth (feet) | Elevation +/- (feet) |
|---|---|---|---|
| B-1 | 30+00 | 10 | 258 |
| B-2 | 40+00 | 10 | 246 |
| B-3 | 50+00 | 10 | 239 |
| B-4 | 60+00 | 10 | 240 |
| B-5 | 66+00 | 10 | 238 |
| B-6 | 72+00 | 40 | 238 |
| B-7 | 76+00 | 60 | 237 |
| B-8 | 79+00 | 60 | 235 |
| B-9 | 83+00 (north) | 40 | 237 |
| B-10 | 83+00 (center) | 40 | 235 |
| B-11 | 83+00 (south) | 40 | 235 |
| B-12 | 95+00 | 10 | 241 |
| B-13 | 105+00 | 10 | 243 |

The borings were advanced utilizing hand auger, hollow stem auger, and mud rotary drilling methods, and soil samples were routinely obtained during the drilling process. Borings B-1 and B-2 were drilled using hand auger drilling methods due to the existing conditions (wooded area), and Borings B-12 and B-13 were drilled using hand auger drilling methods due to spatial limitations along the existing shoulder of the roadway. The remaining borings were drilled using either hollow stem auger drilling methods or a combination of hollow stem auger and mud rotary drilling methods. In general, once groundwater was encountered, hollow stem auger drilling methods were ceased and the hole was advanced using rotary wash drilling methods. Drilling techniques were accomplished in accordance with AASHTO procedures. Upon completion of drilling the borings were backfilled

with a cement-bentonite mixture and/or auger cuttings. Borings in excess of 30 feet are required to be backfilled with a cement based material in Shelby County.

The sampling of soils and in-situ testing were accomplished in accordance with AASHTO procedures. Nine thin-walled (Shelby) tube samples were obtained in accordance with AASHTO Designation T-207-87 using factory new tubes. Soils were tested [standard penetration test (SPT)] and sampled using split barrel type sampling techniques at intervals of 2½ feet in the upper 10 feet and at 5-foot intervals thereafter. Penetration test and split barrel sampling were conducted in accordance with AASHTO Designation T-206-87. SPT were performed using both a rope and cat-head safety hammer and a CME automatic hammer, and the N-values listed on the boring logs represent $N_{60}$ values. The SPT values listed on the boring logs for Borings B-1, B-2, B-12, and B-13 were determined based on correlation with Dynamic cone penetrometer readings.

## 4.2 Subsurface Conditions

Topsoil was encountered in many of the borings. In general, the thickness of topsoil ranged from 2 to 3 inches. The ground surface at the remaining boring locations had been stripped of topsoil. The soils encountered at the 13 borings may be divided into 3 general strata. The upper stratum consisted of fine-grained soils, the second stratum consisted of coarse-grained soils, and the third stratum consisted of fine-grained soils. These soil strata are discussed separately below.

The upper stratum of fine-grained soil extended from the base of the topsoil or ground surface to depths ranging from about 27 to 37 feet or the terminal depths at the boring locations. Based on results of Atterberg limits and visual classification, these soils were classified as A-4, A-6, A-7, or A-7-6 in accordance with the AASHTO classification system or as low plasticity silty/lean clay (CL) and clayey silt (ML) or high plasticity clay (CH) in accordance with the USCS. Standard penetration N-values within these fine-grained soils indicated consistencies of soft to hard, with a majority of the soils having consistencies in the firm range.

The second stratum, encountered in the deeper borings, consisted of sandy soils. This stratum extended to the boring terminal depths, except at Boring B-7 where it extended to a depth of about 57 feet. Based on visual classification and grain size analyses, these soils were classified as A-1, A-1-a, A-1-b, A-2-4, or A-3 in accordance with the AASHTO classification system or as poorly graded sand (SP), or silty sand (SM) in accordance with the USCS. Standard penetration N-values within these granular soils generally indicated the materials to be medium dense to very dense. A sample of loose soil was encountered in Boring B-9 at a depth of 29 to 30.5 feet.

The third stratum of fine-grained soil, encountered only in Boring B-7, extended to the terminal depth at this boring location. Based on visual classification, this soil was classified as A-7 in accordance with the AASHTO classification system or as a high plasticity clay (CH) in accordance

with the USCS. The standard penetration N-value within this fine-grained soil indicated a consistency of stiff.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances (equivalent safety hammer), locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these boring logs. The samples which were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

## 4.3 Groundwater Conditions

For borings which were drilled solely with hollow stem auger drilling methods, water levels were measured within the hollow stem auger during drilling and after removal of auger. For borings in which mud rotary drilling methods were used, water levels were recorded only at the point in which water was encountered while drilling with hollow stem augers, at which point the boring was advanced with mud rotary drilling methods. Groundwater measurements at the boring locations are summarized in the following table. Some fluctuations of groundwater levels should be anticipated with changing climatic conditions. The groundwater data presented in this report was obtained at the time of the subsurface exploration.

**Table 2. Water level readings at boring locations.**

| Boring | Water level during drilling (ft) | Cave-in depth (ft) | Water level at completion (ft) |
|---|---|---|---|
| B-1 | Dry | Open | Dry |
| B-2 | 10 | Open | 10 |
| B-3 | Dry | Open | Dry |
| B-4 | 1 | 9 | Dry |
| B-5 | 9 | Open | 9 |
| B-6 | 15 | 3 | Dry |
| B-7 | 15 | NA | NA |
| B-8 | NE | NA | NA |
| B-9 | 15 | 13 | Dry |
| B-10 | 7 | 13 | NA |
| B-11 | 14 | NA | NA |
| B-12 | Dry | Open | Dry |
| B-13 | Dry | Open | Dry |

NA-not applicable due to mud rotary drilling. NE-not encountered, began mud rotary drilling above groundwater.

## 5.0 LABORATORY TESTING

Select soil samples were tested in the laboratory to determine material properties for our evaluation. Laboratory testing was accomplished in accordance with AASHTO procedures. Tests performed included: moisture content, Atterberg limits, sieve analysis for fine and coarse aggregate, pH, standard Proctor, California bearing ratio (CBR), consolidation test, unconsolidated-undrained triaxial test (Q), consolidated-undrained triaxial test with pore pressure measurements (R), and unconfined compression test.

### 5.1 Moisture Content

Moisture content tests were performed on all soils samples including split barrel and Shelby tube samples in accordance with AASHTO Designation T-265-93. The moisture contents of the fine-grained soils in the upper soil stratum varied from 21 to 32 percent, and the moisture contents in the upper 5 feet ranged from 21 to 30 percent with an average value of 26 percent, which is relatively wet. The moisture contents of the coarse-grained soils in the second stratum varied from 11 to 27 percent. The moisture content of the fine-grained soil in the third stratum was 34 percent. The moisture content for each soil sample is listed on the attached boring logs in Appendix I.

### 5.2 Atterberg Limits and Sieve Analysis

Atterberg limits and sieve analysis tests were performed on select soil samples to aid in the classification of the soils. The Atterberg limits test was performed in accordance with AASHTO Designations T-89-96 and T-90-96, and the sieves were performed in accordance with AASHTO Designations T-11-91 and T-27-97. The results of these tests are presented on the attached boring logs in Appendix I, and graphic results of the tests are attached in Appendix II.

### 5.3 pH

Tests to determine the pH of 10 various samples were performed on samples taken from Borings B-8, B-9, B-10, and B-11 at depths varying from 0 to 25 feet. The pH tests were performed in accordance with AASHTO Designation T-289-91. The results of the pH tests indicate a range of 4.3 to 7.8. The results of these tests are tabulated in Appendix II.

## 5.4 Standard Proctor and California Bearing Ratio

A standard Proctor and a California Bearing Ratio (CBR) test were performed on a bulk soil sample retrieved from the upper 5 feet of the auger cuttings near Boring B-3. The sample was classified as A-6 in accordance with the AASHTO classification system and as silty clay (CL) in accordance with the USCS. The standard Proctor and CBR tests were performed in general accordance with AASHTO Designations T-99-95 Method A and T-193-93, respectively. A minimum of four points were used in obtaining the Proctor results. The maximum dry density and the optimum moisture content of the soil sample were determined to be 103 pcf and 19.5 percent, respectively. The CBR test was performed the bulk sample using a single point compacted in three lifts with the 5.5-pound Proctor hammer. The CBR sample was remolded to a dry density of 97.3 pcf (94.5% compaction) at a moisture content of 21.2 percent. The sample was then soaked for 96 hours with a 10-pound weight as surcharge. After soaking, the sample was tested as specified using a 3 square inch piston. The penetration of the piston on the soil sample indicated CBR values at 0.1-inch and 0.2-inch penetration of 2.4 and 2.2, respectively. The final moisture contents of the sample in the top inch and center of the sample were 25.3 percent and 23.2 percent, respectively. Results of these tests are located in Appendix III.

## 5.5 Consolidation Test

Consolidation tests were performed on two soil samples extruded for Shelby tubes. The tests were performed on samples from Borings B-6 at 6 to 8 feet and B-8 at 16 to 18 feet in accordance with AASHTO Designation T-216-94. The specific gravity of the samples was estimated to be 2.7. The consolidation tests indicated both samples were overconsolidated. The sample from Boring B-6 had a overconsolidation ratio (OCR) of approximately 2.5, and the sample form Boring B-8 had a OCR of approximately 1.5. Results of the consolidation tests are attached in Appendix VI.

## 5.6 Triaxial Compression Test

Triaxial compression tests were performed on multiple samples in order to estimate the shear strength parameters of the soils. The triaxial tests performed included three unconsolidated-undrained (Q) compression tests and one consolidated-undrained (R) with pore pressure measurements compression test. These tests were conducted in accordance with AASHTO Designations T-296-94 and T-297-94. The results of the Q-tests indicated undrained shear strengths ($\phi$=0 concept) in the range of 1.0 to 2.1 ksf. The results of the R-test indicated total shear stress strength parameters for cohesion of 0.3 ksf and angle of internal friction of 18 degrees and effective stress shear strength parameters for cohesion of 0 ksf and drained angle of internal friction of 31 degrees. The total stress failure envelope for the Q- and R-tests were determined using Mohr's circles at failure, and the effective stress failure envelope for the R-test was determined using both

Mohr's circles at failure and also p-q curves. Results of the triaxial tests are attached in Appendix IV.

5.7 Unconfined Compression Test

Unconfined compression (UC) tests were performed on ten soil samples in accordance with AASHTO Designation T-208-92. These tests were performed with the samples at their natural moisture contents and degree of saturation. The results of the tests indicated undrained shear strengths ($\phi$=0 concept) in the range of 0.47 to 1.3 ksf. Results of the unconfined compression tests are attached in Appendix V.

# 6.0 ENGINEERING ANALYSES

## 6.1 Slope Stability Analyses

The proposed overpass embankments for the bridge over the railroad tracks will require maximum fill of approximately 40 feet. The final slope is proposed to be constructed with 2H:1V side slopes. In addition, due to space limitations during the construction phases, portions of the embankment on the eastern side of the railroad tracks will be required to be constructed with temporary slopes of 1H:1V. This temporary slope will have a maximum height of approximately 12 feet and taper down to existing grade. Once traffic is diverted to the new overpass the slope will be flattened to the design slope of 2:1.

The slope stability analyses utilized for this project were based on two dimensional limit plastic equilibrium methods. In this method, a trial failure surface is assumed. The mass of soil above the failure surface is divided into vertical strips called slices. The forces acting on each slice are estimated. The forces are separated into those tending to cause failure and those tending to resist failure. The sum of the two sets of forces for a trial failure surface are tabulated and compared by dividing the forces resisting failure by those causing failure. This ratio is termed the factor of safety (FS). When the FS is 1.0, failure of the slope is imminent. When the FS exceeds 1.0, it is assumed the slope is stable. However, there are certain minimum factors of safety which, by experience, are acceptable. In general, these minimum values of FS depend on the consequences of failure as well as the anticipated loading condition. Computer methods are generally employed to allow multiple surfaces to be explored. The computer program GSTABL7 by Gregory Geotechnical Software was used in the estimation of the factors of safety of the various sections.

To determine the forces necessary to perform the analyses, the slope geometry, stratigraphy, soil strength parameters, groundwater levels, and extraneous loads must be determined. The topographic survey is generally used in modeling the slope geometry. Borings and laboratory tests are used in the determination of the stratigraphy of the site and the soil parameters. Soil shear strength, unit weights, compression characteristics, etc. are determined from this data. The groundwater level was taken to be at an elevation of about +225 feet. The proposed embankments were analyzed with slopes of 2:1. It should be noted that the proposed slopes were assumed to be constructed at a 2:1 slope, and the factors of safety are adequate; however, constructing the slopes to a 3:1 slope may provide better maintenance and erosion control.

The shear strength parameters and other properties of the cohesive (fine-grained) soils were based on correlation with SPT N-values, Atterberg limits, unit weight, unconfined compression tests, and triaxial shear tests (Q and R tests). The results of the triaxial tests are located in Appendix IV. For the sandy soils, drained angle of internal friction ($\phi$) and unit weights were based on results of in-situ testing (N-values). The shear strength parameters for the embankment fill soils were estimated based on general ranges of fine-grained materials. We recommend that once the embankment soils are

chosen, PSI be provided with samples of the soil for testing purposes. The shear strengths used in the analyses are tabulated on the design plates in Appendix VI. Analyses of the sections were performed using unconsolidated-undrained (UU) and consolidated-undrained (CU) shear strengths to model conditions during and immediately after embankment construction, and analyses of the sections considering long term conditions were performed using consolidated-drained (CD) shear strengths. Analyses were also performed considering a seismic event using the CU shear strengths.

The seismic forces on the slopes were evaluated using a pseudo-static analysis. This analysis approach involves computing a force (seismic), in addition to the standard analysis forces, which is equal to the weight of individual soil wedges times a coefficient of acceleration [horizontal ($k_h$) and/or vertical ($k_v$)]. In general, the vertical coefficient of acceleration, $k_v$, is taken as zero, which was the case in these analyses. The magnitude of the horizontal coefficient of acceleration, $k_h$, may be estimated using a variety of methods or basic assumptions; however, our determination of $k_h$ was based on an equation as proposed by Hynes-Griffin and Franklin (1984): $k_h = \frac{1}{2}a_{max}/g$ ($a_{max}$ = PGA at the surface). The peak ground acceleration (PGA) used in the analyses was obtained from the United States Geologic Survey (USGS) National Seismic Hazard Mapping Project web page and was determined to be 0.15g. This value is based on a seismic hazard of 10 percent probability of exceedence (PE) in 50 years (475-year return period). The value of $k_h$ used in these analyses was 0.075g based on the source, probability level, and equation discussed above.

Based on the results of the slope stability analyses, it appears that constructing the full 40-foot high embankments in one stage on unmodified in-situ soils will not be possible. The recommended possible construction alternatives include two stage construction with allowance for the in-situ soils to consolidate, single stage construction with rammed aggregate pier reinforced in-situ soils, or semi-stage construction incorporating sand or wick drains to increase the rate of consolidation of the in-situ soils. These alternatives are discussed below.

### 6.1.1 Staged Construction

Initial evaluation of the 40-foot embankment under UU shear strength parameters (after construction case) indicated a FS of 1.1 which is less than the minimum recommended FS of 1.3. This indicates that staging of the full embankment fill height will be required without other remedial measures. To evaluate the staging process, subsequent analyses were conducted on sections which had smaller fill heights until an adequate FS was obtained. It was estimated that a section with a fill height of 30 feet possessed an adequate factor of safety using the UU shear strength parameters. A subsequent analysis was then performed for the full 40-foot fill height based on CU shear strength corresponding to the initial stage construction assumed to be 30 feet in height. We recommend that the second stage of construction begin once approximately 90 percent of the predicted settlements in the in-situ soils has occurred or settlement plates indicate settlements have subsided. Results of the analyses for this alternative are included in Appendix VI, and the results of specific analyses are listed in Table 3.

**Table 3. Results of Staged Construction Slope Stability Analyses.**

| | Recommended Minimum Factor of Safety | Calculated Factor of Safety |
|---|---|---|
| Fill Constructed in One Stage to 40 feet | 1.3 | 1.1 |
| Stage 1- Fill Constructed to Maximum Height of 30 feet | 1.3 | 1.5 |
| Stage 2- Fill Constructed to Final Height of 40 feet after Consolidation of In-situ Soils | 1.3 | 1.3 |
| Earthquake ($k_h$= 0.075g) | 1.1 | 1.1 |
| Long Term Condition | 1.5 | 1.5 |

In lieu of stage construction of the embankment, alternative measures could be taken to allow a single stage construction of the proposed embankment. These alternatives include using rammed aggregate piers (Geopiers) for shear strength improvements or using sand or wick drains to increase the rate of consolidation. The use of drains will likely require some delay (staging); however, the time will likely be relatively short.

6.1.2 Rammed Aggregate Piers (Geopiers)

The rammed aggregate pier alternative was evaluated using two reinforcing configurations, for ease of discussion termed Case 1 and Case 2. These are discussed separately below. Both cases were analyzed using composite shear strength parameters in the reinforced zone as recommended in the Geopier Foundation Company Inc. Technical Bulletin No. 5 as outlined in the Federal Highway Administration Publication No. FHWA-SA-98-086. The composite shear strength parameters represent a weighted average of the shear strength components of the aggregate pier and the in-situ soil material. The composite shear strengths of the reinforced soils for both cases were modeled based on a ratio of aggregate pier area to gross footprint area equal to 0.2. The analyses for the rammed aggregate piers should be considered preliminary in nature. The specialty contractor installing the piers should be contacted to perform final design analyses. PSI should review the final design analyses when complete.

6.1.2.1 Case 1

As for the unreinforced section, the initial analysis was performed for the full 40-foot cross-section. The area which was assumed to be reinforced with the aggregate piers extended approximately 70 feet either direction from the centerline of the roadway. This limit corresponds to a cross-sectional fill height of 20 feet. The analysis of the 40-foot high embankment using UU composite shear

strength parameters indicates that a single stage of construction can be used. Results of the analyses for this alternative and case are included in Appendix VI, and the results of specific analyses are listed in the table below.

**Table 4. Results of Aggregate Pier Reinforced (Case 1) Slope Stability Analyses.**

| | Recommended Minimum Factor of Safety | Calculated Factor of Safety |
|---|---|---|
| Fill Constructed in One Stage to 40 feet | 1.3 | 1.4 |
| Earthquake ($k_h$= 0.075g) | 1.1 | 1.2 |
| Long Term Condition | 1.5 | 1.5 |

6.1.2.2 Case 2

Again, the initial analysis was performed for the full 40-foot cross-section. The aggregate piers for this case were taken as extending to the sandy soils with a length of approximately 30 feet. The area which was assumed to be reinforced with the aggregate piers spanned from the point where the fill height ranged from 20 to 30 feet. Thus, the width of reinforced soils would be approximately 20 feet and would be located on both sides of the embankment as well as across the end slope. Although not modeled, this case would also require aggregate piers between the reinforced bands to control differential settlements. The analysis of the 40-foot high embankment using UU composite shear strength parameters indicate that a single stage of construction can be used. Results of the analyses for this alternative and case are included in Appendix VI, and the results of specific analyses are listed in the table below.

**Table 5. Results of Aggregate Pier Reinforced (Case 2) Slope Stability Analyses.**

| | Recommended Minimum Factor of Safety | Calculated Factor of Safety |
|---|---|---|
| Fill Constructed in One Stage to 40 feet | 1.3 | 1.3 |
| Earthquake ($k_h$= 0.075g) | 1.1 | 1.2 |
| Long Term Condition | 1.5 | 1.5 |

6.1.3 Sand or Wick Drains

Stability analyses of the sand or wick drain alternative will be identical to those performed for the staged construction alternative. Again, we recommend that the second stage not proceed (waiting period) until approximately 90 percent of the predicted settlements in the in-situ soils have occurred

or settlement plates indicate settlements have ceased. Preliminary estimates for typical spacing of drains (~5 feet) which extend approximately 30 feet below the ground surface to the sandy soils indicate the recommended waiting period can be reduced to approximately one month. Once the stage one settlement criteria have been met, the second stage construction can begin.

### 6.1.4 Temporary Slope

Finally, analysis of the proposed temporary 1:1 slope east of the existing railroad tracks was analyzed using UU shear strength parameters. This slope was reported to have a maximum height of 12 feet. The analysis indicated a factor of safety in excess of 3 for this condition. The results of this analysis are included in Appendix VI.

## 6.2 Settlement Considerations

We have performed calculations to estimate the potential settlements which may occur due to the proposed embankments for both unreinforced (in-situ) and reinforced (rammed aggregate piers) soils.

### 6.2.1 In-Situ Soils

For the unreinforced soils, settlement calculations were performed for fill heights of 20 feet, 30 feet, and 40 feet. These analyses were performed using the results of the consolidation tests performed on samples from B-6 at 6 to 8 feet and B-8 at 16 to 18 feet. Settlements were determined by dividing the subsurface soils into layers, assuming the applied stress was distributed uniformly in the upper soils, using consolidation theory to compute strains for the applied stresses, and summing the computed strains for each layer. Based on the modeled subsurface conditions and the applied stresses, we estimated the following maximum consolidation settlements of the existing unreinforced soils:

**Table 6. Results of Settlement Analyses for In-Situ Soil Conditions.**

| Slope Fill Height (feet) | Estimated Settlements of Unreinforced Soils (inches) |
|---|---|
| 20 | 4 |
| 30 | 8 |
| 40 | 12 |

6.2.2 Soils Modified with Rammed Aggregate Piers

For the soils modified with rammed aggregate piers, settlements were calculated for various conditions based on the two cases presented. The analyses were performed using the above mentioned consolidation test results along with recommended settlement analysis procedures (elastic procedures) as outlined in Geopier design literature. The settlements were determined based on upper zone (reinforced zone) settlements using the Geopier analysis procedure and lower zone settlements using consolidation theory. For Case 1, the settlements were estimated for the reinforced zone based on aggregate pier lengths of 20 feet and a lower zone thickness of approximately 10 feet. Settlements for the reinforced zone in Case 2 were estimated based on a reinforced zone with a aggregate pier length of 30 feet and no lower zone thickness.

In addition, several other configurations of rammed aggregate piers were analyzed, as discussed in the next section. These additional aggregate piers were included to control differential settlements. For both Case 1 and 2, rammed aggregate piers were added parallel to the roadway centerline where the fill height varies from 30 feet to 20 feet. These aggregate piers have a length of 10 feet and are spaced on 10-foot centers. Additional aggregate piers were also required between the 20-foot wide reinforced bands proposed in Case 2. These aggregate piers have a length of 15 feet and are spaced on 10-foot centers. The following table lists the various configurations and associated estimated settlements:

**Table 7. Results of Settlement Analyses for Rammed Aggregate Pier Soil Conditions.**

| **Case 1** | Estimated Settlement of Rammed Aggregate Pier Reinforced Soils (inches) |
|---|---|
| 40' fill height- 20' long aggregate piers on 5' centers | 4.5 |
| 30'-20' fill height- 10' long aggregate piers on 10' centers | 5 |
| | |
| **Case 2** | Estimated Settlement of Rammed Aggregate Pier Reinforced Soils (inches) |
| 20' to 30' fill height (reinforced bands)- 30' long aggregate piers on 5' centers | 1.5 |
| 40' fill height (between reinforced bands)- 15' long aggregate piers on 10' centers | 6 |
| 30'-20' fill height- 10' long aggregate piers on 10' centers | 5 |

### 6.2.3 Fill Soils

In addition to the consolidation of the natural soils, we anticipate the engineered fill of the embankments may also experience some consolidation with time. Studies have shown that settlements can occur within properly compacted engineered fill on the order of about 1 percent of the fill height as the fill mass reaches a state of equilibrium. Therefore, settlements on the order of about 4 to 5 inches may occur within the embankment after construction. We anticipate the time required for these settlements to occur will be less than the time estimated for consolidation of the natural soils, and may occur as the fill is constructed.

### 6.2.4 Time Rates of Settlements

Estimates of the time rate of consolidation were also calculated for times required for 50 percent and 90 percent consolidation based on double drainage. In addition, we have also estimated the rate of consolidation based on the use of sand or wick drains. The drains were assumed to extend to the sandy soils at a depth of about 30 feet, and a permeable granular layer was also assumed to be placed at the ground surface. An exact design of the potential drain system was not performed, and the estimates provided are based on typical design parameters.

**Table 8. Results of Time Rate of Settlement Analyses for In-Situ, Sand or Wick Drains, and Rammed Aggregate Pier Soil Conditions.**

| Percent Consolidation | Estimated Time Required for Natural In-situ Soils (months) | Estimated Time Required for Soils with Sand or Wick Drains or Rammed Aggregate Piers (months) |
|---|---|---|
| 50 | 2 | <1 |
| 90 | 6 | 1 |

# 7.0 RECOMMENDATIONS

## 7.1 Site Preparation

We recommend that topsoil, vegetation, roots, and any soft soils in the construction areas be stripped from the site. The depth of removal should be determined by a representative of the geotechnical engineer at the time of construction. Because of the wooded areas, some clearing and grubbing operations will be required to remove organic matter, roots, stumps and other remnants of the vegetation. Areas disturbed by the tree and stump removal operations should be undercut to suitable undisturbed soils and backfilled with properly compacted structural fill placed and tested in accordance with the recommendations in this report. Utilities should be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed to inhibit the potential for subsurface erosion. Utility trench excavations must be backfilled with properly compacted structural fill which is constructed as outlined in Section 7.2 of this report.

After stripping and excavating to the proposed subgrade level, as required, the fill areas should be proof-rolled with a heavily loaded tandem axle dump truck or similar rubber tired vehicle. Soils which are observed to rut or deflect excessively under the moving load, or are otherwise judged to be unsuitable, should be undercut and replaced with properly compacted fill. Many soils encountered at the boring locations indicated either soft or wet soils in the upper 2 to 4 feet. We preliminarily estimate undercut quantities in the range of about 10,000 to 20,000 $yd^3$ based on the soils encountered at the boring locations; although, we note that it is likely these soils can be processed and compacted in lieu of undercutting. These areas should be carefully observed during construction. In addition, the necessity of these activities will likely be a function of the climatic conditions at the time of construction. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather.

The subgrade soils should be scarified and compacted to at least 95 percent of the standard Proctor maximum dry density as determined by AASHTO T-99-95 Method A for a depth of at least 6 inches below the surface. If fill is required, the structural fill should then be placed on the prepared subgrade.

Particular attention should be directed to the swale/ditch areas during site preparation because wet and/or organic soils are often found in areas such as these. Any such unsuitable materials encountered should be undercut and replaced by properly compacted fill. Past experience indicates that it is not uncommon to find several feet of unsuitable soils within drainage swales/ditches. Any existing steep side slopes shall be sufficiently flattened and any loose materials removed prior to proof-rolling operations. The owner should consider an allowance in the budget for undercut and replacement of such material. If desired, test pits can be excavated in these areas to better define potential undercut requirements.

Relatively wet fine-grained soils were encountered in the borings. Fine-grained soils which have moisture contents more than about 2 to 3 percentage points above the optimum moisture are generally prone to softening when dynamic loads such as those generated by the wheels of construction equipment are imposed upon them even if the soils exhibited substantial strength in an undisturbed state. After disturbance, these fine-grained soils typically rut and deflect significantly and do not provide adequate subgrade support for foundations, pavements, or fill placement.

## 7.2 Fill Requirements

After subgrade preparation and observation have been completed, fill placement may begin. The first layer of fill material should be placed in a relatively uniform horizontal lift on the prepared subgrade. Fill materials should be free of organic or other deleterious materials, have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. Most of the on-site soils are suitable for use as structural fill with the exception of the existing topsoil; however, the moisture content will most likely have to be adjusted to coincide with the moisture range required for structural fill. If a fine-grained silt or clay soil is used for fill, close moisture content control will be required to achieve the recommended degree of compaction.

Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by AASHTO Designation T 99-95 Method A. Fill should be placed in maximum lifts of 8 inches of loose material and should be compacted within the range of 3 percentage points below to 2 percentage points above the optimum moisture content value. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of compacted engineered fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts.

After fill placement is complete for the embankments, we recommend the fill be allowed to achieve a state of equilibrium prior to installing the pile. We anticipate a majority of the consolidation settlements in the natural soils will occur as the fill is being constructed. We anticipate the estimated time rate of consolidation for the natural soils will provide ample time for the fill soils to also reach a state of equilibrium.

## 7.3 Construction Considerations

The upper fine-grained soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly

retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork, pavement and foundation construction activities during dry weather.

Also, some of the existing in-situ soils which will be present near the top of exposed subgrades or will be cut and used for fill must be processed to a suitable moisture content (3 percentage points below to 2 percentage points above the standard Proctor optimum moisture). Dry weather with favorable drying conditions (sunshine, low relative humidity, and/or wind) is best suited for these operations. This is especially important at this site considering the relatively wet soils which were encountered in the subsurface exploration.

Water should not be allowed to collect in the foundation excavations or on prepared subgrades for pavements during construction. Positive site drainage should be maintained throughout construction activities. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. The site grading plan should be developed to provide rapid drainage of surface water away from pavement areas and to inhibit infiltration of surface water beneath the pavements. The grades should be sloped away from the pavement areas.

While limited areas of apparent perched groundwater were encountered in the upper soils at the time the field exploration was conducted, we do not anticipate groundwater issue will be a construction concern. Any water accumulation should be removed from excavations by pumping. Should excessive and uncontrolled amounts of seepage occur, the Geotechnical Engineer should be consulted.

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document and subsequent updates were issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

## 7.4 California Bearing Ratio

Bulk soil samples were retrieved from the upper 5 feet of the auger cuttings near Boring B-3. Visual classification and Atterberg limits indicated these soils were brown silty clay (CL). Standard Proctor and California Bearing Ratio (CBR) tests were performed on the sample in accordance with AASHTO specifications. The CBR test performed on the soil sample indicated CBR values at 0.1-inch and 0.2-inch penetration of 2.4 and 2.2. Based on the results of these tests we recommend a CBR value of 2.3 be used for the existing silty clay soils.

## 7.5 Pile Foundations

Once the site has been properly prepared as discussed above, the proposed bridge can be supported on pile foundations. A variety of deep foundations (augered, cast-in-place piles; drilled piers; driven steel H-piles; or driven steel or concrete displacement piles) are available which may produce a satisfactory deep foundation system; however, we understand TDOT prefers to use driven square prestressed concrete displacement piles. Considering this, TDOT has developed pile design tables intended for use with these driven piles. The design tables correlate field N-values with both adhesion ($f_s$) and end bearing ($q_b$) values based on soil type (clay, silt, or sand). The attached pile capacity diagrams (Appendix VII) were developed using these tables and can be used to estimate individual pile capacities for driven displacement piles. The individual pile capacities (in tons) estimated using these diagrams represent an ultimate capacity, and as such, an appropriate factor of safety should be applied to these values. We recommend a minimum factor of safety of 2.0 for compression loading be used in the design of the piles. In addition, we recommend the piles be driven a minimum of 10 feet into the sandy soil stratum. We recommend a minimum center to center pile spacing of 2.5 pile widths.

Each pile should have an elevation recorded on the pile head upon completion of driving. Upon completion of driving of the pile group, these elevations should be checked to verify heave of the soil during driving of adjacent piles has not resulted in a pile becoming unseated. If this is found to have occurred, the pile should be re-driven to the original tip elevation. We recommend the estimated pile compression capacities be verified with an in-situ load test for each size and configuration of pile selected for use in accordance with ASTM Designation D-1143, "Standard Method of Test for Piles Under Static Axial Compressive Loads" (quick load test method for individual piles).

It is important to note that if the piles are installed prior to completion of consolidation of the in-situ or embankment soils, negative skin friction forces can be developed on the piles. For piles embedded in the sandy soils, as recommended above, this negative skin friction force could exceed the capacity of the pile. Therefore, we recommend the piles either be installed after settlements have ceased (based on either settlement plate data or estimated time rates stated in this report) or the upper portions of the piles be installed in predrilled holes and be coated with a bituminous material. We note that only small settlements are required to mobilize the negative skin friction forces on the piles.

The pile capacity diagrams are based on the information obtained in the subsurface exploration at the existing grade. However, at the abutment locations, the piles will be driven through approximately 32 feet of fill. As a result, additional capacity could be realized from this fill material provided settlements due to fill loading are complete prior to pile installation. Assuming the fill material is a fine-grained soil (assumed to be a CL/ML soil) compacted to the recommended dry density, adhesion and end bearing values can be determined using the TDOT pile design tables for a N-value of about 8. However, based on the fill height and the potential for even small settlements to occur in the naturally deposited or fill soils after pile installation, we recommend pile capacities be calculated neglecting the potential capacity from the fill soils.

In driving the piles a proper size hammer should be chosen such that the piles are driven at a reasonable rate and such that the piles are not damaged during driving. Once the required pile capacity is identified, PSI can provide information as to the acceptability of a hammer for use on this project.

## 7.6 Slope Stability

Based on the results of the slope stability analyses, it appears that constructing the full 40-foot high embankments in one stage on unmodified in-situ soils will not be possible. The recommended possible construction alternatives include two stage construction with allowance for the in-situ soils to consolidate, single stage construction with rammed aggregate pier reinforced in-situ soils, or semi-stage construction incorporating sand or wick drains to increase the rate of consolidation of the in-situ soils. These alternatives are discussed below. For all these alternatives, we recommend installing multiple settlement plates and piezometers (or pore pressure transducers) in the embankments. The settlement plates should be installed near the existing ground surface at various fill heights along the centerline of the roadway. We recommend installing the piezometers in the embankment areas along the roadway centerline where the fill height will be equal to or greater than 30 feet. The piezometers should be installed to a depth of about 15 feet below existing grade.

7.6.1 Staged Construction

In regards to the two stage construction alternative, we recommend the embankment initially be filled to a maximum height of 30 feet. The settlement plates should be monitored during embankment construction and after completion of the first stage. Once either the estimated time of consolidation has passed (estimated to be about 6 months) or the settlement plate data indicate movements have subsided, the second phase of construction may commence.

The two alternatives involving rammed aggregate piers (Geopiers) may be constructed in a single, continuous stage of construction. In the analyses conducted, the aggregate piers in the reinforced soil zones were assumed to cover 20% of the reinforced area, and this equates to a center-to-center spacing of approximately 5 feet. Areas where the aggregate piers were installed for settlement control were assumed to be spaced at 10 feet on center. Specific recommendations for the two alternatives are discussed below. For either case and regardless of function, the rammed aggregate piers are not necessary where the fill height is less than 20 feet.

7.6.2 Case 1 – Rammed Aggregate Piers

The reinforced area for this case was taken as an area spanning away from the centerline of the roadway to a fill height of 20 feet in the 40-foot high cross-section, and the aggregate piers were assumed to be 20 feet long. The total width of this cross-section is approximately 230 feet, with the reinforced section covering the middle approximately 140 feet. We recommend this reinforced zone extend along the centerline of the roadway to a point where the maximum fill height is 30 feet. This would equate to a reinforced zone length of approximately 350 feet for each embankment.

Then, parallel to the centerline of the roadway from fill heights ranging from 30 feet to 20 feet, we recommend aggregate piers be 10 feet in length and be installed on 10-foot centers for the purpose of controlling differential movements. As with the reinforced zone, this zone of aggregate piers should span between fill heights of 20 feet based on cross-section fill heights.

For cross-sections with less than 20 feet of fill height, piers do not appear to be necessary.

Based on the above, we have estimated a total of 4,920 rammed aggregate piers will be required for this alternative. The total lineal feet of aggregate piers will be approximately 87,000 feet. Preliminary estimates indicate the cost of Geopiers for both embankments for Case 1 would be in the range of $1,750,000 to $2,000,000.

7.6.3 Case 2 – Rammed Aggregate Piers

The reinforced area for this case was taken as an area spanning between fill heights of 20 to 30 feet in the 40-foot high cross-section, and the aggregate piers were assumed to extend to the sandy soils

with an average length of 30 feet. The total width of this reinforced band would be 20 feet wide. We recommend this reinforced zone extend parallel to the centerline of the roadway to a point where the maximum fill height is 30 feet. This would equate to a reinforced band length of approximately 350 feet for each embankment. This narrow band of reinforced soil would be constructed on either side of the centerline of the proposed roadway. Additionally, for this case, aggregate piers will also be required between the reinforced bands in order to control differential settlements. These aggregate piers should be 15 feet in length and on 10-foot centers.

Again, as in Case 1, we recommend aggregate piers be installed which are 10 feet in length on 10-foot centers in an area which is parallel to the centerline of the roadway for fill heights ranging from 30 feet to 20 feet. This will control differential settlements. As with the reinforced zone, this zone of aggregate piers should span between fill heights of 20 feet based on cross-section fill heights.

For cross-sections with less than 20 feet of fill height, piers do not appear to be necessary.

Based on the above, we have estimated a total of 3,666 rammed aggregate piers will be required for this alternative. The total lineal feet of aggregate piers will be approximately 68,370 feet. Preliminary estimates indicate the cost of Geopiers for both embankments for Case 1 would be in the range of $1,250,000 to $1,500,000.

### 7.6.4 Sand or Wick Drains

For the alternative involving sand or wick drains the embankments will have to be constructed similarly to the unmodified alternative with the exception that the time required to achieve 90 percent consolidation will be much shorter. The drains should be installed to a minimum depth of 35 feet to ensure the drains penetrate into the sandy soil stratum. The initial lift for the embankments should consist of a granular material such that water transported up the drains may exit the drains. We recommend the drains be installed in the same plan areas (fill height ranges) as described for the aggregate piers. The ratio of the diameter of the zone draining to a drain to the diameter of the drain should be in the range of 40 to 80. Again, we recommend the embankment initially be filled to a maximum height of 30 feet. The settlement plates should be monitored during embankment construction and after completion of the first stage. Once either the estimated time of consolidation has passed (estimated to be about 1 month) or the settlement plate data indicate movements have subsided, the second phase of construction may commence.

### 7.6.5 General Slope Recommendations

The following are some general issues which should be noted concerning the proposed slopes of the embankments as follows:

- A slope of 2:1 can generally be maintained provided the slope face is protected from

erosion and provided any shallow slope failures (if they occur) are repaired immediately. Since fill soils are typically highly susceptible to erosion and sloughing, the contractor will have to take immediate precautions to protect the constructed slopes from surface water and to provide vegetation or other slope protection measures (e.g., erosion mats, rip rap, etc.). Surface water at the crest of the slope should be collected and removed without allowing the water to flow over the face of the slope. The slope should be periodically inspected for any shallow, surficial slips and repaired. Failure to repair shallow slips in a timely manner may lead to progressive shallow failures, 'sympathetic slips', which may progress into a serious slope situation. The use of a slope of 3:1 would help to mitigate some of the problems discussed above and would be preferable from a maintenance standpoint.

- Water should not be allowed to stand or pond at the crest or at the toe (base) of the slope. Increases in moisture content will tend to soften the existing fine-grained soils and reduce the shear strengths of the soil.

## 7.7 Earth Retaining Structures

Any below grade walls must be designed to withstand the soil pressures which will be exerted upon them. The magnitude of the earth pressure is dependent upon several factors including the type of loading and the soil conditions. It is recommended that the backfill adjacent to the below grade retaining walls be consistent with backfill material as indicated in drawing STD-10-1 of the Tennessee Department of Transportation 'Standard Structure Drawings'. A positive drainage system should be employed to prevent the accumulation of water (from any source) in the backfill behind the wall.

For drained loading conditions, lateral earth pressure may be estimated using the standard loading diagrams as presented on STD-13-1. The earth forces determined from STD-13-1 assume the wall yields sufficiently such that active earth pressures are developed; however, if earth retaining structures are designed as non-yielding structures these earth forces should be increased by 67 percent to reflect an at-rest earth pressure condition. The actual earth pressures on the walls will vary according to the building material types and the way backfill material is compacted. Heavy compaction equipment and/or over-compaction of fill next to the walls may induce higher pressures than estimated herein. Build-up of hydrostatic pressures behind the earth retaining structure should be avoided.

In regards to sliding, the ultimate horizontal friction resistance may be computed by multiplying the vertical wall load by a coefficient of friction which is dependent on the type of soil in contact with the base of the foundation elements (assumed to be in a horizontal plane). We recommend the

coefficient of friction as stated on STD-13-1 be used for design. Factors of safety recommended on STD-13-1 should be used in design of the earth retaining structures.

*Seismic Force*

In regards to lateral earth pressures on retaining walls due to seismic forces, estimates of the magnitude of these forces may be made in accordance with methods outlined in Technical Engineering and Design Guides as adapted from the U.S. Army Corps of Engineers, No. 4, Retaining and Flood Walls, Mononobe-Okabe (M-O) Analysis, published by the American Society of Civil Engineers.

In using the M-O analysis procedure we have assumed that the backfill surface beyond the below grade walls will be horizontal with no surcharge loading, the face of the walls will be in a vertical plane, and the walls will be above the groundwater level (or that a drain system will lower the groundwater level). The retaining wall height (or depth) below the highest ground surface is denoted as H with units of feet. Based on the recommended free draining granular backfill discussed above, a value of 30 degrees was selected for the angle of internal friction for the granular backfill and a unit weight of 120 pounds per cubic foot (pcf) was used. The wall friction angle was assumed to be zero.

In order to perform the analyses, it is necessary to make assumptions regarding the seismic event causing the lateral forces on the wall; obviously, a larger event will impose larger forces. For the case at hand, we used a seismic event based on a 10 percent probability of exceedence in 50 years as the design seismic event. The pseudostatic horizontal seismic coefficient of acceleration was calculated to be 0.075 based on the Peak Ground Acceleration (PGA) of this seismic event. The pseudostatic vertical seismic coefficient of acceleration was assumed to be zero.

Analyses utilizing the M-O equations and the above data results in a predicted Lateral Dynamic Component Force (LDCF) for active earth pressure conditions with units of pounds per linear (horizontal) foot of wall of $3H^2$. If the earth retaining structure is designed for an at-rest earth pressure condition in which the structure will be non-yielding the predicted LDCF will be $9H^2$. This dynamic force may be assumed to act at the upper one-third point as relates to the portion of the wall between the top of the backfill and the base. The minimum required deflection for use of an active earth pressure condition is estimated to be about 0.3 percent of the wall height in the granular backfill.

## 7.8 Seismicity

Shelby County, Tennessee is in the general proximity of New Madrid, Missouri, the epicenter for some of the largest earthquakes in the North American continent. Four earthquakes of about magnitude 8 occurred within this seismic zone during the winter of 1811-1812. Presently, the New

Madrid area contains the highest level of seismicity in the central and eastern parts of the United States.

According to Figure 1607.1.5A of the Standard Building Code, 1999 Edition, the project site is located near the 0.2 effective peak velocity related acceleration coefficient ($A_v$) contour. Based on Figure 1607.1.5B, the project site is located near the 0.2 effective peak acceleration coefficient ($A_a$) contour. Upon evaluation of the available data, the site coefficient, S, may be assumed to have a value of 1.2 since the soils encountered in the subsurface exploration most closely approximate standard soil profile type "S2" as defined in Table 1607.3.1.

## 7.9 Liquefaction

In order for liquefaction to occur, site conditions must include a layer of saturated soil which is susceptible to liquefaction (a loose sand, gravel, or non-plastic silt). In addition, this layer of loose, saturated soil must either be bounded by layers which are relatively impermeable with respect to the liquefiable layer or have a low enough permeability such that the time required for drainage to occur is too long to avoid buildup of excess pore pressures.

For ease of illustration assume we have a liquefiable layer which is bounded by relatively impermeable layers. This means the liquefiable layer has a specific height, H. Looking at a column of saturated soil in this layer with a height of H, all the volume is taken up by either soil particles or water (both of which are taken as incompressible) and the height of the soil matrix is equal to the height of the layer. Assuming the stress conditions in the soil profile have been constant for a long time (i.e. all consolidation has occurred), the soil layers will be at a state of equilibrium (i.e. no excess pore pressure). As a result, the overburden stresses supported by the liquefiable layer (soil and any other loads) will be taken by the grain to grain contact of the soil particles. As the soil column is subjected to shear stresses (earthquake motions), the loose soil particles tend to move closer together forming a denser soil matrix (i.e. the height of the soil matrix is no longer equal to the height of the layer). As this occurs the overburden stress are transferred to the water (i.e. the pore pressure increases) due to the fact that the materials are incompressible and the water is trapped and can not flow out of the column. As the soil matrix densifies (soil matrix height reduces) and the overburden pressures are transferred to the pore water, the available shear strength of the column of soil is reduced and the soil is said to liquefy.

Because water has no shear strength and the grain to grain shear strength of the soil particles is reduced, any shear strength demand placed on the liquefiable layer to resist a bearing capacity failure (shallow foundation, deep foundation, slope stability) or provide adhesion (skin friction) will be drastically reduced until the pore pressure dissipates. Also, the settlements associated with liquefaction result from the densification of the soil matrix and the subsequent dissipation of the pore pressure (outflow of trapped groundwater).

### 7.9.1 Liquefaction Analysis

This evaluation of liquefaction potential for this study was performed using a software program developed by PSI based on the simplified procedure as proposed by Seed and Idriss with associated modifications derived from a 1996 National Center for Earthquake Engineering Research (NCEER) review of the procedure. The simplified procedure for evaluating liquefaction potential is considered the standard of practice. This procedure was developed using a data base of information collected from sites throughout the world where liquefaction did and did not occur. Empirical correlation between the cyclic stress ratio and either corrected N-values, corrected shear wave velocities, or corrected CPT tip resistance were developed which indicate soil conditions in which liquefaction is either likely or unlikely to occur. The liquefaction potential for this site was evaluated based on corrected N-values. The N-values were corrected for overburden pressure, energy transfer, sampler style, borehole diameter, rod length, and percent fines. The N-values corrected in this manner are termed $(N_1)_{60cs}$.

The moment magnitude, $M_w$, and PGA used in the analyses were determined to be 6.5 and 0.15g. The value of PGA was determined based on results obtained from the United States Geologic Survey (USGS) National Seismic Hazard Mapping Project web page. The values presented above are consistent with a level of seismic hazard of 10 percent probability of exceedance in 50 years (475-year return period). The groundwater level was assumed to be at a depth of 10 feet below the existing ground surface. Analyses were performed for conditions with minimal fill depths and for the maximum fill depth of 40 feet. The subsurface conditions analyzed consisted of an average soil profile, as defined from all the deeper borings, and a profile consisting of the conditions encountered at Boring B-9.

The results of the liquefaction analyses are presented in Appendix VIII. These plots indicate the calculated cyclic stress ratio (CSR), the cyclic resistance ratio (CRR), and the factor of safety (CRR/CSR) at 5-foot intervals within the sandy soils. The CSR represents the applied load or demand placed on the soil by the seismic event. The CRR represents the capacity available in the soil to resist liquefaction due to the applied load. Therefore, liquefaction potential would be indicated at depths where the CRR is less than the CSR (i.e. factor of safety less than 1). Generally it is recommended the CRR should be a minimum of 1.2 times the CSR (factor of safety $\geq$ 1.2). Based on the soil conditions, assumed parameters, and seismic hazard level; the analyses indicate that liquefaction of the sands at the site are unlikely. However, it should be noted that liquefaction is a function of the seismic event; therefore, liquefaction may be possible if a stronger seismic event (larger magnitude or PGA) occurs than what was determined for use in these analyses.

## REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by Fisher & Arnold, Inc. for the proposed project as delineated in this report. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the recommendations are required. If PSI is not retained to review these changes, PSI will not be responsible for the impact of those conditions on the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Fisher & Arnold, Inc. for the specific application to the proposed Fite Road Extension in Shelby County, Tennessee.

# APPENDIX I

# BORING LOGS

# GENERAL NOTES

## SAMPLE INDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted (ASTM D 487)

## SOIL PROPERTY SYMBOLS

N: Standard "N" penetration; Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split spoon sampler (ASTM D 1586)

c: Cohesive strength, KSF (ASTM D 2166)

DUW: Dry Unit Weight, PCF

Qp: Penetrometer value, an estimate of the unconfined compressive stregth, TSF

MC: Moisture content, based on dry weight of soil, % (ASTM D 2216)

LL: Liquid limit, % - Atterberg Limits Test (ASTM D 4318)

PI: Plasticity Index, % - Atterberg Limits Test (ASTM D 4318)

## DRILLING AND SAMPLING SYMBOLS

H.S.A. Hollow Stem Auger Drilling
S.F.A. Solid Flight Auger Drilling
M.R. Mud-Rotary Drilling
H.A. Hand Auger Drilling

SPT: Split Spoon Sampler: 1-3/8" I.D., 2" O.D., except where noted (ASTM D 1586)

ST: Shelby Tube Sampler: 3" O.D., except where noted (ASTM D 1587)

CP: Hand Cone Penetrometer - Blows per 1-3/4 inches (ASTM STP 399) - correlated to the Standard Penetration Test

▽ Ground water level encountered during drilling of borehole

▼ Ground water level encountered upon completion of drililng

## RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

| Term (Non-Cohesive Soils) | Standard Penetration Resistance, Blows/ft. | Term (Cohesive Soils) | Standard Penetration Resistance, Blows/ft. |
|---|---|---|---|
| Very Loose | 0 - 4 | Very Soft | 0 - 2 |
| Loose | 5 - 9 | Soft | 3 - 4 |
| Medium Dense | 10 - 29 | Firm | 5 - 8 |
| Dense | 30 - 49 | Stiff | 9 - 15 |
| Very Dense | 50 + | Very Stiff | 16 - 30 |
| | | Hard | 30 + |

## PARTICLE SIZE

| | | | | | |
|---|---|---|---|---|---|
| Boulders | 8 in. + | Coarse Sand | 0.6 mm - 5 mm | Silt | 0.005 mm - 0.074 mm |
| Cobbles | 3 in. - 8 in. | Medium Sand | 0.2 mm - 0.6 mm | Clay | < 0.005 mm |
| Gravel | 5 mm - 3 in. | Fine Sand | 0.074 mm - 0.2 mm | | |

# SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS | | | SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | GRAVEL AND GRAVELLY SOILS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS<br>(LITTLE OR NO FINES) | | GW | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES |
| | | | | GP | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES |
| | | GRAVELS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | | | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| | SAND AND SANDY SOILS<br>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE | CLEAN SANDS<br>(LITTLE OR NO FINES) | | SW | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| | | | | SP | POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES |
| | | SANDS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | | | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS |
| | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | | | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| MISCELLANEOUS FILL SOILS | | | | | FILL SOILS, CONTAINING VARYING AMOUNTS OF DEBRIS, NON-ENGINEERED FILL |

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-1 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 258 ± |
| **Date:** 5/1/03 | **Water level while drilling:** ▽ Dry | **Water level at completion:** ▼ Dry | |
| **Boring Method:** Hand Auger | **Boring Cave In:** Open | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL (10 20 30 40 50 60 70 80 90) | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Soft to Firm Brown Silty CLAY (CL), A-7-6 | | | | | | | |
| | ☒ | | 4 | | 29 | | | | trace sand and roots |
| 5 | ☒ | | 5 | | 28 | | | | |
| | ☒ | | 5 | | 27 | 46 | 24 | | |
| 10 | ☒ | | 4 | | 26 | | | | |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-2 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 246 ± |
| **Date:** 5/1/03 | **Water level while drilling:** ▽ 10' | **Water level at completion:** ▼ 10' | |
| **Boring Method:** Hand Auger | **Boring Cave In:** Open | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Firm Brown SILT (ML), A-4 | 6 | | 25 | NP | NP | | |
| 5 | | Firm to Soft Brown to Gray Silty CLAY (CL), A-6 | 5 | | 30 | | | | |
| | | | 4 | | 30 | | | | |
| 10 | | | 4 | | 28 | | | | |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-3 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 239 ± |
| **Date:** 4/14/03 | **Water level while drilling:** ▽ Dry | **Water level at completion:** ▼ Dry | |
| **Boring Method:** HSA | **Boring Cave In:** Open | **Driller:** Jeff | |

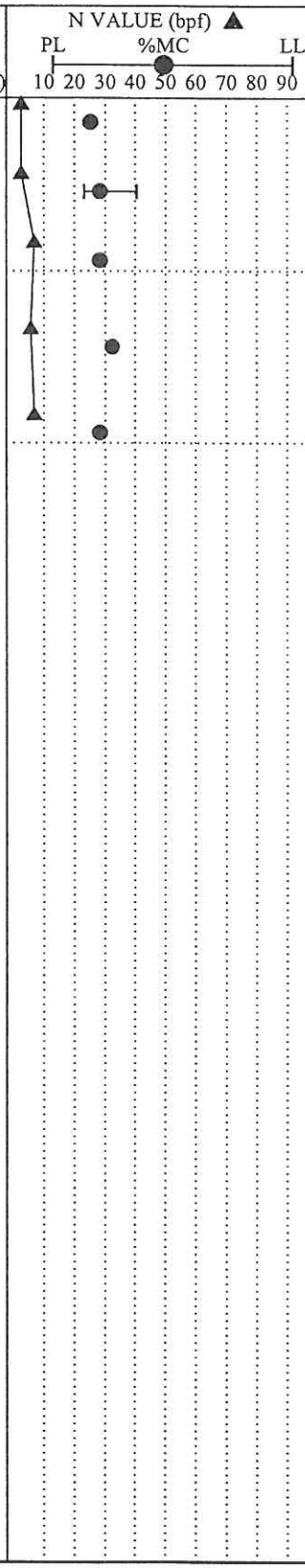
| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Soft Brown and Light Gray Clayey SILT (ML), A-4 | 4 | | 24 | | | | |
| | | | 6 | | 27 | | | | |
| 5 | | Firm to Stiff Light Gray to Brown Silty CLAY (CL), A-6 | 6 | | 24 | 35 | 12 | | |
| | | | 10 | | 26 | | | | |
| 10 | | | 7 | | 30 | | | | trace sand, wet |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-4 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 240 ± |
| **Date:** 4/14/03 | **Water level while drilling:** ▽ 1' | **Water level at completion:** ▼ Dry | |
| **Boring Method:** HSA | **Boring Cave In:** 9' | **Driller:** Jeff | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Soft to Firm Brown Silty CLAY (CL), A-6 | 3 | | 25 | | | | |
| | | | 3 | | 28 | 40 | 17 | | |
| 5 | | | 7 | | 28 | | | | |
| | | | 6 | | 32 | | | | |
| 10 | | | 7 | | 28 | | | | trace sand |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |



PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-5 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 238 ± |
| **Date:** 4/14/03 | **Water level while drilling:** ▽ 9' | **Water level at completion:** ▼ 9' | |
| **Boring Method:** HSA | **Boring Cave In:** Open | **Driller:** Jeff | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Soft Brown Clayey SILT (ML), A-4 | 4 | | 28 | | | | |
| | | Soft to Stiff Brown Silty CLAY (CL), A-6 | 3 | | 26 | 38 | 14 | | |
| 5 | | | 6 | | 27 | | | | |
| | | | 7 | | 28 | | | | |
| 10 | | | 10 | | 29 | | | | |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| Project: **Fite Road Extension** | | | Boring No.: **B-6** |
| Location: **Shelby County, Tennessee** | | | Elev: **238 ±** |
| Date: **4/14/03** | Water level while drilling: ▽ **15'** | Water level at completion: ▼ **Dry** | |
| Boring Method: **HSA** | Boring Cave In: **3'** | Driller: **E. Morris** | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Firm Brown Silty CLAY (CL), A-6 | 5 | | 26 | | | 1.5 | |
| | | | 7 | | 27 | | | 2.0 | |
| 5 | | | 6 | | 29 | | | | |
| | | Firm to Stiff Brown and Light Gray Clayey SILT (ML), A-4 | | | 32 | 33 | 8 | 3.2 | Dry Density = 90.9 pcf<br>Vane Shear = 0.84 ksf<br>Cohesion = 0.85 ksf<br>(UC) |
| 10 | | | 6 | | 29 | | | 3.0 | |
| 15 | | | 7 | | 30 | | | 1.0 | |
| 20 | | | 6 | | 28 | | | | |
| | | | | | 25 | 27 | 4 | 1.8 | Dry Density = 101 pcf<br>Vane Shear = 1.25 ksf<br>Cohesion = 1.15 ksf<br>(UC) |
| 25 | | | 7 | | 24 | | | 1.5 | |
| 30 | | Stiff to Hard Light Gray Silty CLAY (CL), A-6 | 9 | | 21 | | | 2.0 | |
| 35 | | | 42 | | 30 | | | 1.5 | |
| 40 | | Dense Brown SAND (SP), A-1 | 46 | | 16 | | | | |
| | | Boring Terminated at 40.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-7 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 237 ± |
| **Date:** 4/14/03 | **Water level while drilling:** ▽ 15' | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA to 35'/MR to 60' | **Boring Cave In:** NA | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Firm Brown Clayey SILT (ML), A-4 | 6 | | 23 | | | 1.0 | |
| | | Firm Brown Silty CLAY (CL), A-6 | 6 | | 26 | | | 1.5 | |
| 5 | | | 8 | | 27 | | | 1.0 | |
| | | Firm to Stiff Brown Clayey SILT (ML), A-4 | | | 28 | 35 | 8 | 2.0 | Dry Density = 94.6 pcf<br>Vane Shear = 0.94 ksf<br>c=0.3, phi=18<br>c'=0, phi'=31 |
| 10 | | | 5 | | 32 | | | | |
| | | | | | 29 | 35 | 5 | 2.5 | Dry Density = 96.1 pcf<br>Vane Shear = 1.0 ksf<br>Cohesion = 1.5 ksf (UU) |
| 15 | | | 5 | | 29 | | | 2.0 | |
| 20 | | Soft to Firm Brown to Light Gray Silty CLAY (CL), A-6 | 7 | | 25 | | | 1.0 | |
| | | | | | 24 | | | 2.5 | Vane Shear = 0.84 ksf |
| 25 | | | 4 | | 30 | 34 | 14 | | |
| 30 | | | 5 | | 29 | | | 1.0 | |
| 35 | | Reddish Brown to Brown SAND (SP)<br>A-2-4 | + | | 27 | | | | clay seams |
| 40 | | A-3 | + | | 23 | | | | |

PSI502 35079.GPJ 11/18/03

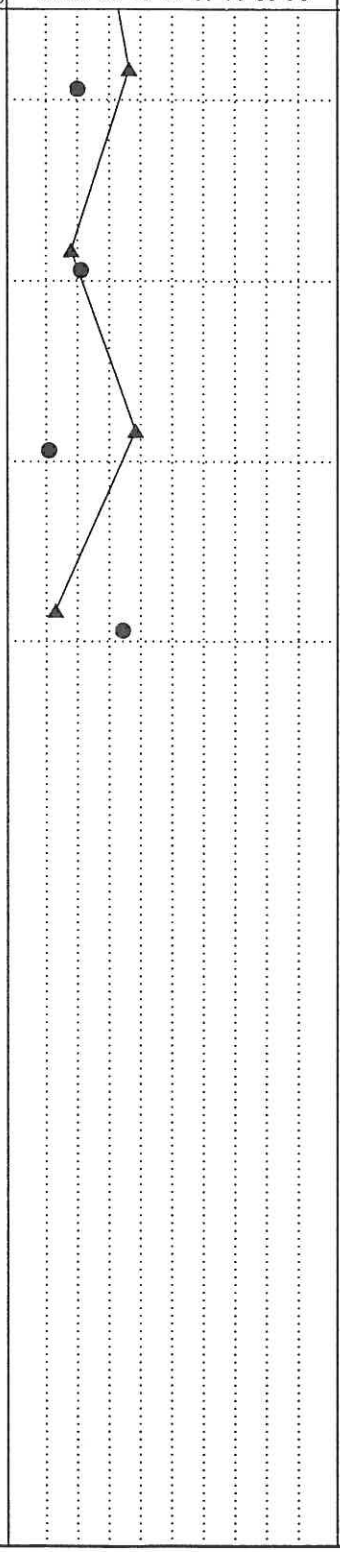
PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-7 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 237 ± |
| **Date:** 4/14/03 | **Water level while drilling:** ▽ 15' | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA to 35'/MR to 60' | **Boring Cave In:** NA | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 45 | | Medium Dense to Dense Brown SAND (SP) A-2-4 | 36 | | 20 | | | | clay seams |
| 50 | | A-3 | 18 | | 21 | | | | |
| 55 | | A-1-a | 38 | | 11 | | | | with gravel |
| 60 | | Stiff Dark Brown CLAY (CH), A-7 | 13 | | 34 | | | 1.5 | |
| | | Boring Terminated at 60.5 Feet. | | | | | | | |



PSI502 35079.GPJ 11/18/03

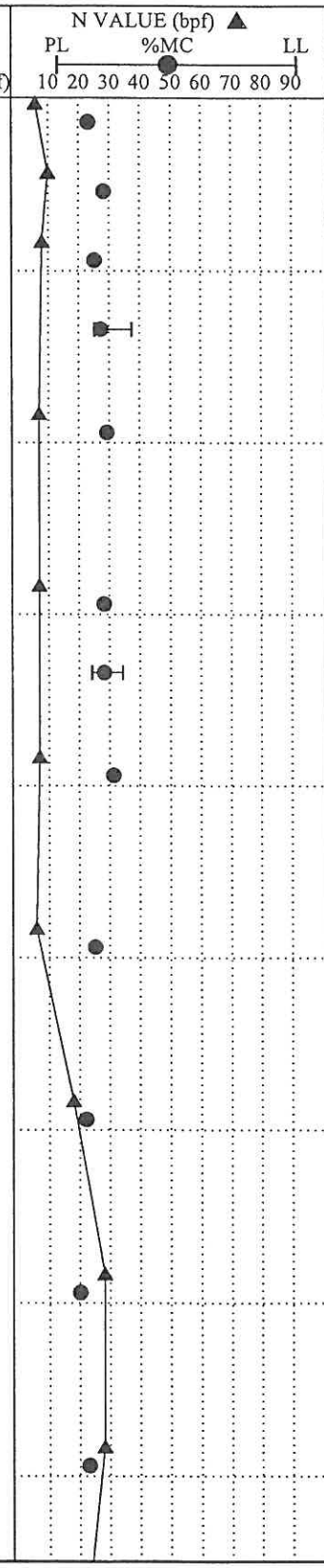
PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-8 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 235 ± |
| **Date:** 5/8/03 | **Water level while drilling:** ▽ NE | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA/MR | **Boring Cave In:** NA | **Driller:** R. Strunk | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|
| | | 2" Topsoil | | | | | | |
| | | Firm Brown Clayey SILT (ML), A-4 | 6 | 23 | | | 1.0 | |
| | | Stiff Black CLAY (CH), A-7 | 10 | 28 | | | 1.75 | |
| 5 | | Firm Gray Lean CLAY (CL), A-6 | 8 | 25 | | | 0.75 | |
| | | Firm to Very Stiff Brown and Light Gray Clayey SILT (ML), A-6 | | 27 | 37 | 12 | | Dry Density = 96.7 pcf<br>Vane Shear = 0.71 ksf<br>Cohesion = 0.70 ksf (UC) |
| 10 | | | 7 | 29 | | | 1.75 | |
| 15 | | | 7 | 28 | | | 2.0 | |
| | | A-4 | | 28 | 34 | 10 | 3.0 | Dry Density = 97.6 pcf<br>Vane Shear = 0.75 ksf<br>Cohesion = 2.1 ksf (UU) |
| 20 | | Firm Gray Silty CLAY (CL), A-6 | 7 | 31 | | | | |
| 25 | | | 6 | 25 | | | 0.25 | some sand |
| 30 | | Medium Dense Brown SAND (SP), A-3 | 18 | 22 | | | | |
| 35 | | | 28 | 20 | | | | |
| 40 | | | 28 | 23 | | | | |




PSI502 35079.GPJ 11/18/03

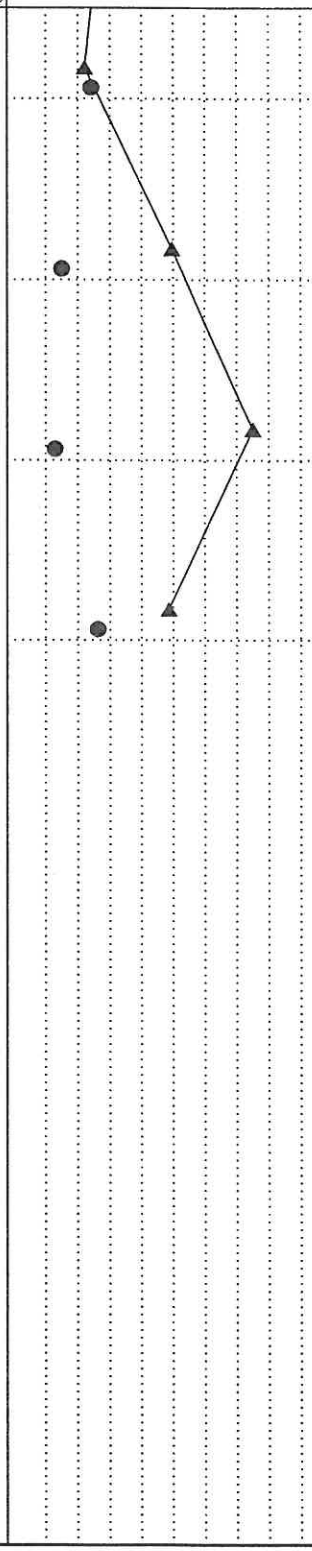
PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-8 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 235 ± |
| **Date:** 5/8/03 | **Water level while drilling:** ▽ NE | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA/MR | **Boring Cave In:** NA | **Driller:** R. Strunk | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 2" Topsoil | | | | | | | |
| 45 | | Medium Dense to Very Dense Brown to Gray SAND (SP) A-3 | 22 | | 24 | | | | |
| 50 | | A-1-b | 49 | | 15 | | | | trace gravel |
| 55 | | A-1-b | 74 | | 13 | | | | trace gravel |
| 60 | | A-3 | 48 | | 26 | | | | trace organics |
| | | Boring Terminated at 60.5 Feet. | | | | | | | |



PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-9 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 237 ± |
| **Date:** 5/8/03 | **Water level while drilling:** ▽ 15' | **Water level at completion:** ▼ Dry | |
| **Boring Method:** HSA | **Boring Cave In:** 13' | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 2-1/2" Topsoil | | | | | | | |
| | | Firm Brown and Light Gray Silty CLAY (CL), A-6 | 7 | | 28 | | | 1.0 | trace roots |
| | | | 6 | | 26 | | | | trace roots |
| 5 | | | 7 | | 28 | | | | |
| | | | 8 | | 28 | | | 1.0 | |
| 10 | | Firm to Stiff Brown to Reddish Brown Clayey SILT (ML), A-4 | 5 | | 31 | 29 | 3 | | wet |
| 15 | | | 5 | | 29 | | | | wet |
| 20 | | | 9 | | 25 | | | | |
| 25 | | Firm Light Gray and Reddish Brown Silty CLAY (CL), with trace sand, A-6 | 7 | | 22 | | | 1.0 | |
| 30 | | Loose Gray and Reddish Brown Silty SAND (SM), A-2-4 | 9 | | 20 | | | | |
| 35 | | Medium Dense Brown SAND (SP), A-2-4 | 14 | | 21 | | | | clay lense |
| 40 | | | 21 | | 20 | | | | |
| | | Boring Terminated at 40.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-10 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 235 ± |
| **Date:** 5/8/03 | **Water level while drilling:** ▽ 7' | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA to 20'/MR to 40' | **Boring Cave In:** 13' | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL (10 20 30 40 50 60 70 80 90) | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 3" Topsoil | | | | | | | |
| | | Soft to Firm Brown Silty CLAY (CL), A-6 | 5 | | 28 | | | | trace roots |
| | | | 7 | | 26 | | | 1.5 | |
| 5 | | | | | 26 | 36 | 15 | 0.8 | Dry Density = 95.3 pcf<br>Vane Shear = 0.42 ksf<br>Cohesion = 0.73 ksf (UC) |
| | | | 4 | | 31 | 36 | 12 | | |
| 10 | | | 5 | | 30 | | | | wet |
| | | Firm to Stiff Brown to Light Gray Clayey SILT (ML), A-4 | 6 | | 29 | | | 2.0 | |
| 15 | | | | | 31 | 32 | 8 | | Dry Density = 95.9 pcf<br>Vane Shear = 0.46 ksf<br>Cohesion = 1.0 ksf (UU) |
| 20 | | | 9 | | 26 | | | 2.0 | |
| | | Firm Light Gray Silty CLAY (CL), A-6 | 6 | | 31 | | | 1.0 | |
| 25 | | | | | | | | | |
| 30 | | | 6 | | 22 | | | | trace sand |
| | | Dense to Medium Dense Brown SAND (SP), A-3 | 41 | | 21 | | | | |
| 35 | | | | | | | | | |
| 40 | | | 24 | | 21 | | | | |
| | | Boring Terminated at 40.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

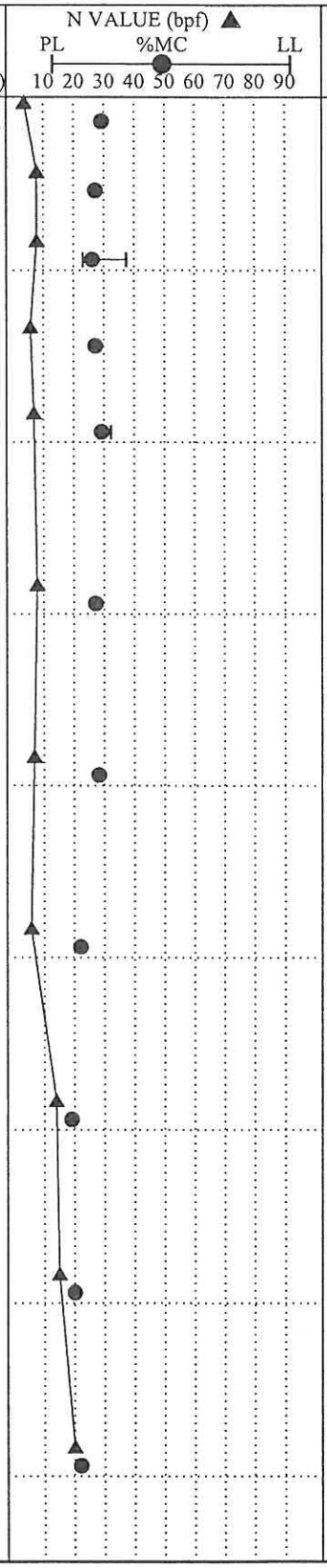
PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-11 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 235 ± |
| **Date:** 5/8/03 | **Water level while drilling:** ▽ 14' | **Water level at completion:** ▼ NA | |
| **Boring Method:** HSA to 20'/MR to 40' | **Boring Cave In:** NA | **Driller:** R. Strunk | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|
| | | 2" Topsoil | | | | | | |
| | | Soft to Firm Brown Silty CLAY (CL), A-6 | 4 | 29 | | | 0.75 | trace roots |
| | | | 8 | 27 | | | 0.75 | |
| 5 | | | 8 | 26 | 37 | 14 | 1.25 | |
| | | | 6 | 27 | | | 1.0 | |
| 10 | | Firm Brown and Light Gray Clayey SILT (ML), A-4 | 7 | 29 | 32 | 4 | 2.75 | |
| 15 | | | 8 | 27 | | | 2.0 | |
| 20 | | | 7 | 28 | | | 1.5 | |
| 25 | | Firm Light Gray Silty CLAY (CL), with trace sand, A-6 | 6 | 22 | | | 2.25 | |
| 30 | | Medium Dense Brown Silty SAND (SM), A-2-4 | 14 | 19 | | | | |
| 35 | | Medium Dense Brown SAND (SP), A-1-b | 15 | 20 | | | | |
| 40 | | | 20 | 22 | | | | |
| | | Boring Terminated at 40.5 Feet. | | | | | | |




PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-12 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 241 ± |
| **Date:** 5/1/03 | **Water level while drilling:** ▽ Dry | **Water level at completion:** ▼ Dry | |
| **Boring Method:** Hand Auger | **Boring Cave In:** Open | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL 10 20 30 40 50 60 70 80 90 | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 3" Topsoil | | | | | | | |
| | | Stiff to Soft Brown Clayey SILT (ML), A-4 | | | | | | | |
| | ☒ | | 9 | | 21 | | | | |
| 5 | ☒ | | 6 | | 24 | | | | |
| | ☒ | | 4 | | 23 | 32 | 7 | | |
| 10 | ☒ | | 4 | | 25 | | | | |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

PSI

# RECORD OF SUBSURFACE EXPLORATION

## PSI File No.: 502-35079

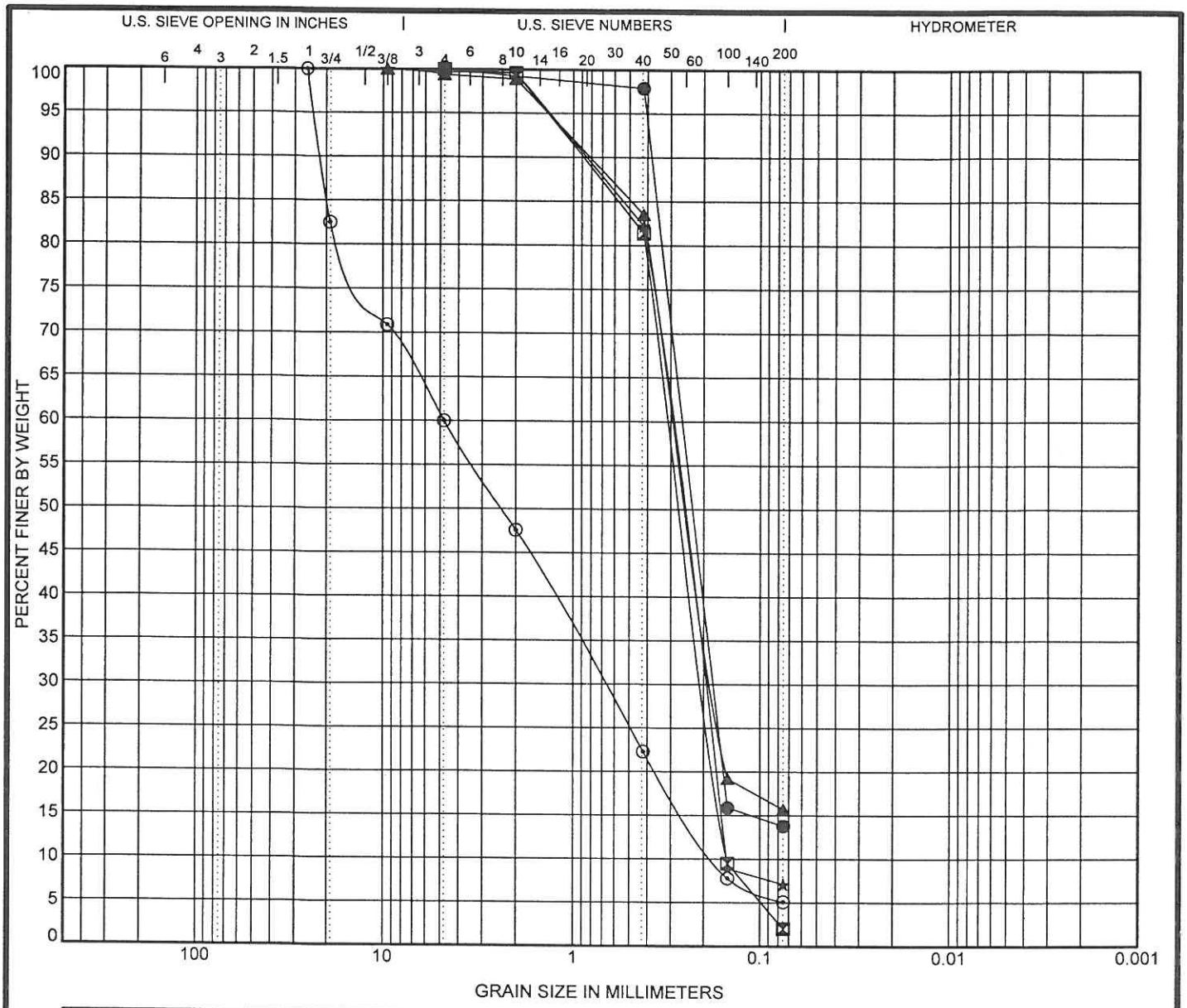
| | | | |
|---|---|---|---|
| **Project:** Fite Road Extension | | | **Boring No.:** B-13 |
| **Location:** Shelby County, Tennessee | | | **Elev:** 243 ± |
| **Date:** 5/1/03 | **Water level while drilling:** ▽ Dry | **Water level at completion:** ▼ Dry | |
| **Boring Method:** Hand Auger | **Boring Cave In:** Open | **Driller:** E. Morris | |

| Depth (feet) | Sampler | DESCRIPTION OF MATERIALS | N (bpf) | N VALUE (bpf) ▲ PL %MC LL (10 20 30 40 50 60 70 80 90) | MC % | LL | PI | Qp tsf | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 2" Topsoil | | | | | | | |
| | | Firm to Soft Brown Clayey SILT (ML), A-4 | 7 | | 22 | | | | |
| 5 | | | 5 | | 23 | 29 | 4 | | |
| | | | 5 | | 26 | | | | |
| 10 | | | 4 | | 26 | | | | |
| | | Boring Terminated at 10.5 Feet. | | | | | | | |

PSI502 35079.GPJ 11/18/03

# APPENDIX II

## GRADATION CURVES, ATTERBERG LIMITS, AND pH




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

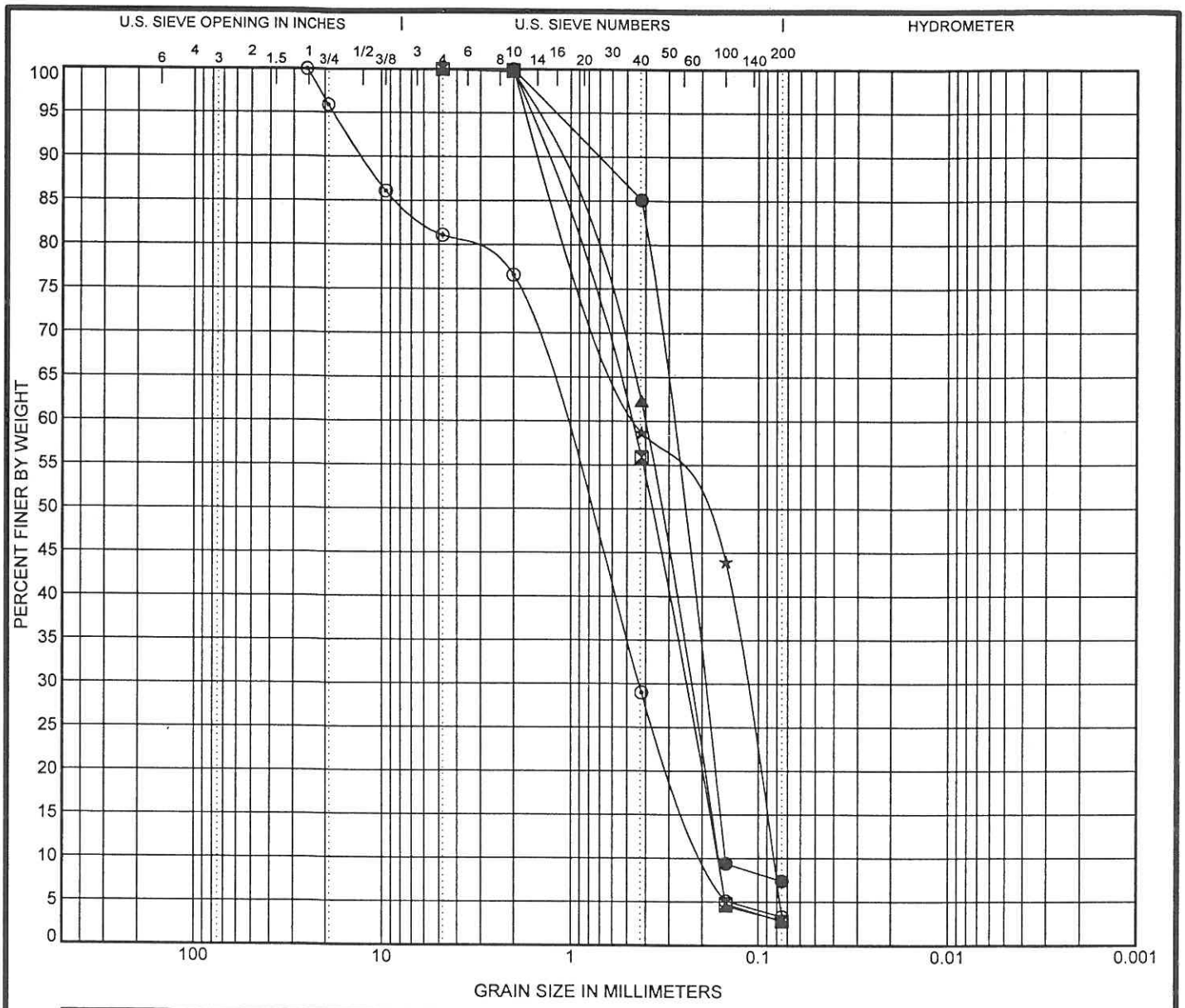
| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | B-7 | 34.5 | | | | | | |
| ⊠ | B-7 | 39.5 | | | | | 0.87 | 2.06 |
| ▲ | B-7 | 44.5 | | | | | | |
| ★ | B-7 | 49.5 | | | | | 0.87 | 2.03 |
| ⊙ | B-7 | 54.5 | | | | | 0.55 | 27.30 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-7 | 34.5 | 4.76 | 0.26 | 0.178 | | 0.0 | 86.2 | 13.8 | |
| ⊠ | B-7 | 39.5 | 4.76 | 0.309 | 0.2 | 0.15 | 0.0 | 98.0 | 2.0 | |
| ▲ | B-7 | 44.5 | 9.5 | 0.288 | 0.177 | | 0.6 | 83.7 | 15.7 | |
| ★ | B-7 | 49.5 | 9.5 | 0.307 | 0.201 | 0.151 | 0.3 | 92.6 | 7.1 | |
| ⊙ | B-7 | 54.5 | 25.4 | 4.76 | 0.675 | 0.174 | 40.0 | 54.9 | 5.1 | |

psi

## GRAIN SIZE DISTRIBUTION

Client:
Project: Fite Road Extension
Location:
Number: 502-35079




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

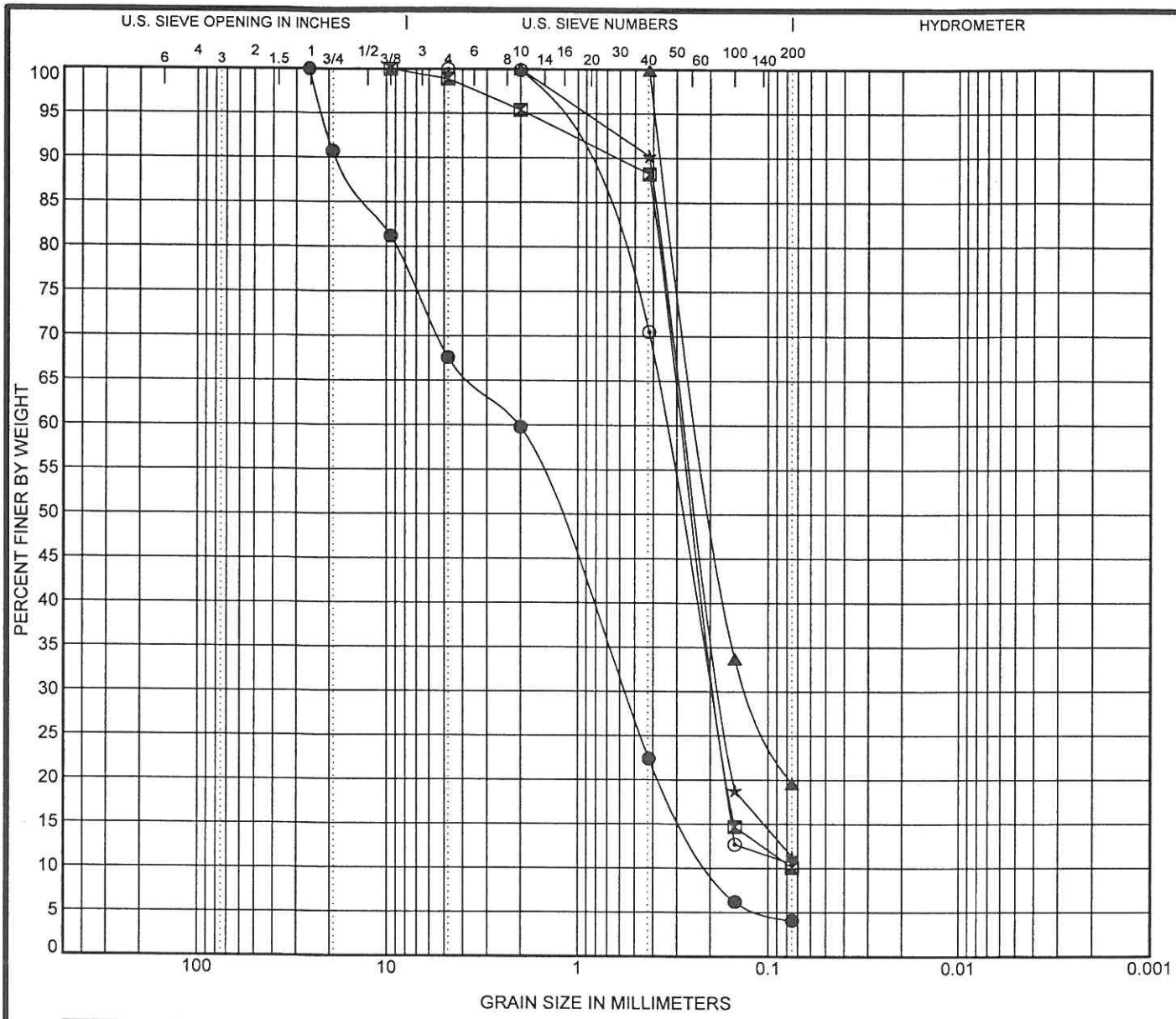
| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | B-8 | 29.5 | | | | | 0.87 | 1.98 |
| ⊠ | B-8 | 34.5 | | | | | 0.77 | 2.93 |
| ▲ | B-8 | 39.5 | | | | | 0.84 | 2.45 |
| ★ | B-8 | 44.5 | | | | | 0.37 | 5.25 |
| ⊙ | B-8 | 49.5 | | | | | 0.88 | 6.30 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-8 | 29.5 | 2 | 0.298 | 0.198 | 0.15 | 0.0 | 92.6 | 7.4 | |
| ⊠ | B-8 | 34.5 | 4.76 | 0.486 | 0.248 | 0.166 | 0.0 | 97.2 | 2.8 | |
| ▲ | B-8 | 39.5 | 4.76 | 0.403 | 0.235 | 0.164 | 0.0 | 97.1 | 2.9 | |
| ★ | B-8 | 44.5 | 2 | 0.441 | 0.118 | 0.084 | 0.0 | 96.8 | 3.2 | |
| ⊙ | B-8 | 49.5 | 25.4 | 1.161 | 0.434 | 0.184 | 18.9 | 77.8 | 3.3 | |

psi

## GRAIN SIZE DISTRIBUTION

Client:
Project: Fite Road Extension
Location:
Number: 502-35079




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

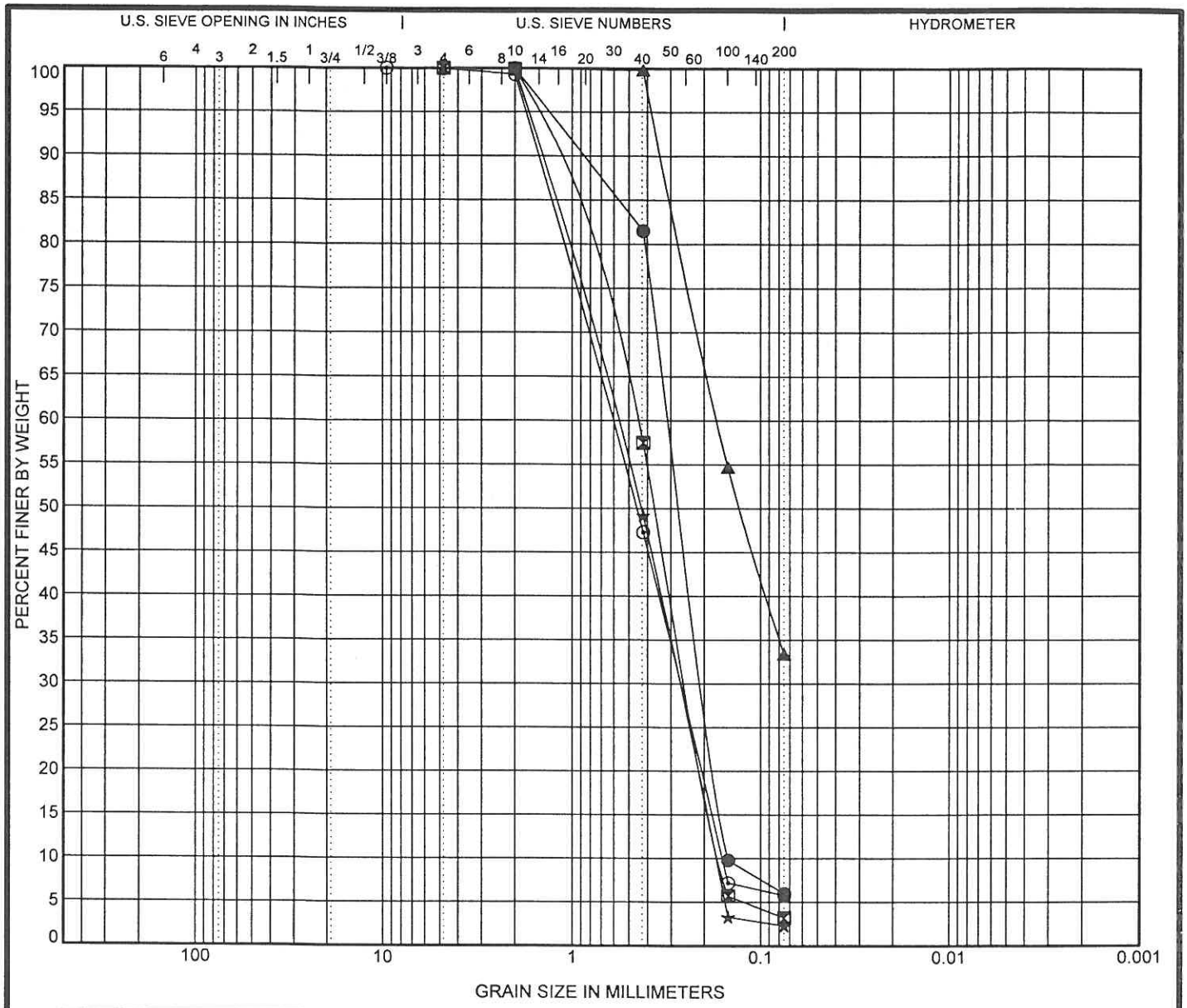
| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | B-8 | 54.5 | | | | | 0.86 | 10.76 |
| ⊠ | B-8 | 59.5 | | | | | 1.64 | 3.82 |
| ▲ | B-9 | 29.5 | | | | | | |
| ★ | B-9 | 34.5 | | | | | 1.70 | 4.07 |
| ⊙ | B-9 | 39.5 | | | | | 1.85 | 5.42 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-8 | 54.5 | 25.4 | 2.045 | 0.577 | 0.19 | 32.4 | 63.5 | 4.1 | |
| ⊠ | B-8 | 59.5 | 9.5 | 0.282 | 0.185 | | 1.1 | 88.8 | 10.1 | |
| ▲ | B-9 | 29.5 | 2 | 0.225 | 0.124 | | 0.0 | 80.4 | 19.6 | |
| ★ | B-9 | 34.5 | 2 | 0.271 | 0.175 | | 0.0 | 88.7 | 11.3 | |
| ⊙ | B-9 | 39.5 | 4.76 | 0.348 | 0.203 | | 0.0 | 89.5 | 10.5 | |

psi

## GRAIN SIZE DISTRIBUTION

Client:
Project: Fite Road Extension
Location:
Number: 502-35079




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

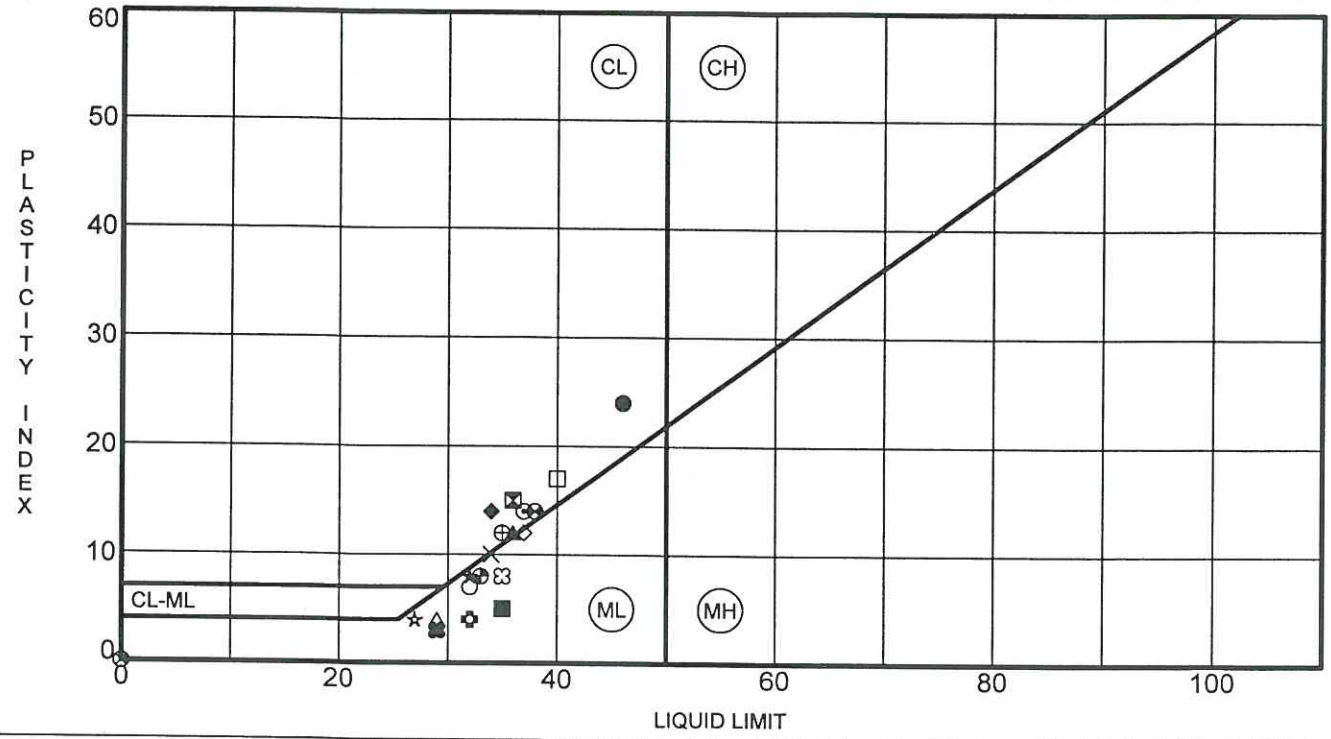
| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | B-10 | 34.5 | | | | | 0.87 | 2.06 |
| ⊠ | B-10 | 39.5 | | | | | 0.79 | 2.84 |
| ▲ | B-11 | 29.5 | | | | | | |
| ★ | B-11 | 34.5 | | | | | 0.73 | 3.38 |
| ⊙ | B-11 | 39.5 | | | | | 0.73 | 3.84 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-10 | 34.5 | 2 | 0.308 | 0.2 | 0.149 | 0.0 | 94.0 | 6.0 | |
| ⊠ | B-10 | 39.5 | 4.76 | 0.46 | 0.242 | 0.162 | 0.0 | 96.8 | 3.2 | |
| ▲ | B-11 | 29.5 | 2 | 0.168 | | | 0.0 | 66.6 | 33.4 | |
| ★ | B-11 | 34.5 | 2 | 0.585 | 0.272 | 0.173 | 0.0 | 97.7 | 2.3 | |
| ⊙ | B-11 | 39.5 | 9.5 | 0.615 | 0.269 | 0.16 | 0.1 | 94.1 | 5.8 | |

psi

## GRAIN SIZE DISTRIBUTION

Client:
Project: Fite Road Extension
Location:
Number: 502-35079




| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | B-1 | 7.0 | 46 | 22 | 24 | | |
| ⊠ | B-10 | 4.5 | 36 | 21 | 15 | | |
| ▲ | B-10 | 7.0 | 36 | 24 | 12 | | |
| ★ | B-10 | 17.5 | 32 | 24 | 8 | | |
| ⊙ | B-11 | 4.5 | 37 | 23 | 14 | | |
| ✿ | B-11 | 9.5 | 32 | 28 | 4 | | |
| ○ | B-12 | 7.0 | 32 | 25 | 7 | | |
| △ | B-13 | 4.0 | 29 | 25 | 4 | | |
| ⊗ | B-2 | 2.0 | NP | NP | NP | | |
| ⊕ | B-3 | 4.5 | 35 | 23 | 12 | | |
| □ | B-4 | 2.5 | 40 | 23 | 17 | | |
| ⊖ | B-5 | 2.5 | 38 | 24 | 14 | | |
| ◐ | B-6 | 6.5 | 33 | 25 | 8 | | |
| ☆ | B-6 | 21.5 | 27 | 23 | 4 | | |
| ⊠ | B-7 | 6.5 | 35 | 27 | 8 | | |
| ■ | B-7 | 11.5 | 35 | 30 | 5 | | |
| ◆ | B-7 | 24.5 | 34 | 20 | 14 | | |
| ◇ | B-8 | 6.5 | 37 | 25 | 12 | | |
| × | B-8 | 16.5 | 34 | 24 | 10 | | |
| ✖ | B-9 | 9.5 | 29 | 26 | 3 | | |

psi

## ATTERBERG LIMITS' RESULTS

Client:
Project: Fite Road Extension
Location:
Number: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

## Soil pH - AASHTO T-289-91

**Project:** Fite Road Extension
502-35079

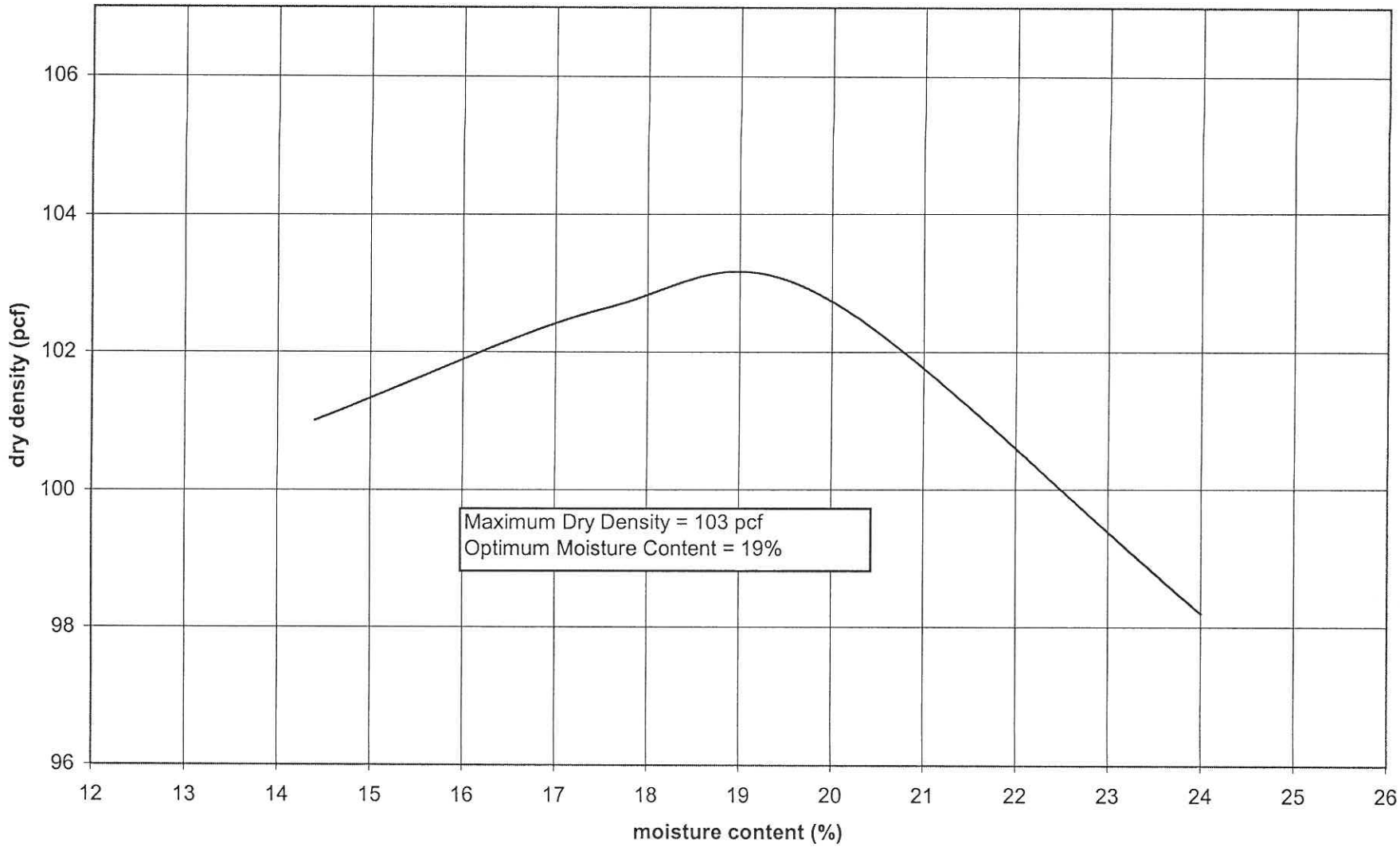
| Sample | Boring | Depth (ft) | Soil Classification | pH |
|---|---|---|---|---|
| 1 | B-8 | 4 | A-6, lean clay (CL) | 7.2 |
| 2 | B-8 | 20 | A-6, silty clay (CL) | 7.8 |
| 3 | B-9 | 4 | A-6, silty clay (CL) | 4.7 |
| 4 | B-10 | 2 | A-6, silty clay (CL) | 5.9 |
| 5 | B-11 | 0 | A-6, silty clay (CL) | 4.3 |
| 6 | B-11 | 4 | A-6, silty clay (CL) | 6.5 |
| 7 | B-11 | 7 | A-6, silty clay (CL) | 6.9 |
| 8 | B-11 | 15 | A-4, clayey silt (ML) | 7.7 |
| 9 | B-11 | 20 | A-4, clayey silt (ML) | 7.5 |
| 10 | B-11 | 25 | A-6, silty clay (CL) | 6.8 |

# APPENDIX III

## MAXIMUM DRY DENSITY (STANDARD PROCTOR)

## CALORIFINA BEARING RATIO TEST RESULTS

## Fite Road Extension- B-3 Top 5 feet
## standard Proctor AASHTO T 99-95 Method A



# REPORT OF LABORATORY CALIFORNIA BEARING RATIO (CBR) TEST

Project: Fite Road Extension

Location: Memphis, Tennessee

Sample Source: Boring B-3, Top 5 feet

Job Number: 502-35079 Date: November, 2003

Sample Classification

Liquid Limit: 35 Plasticity Index: 12

Soil Description: Brown Silty Clay (CL)

Compaction Data

Compaction Method: Standard Proctor, AASHTO T 99-95 Method A

Maximum Dry Density: 103 pcf

Optimum Moisture: 19.5 percent

CBR (AASHTO T 193-93) Specimen Data and Test Results

Dry Density as Remolded: 97.3 pcf

Remolded Moisture: 21.2 %

Percent Compaction: 94.5 %

Percent Swell: 1.0 % after 96 hour soak

CBR at 0.1 Inch Penetration: 1.2

CBR at 0.2 Inch Penetration: 1.1

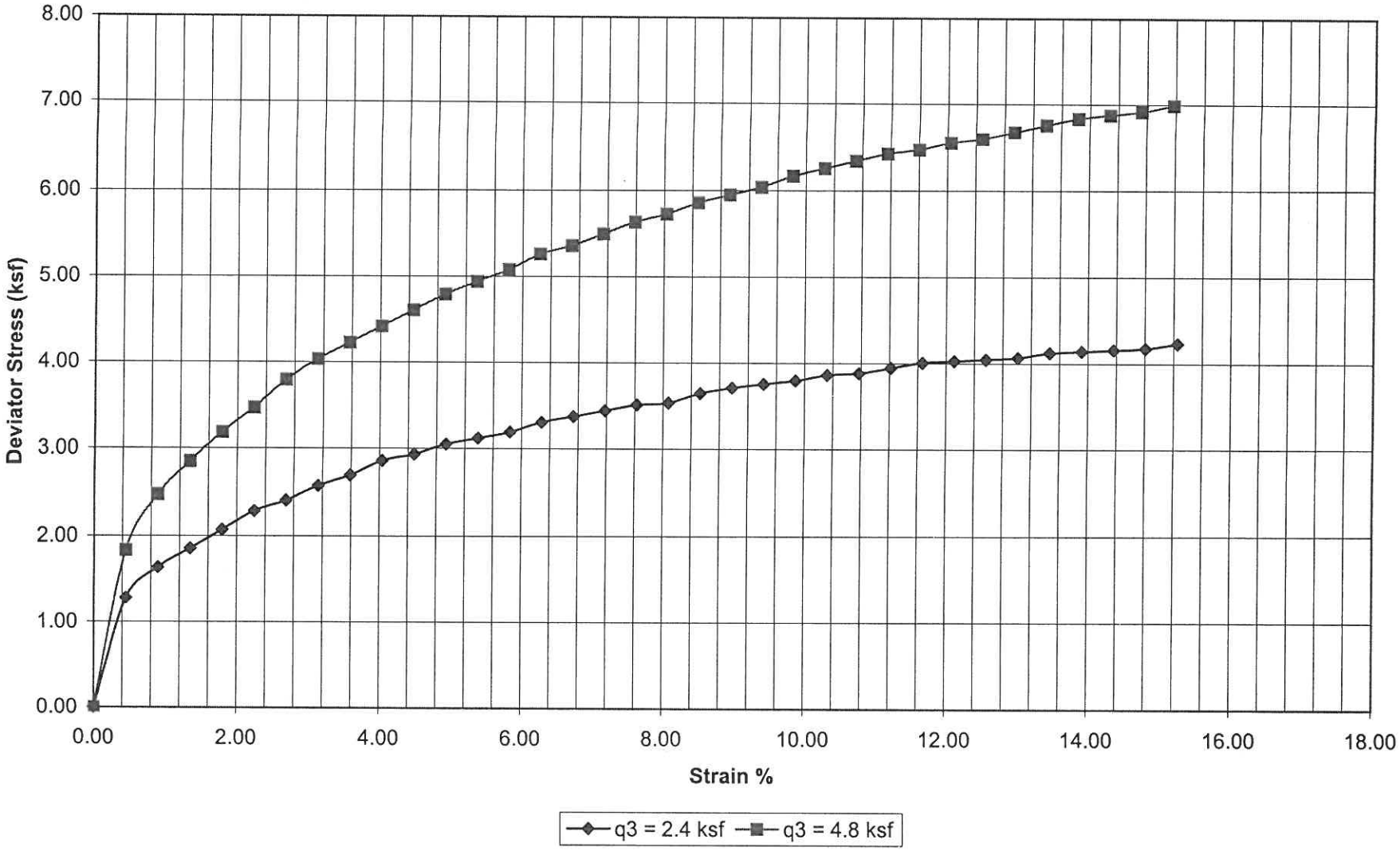
Moisture of Top Inch: 25.3 %

Average Moisture: 23.2 %

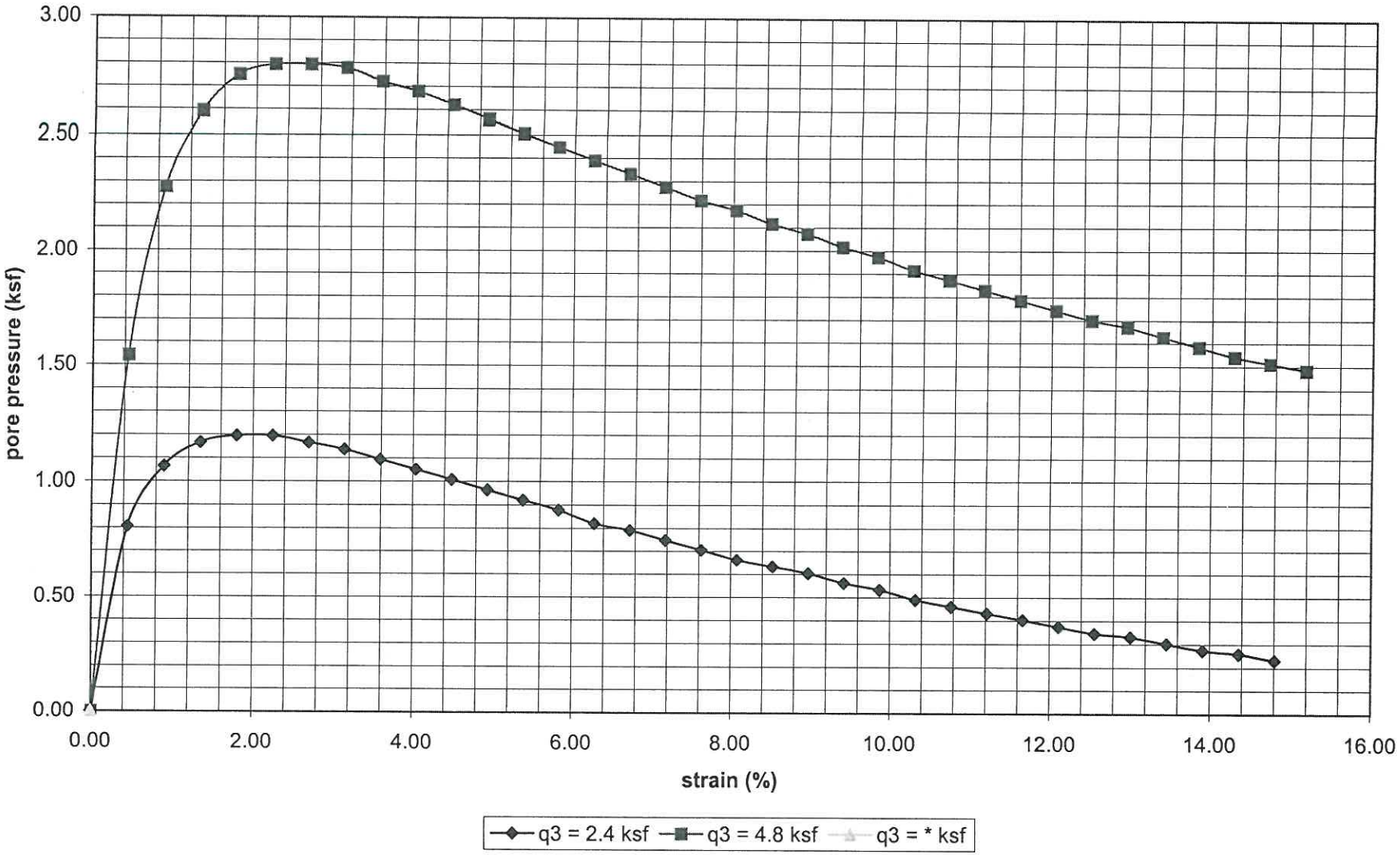
# APPENDIX IV

# TRIAXIAL TEST FAILURE ENVELOPES

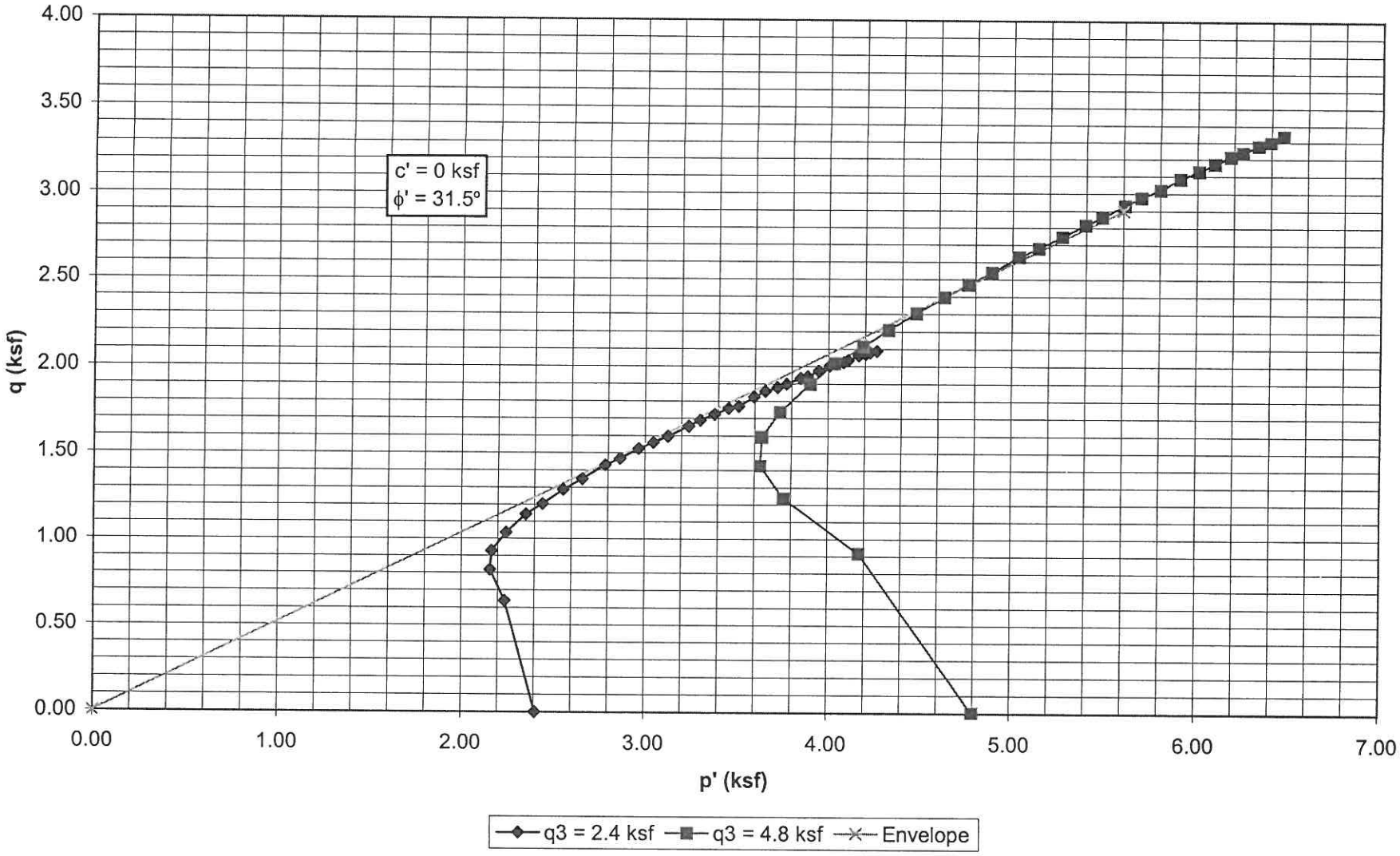
**Triaxial R test B7 6'-8'**
**ASTM D-4767**



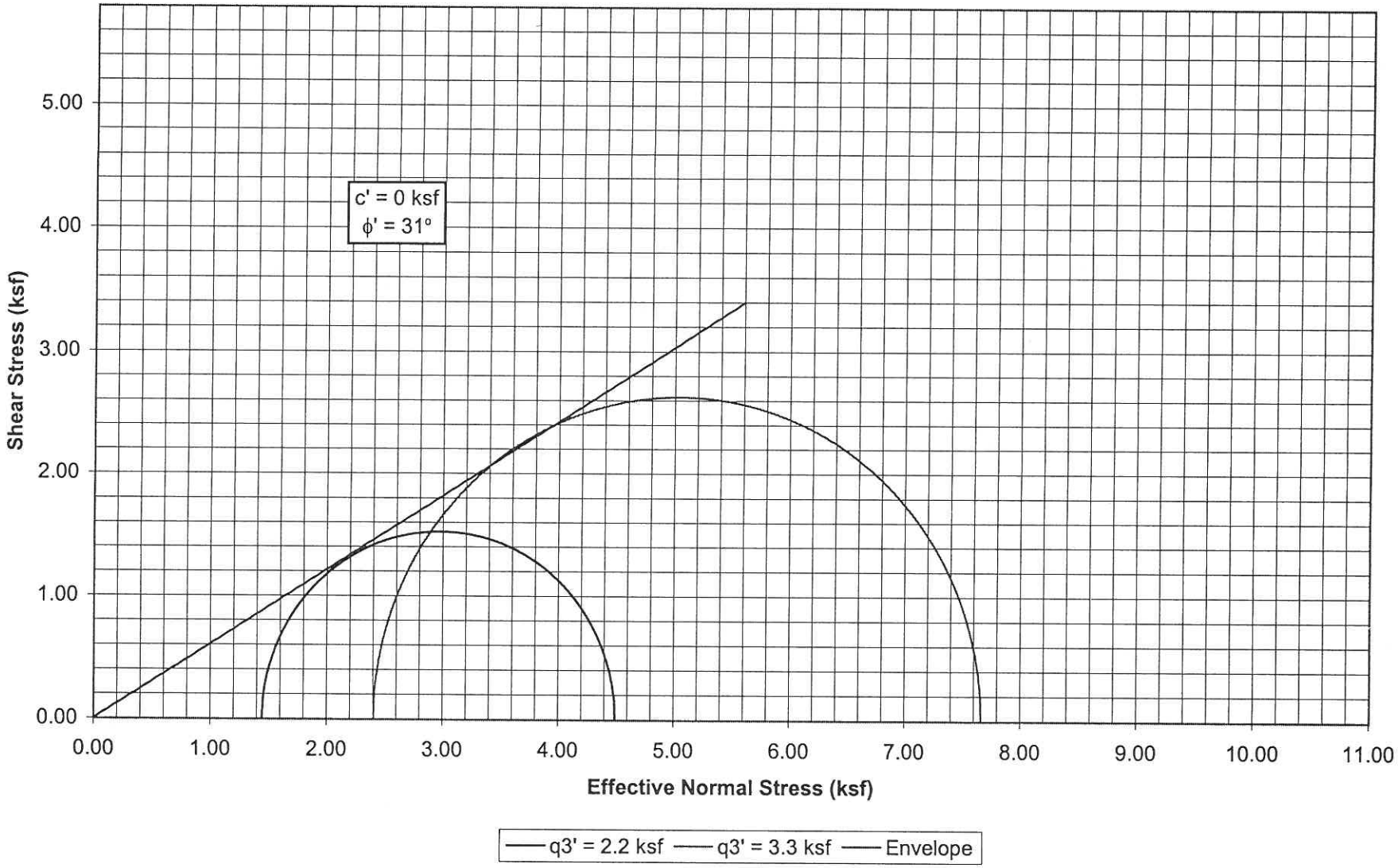
## Triaxial R Test B-7 6'-8'
## ASTM D-4767



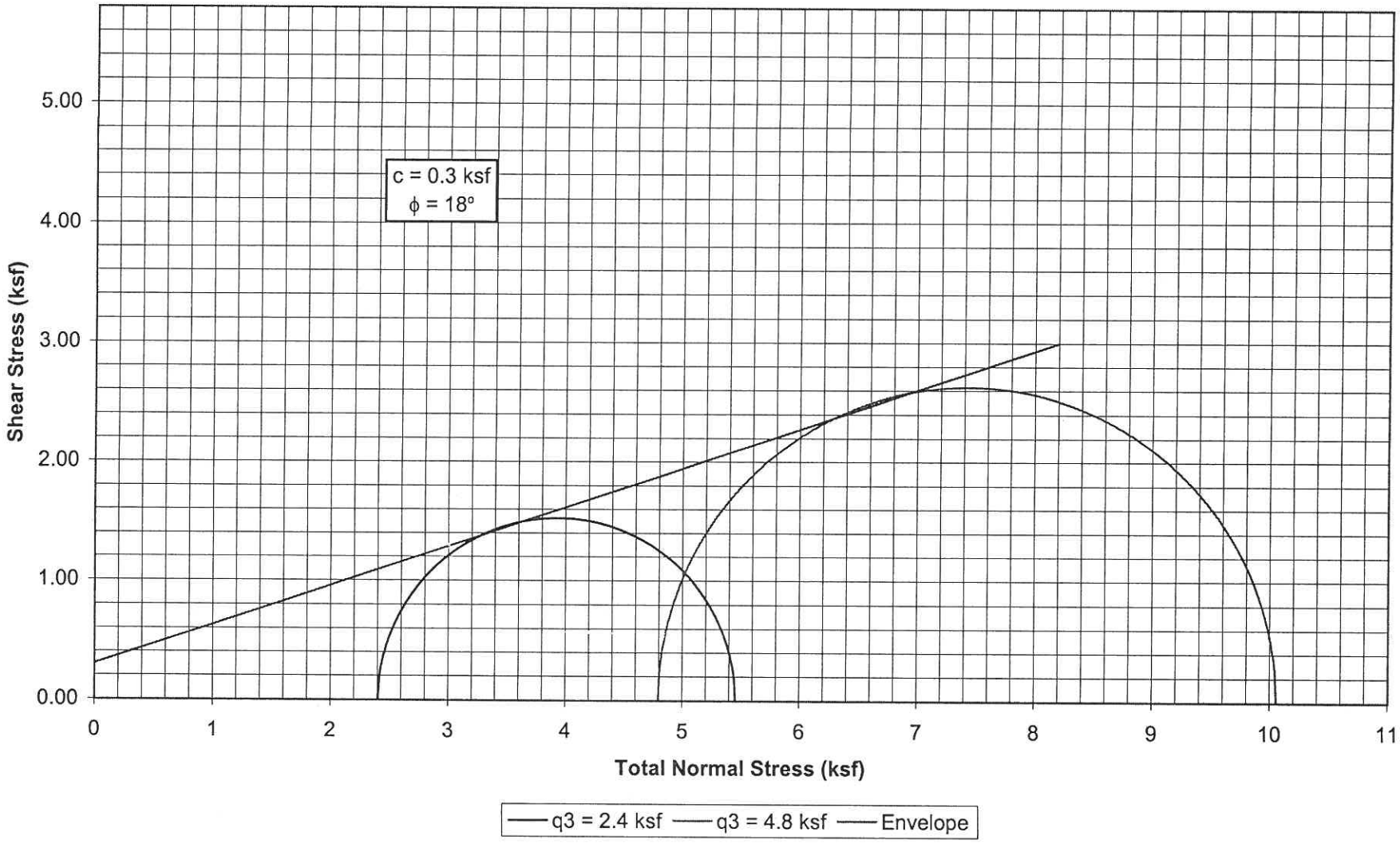
## P-Q Curve B7 6'-8'
## ASTM D-4767

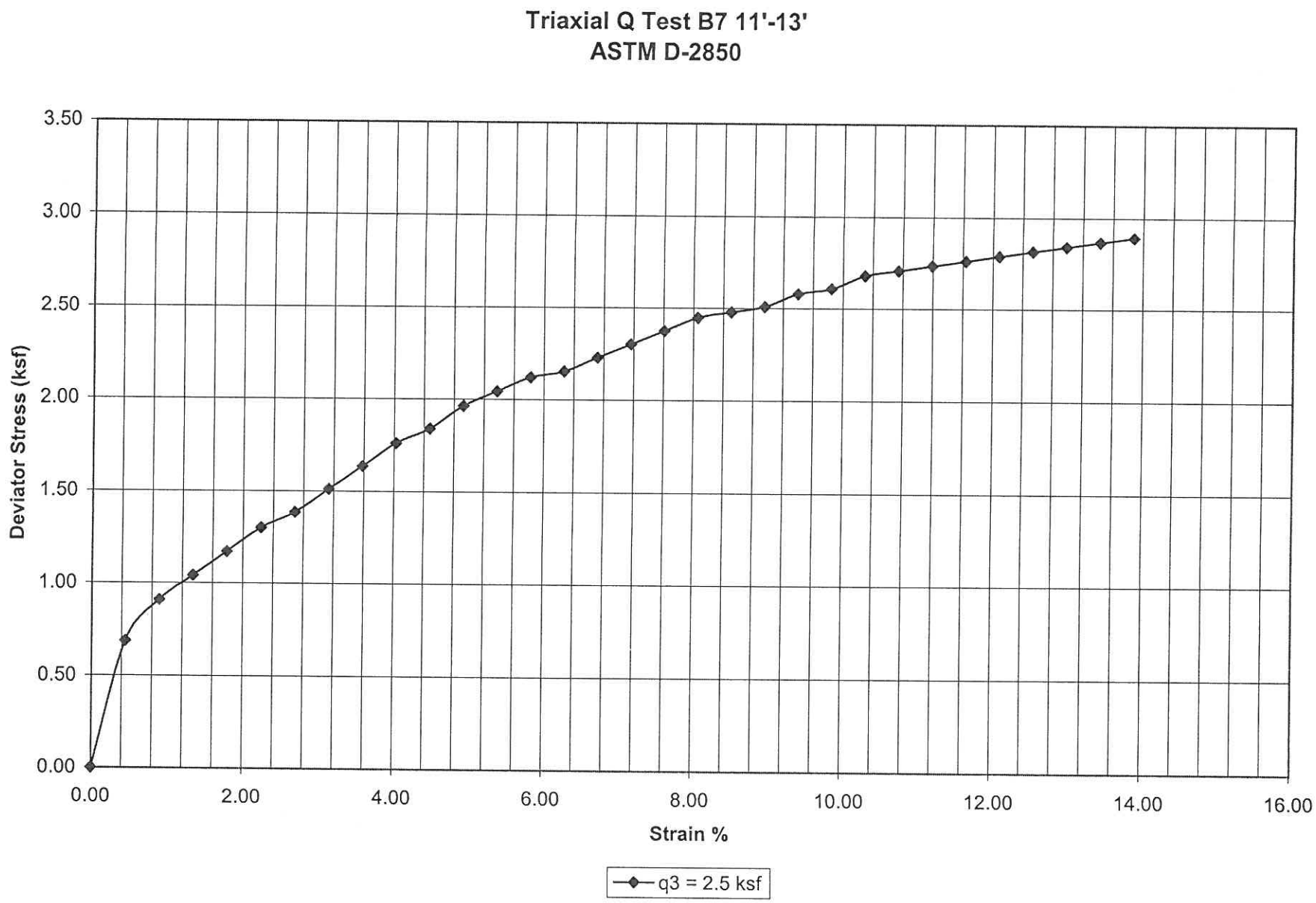


## Triaxial R Test B7 6'-8'
## (Effective Stress) ASTM D-4767

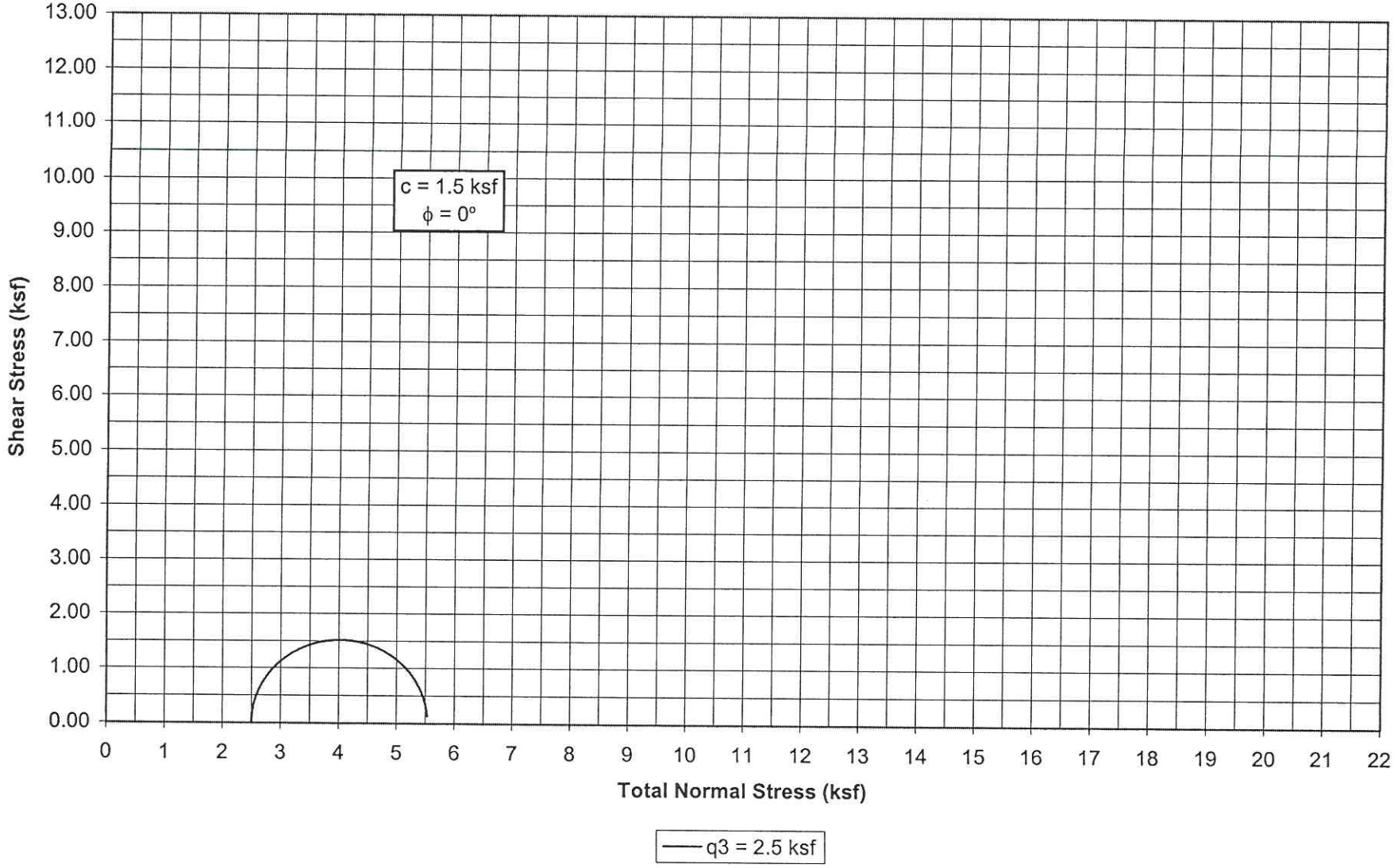


## Triaxial R Test B7 6'-8'
## (Total Stress) ASTM D-4767

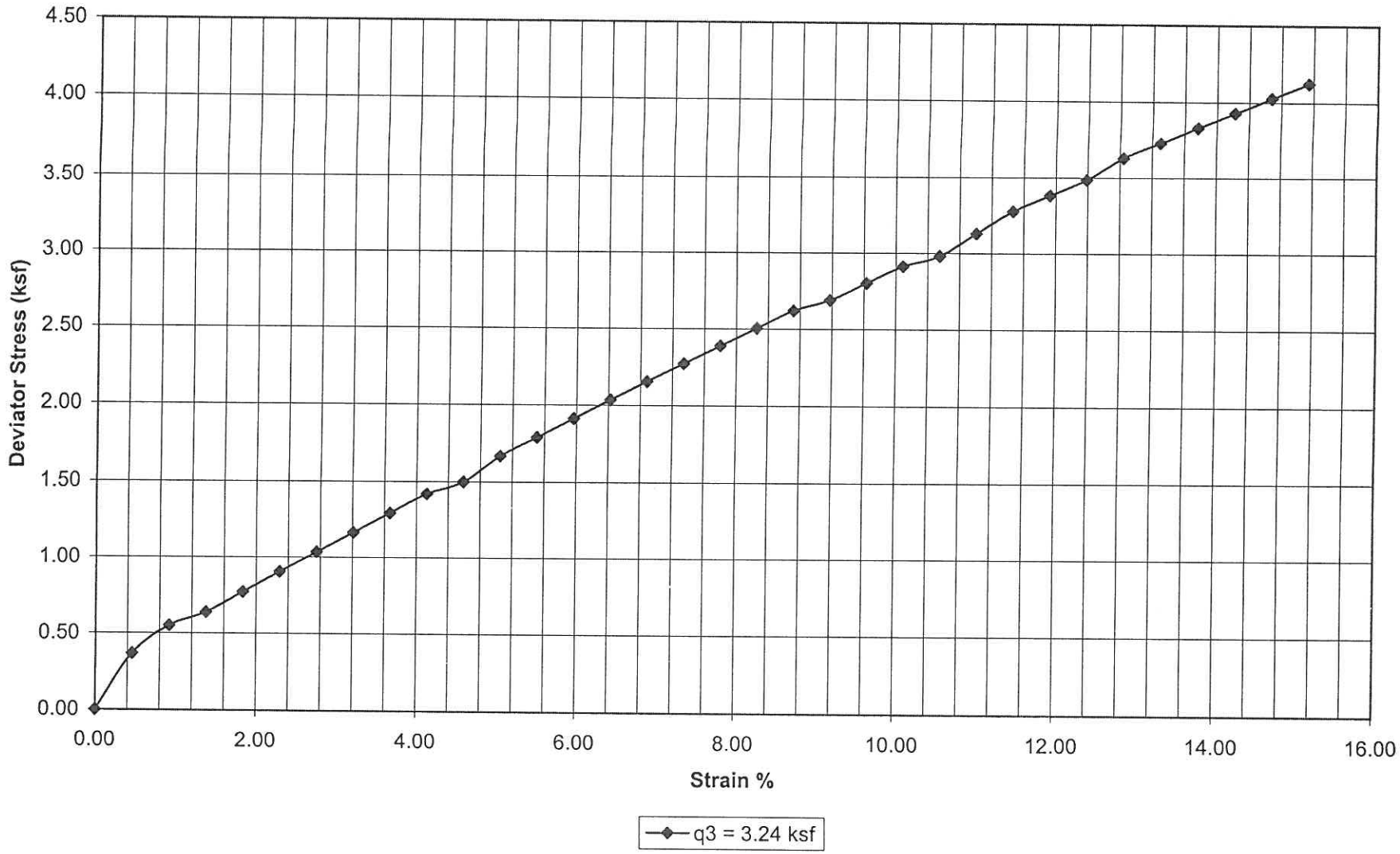



Triaxial Q Test B7 11'-13'
ASTM D-2850
Deviator Stress (ksf)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
Strain %
q3 = 2.5 ksf

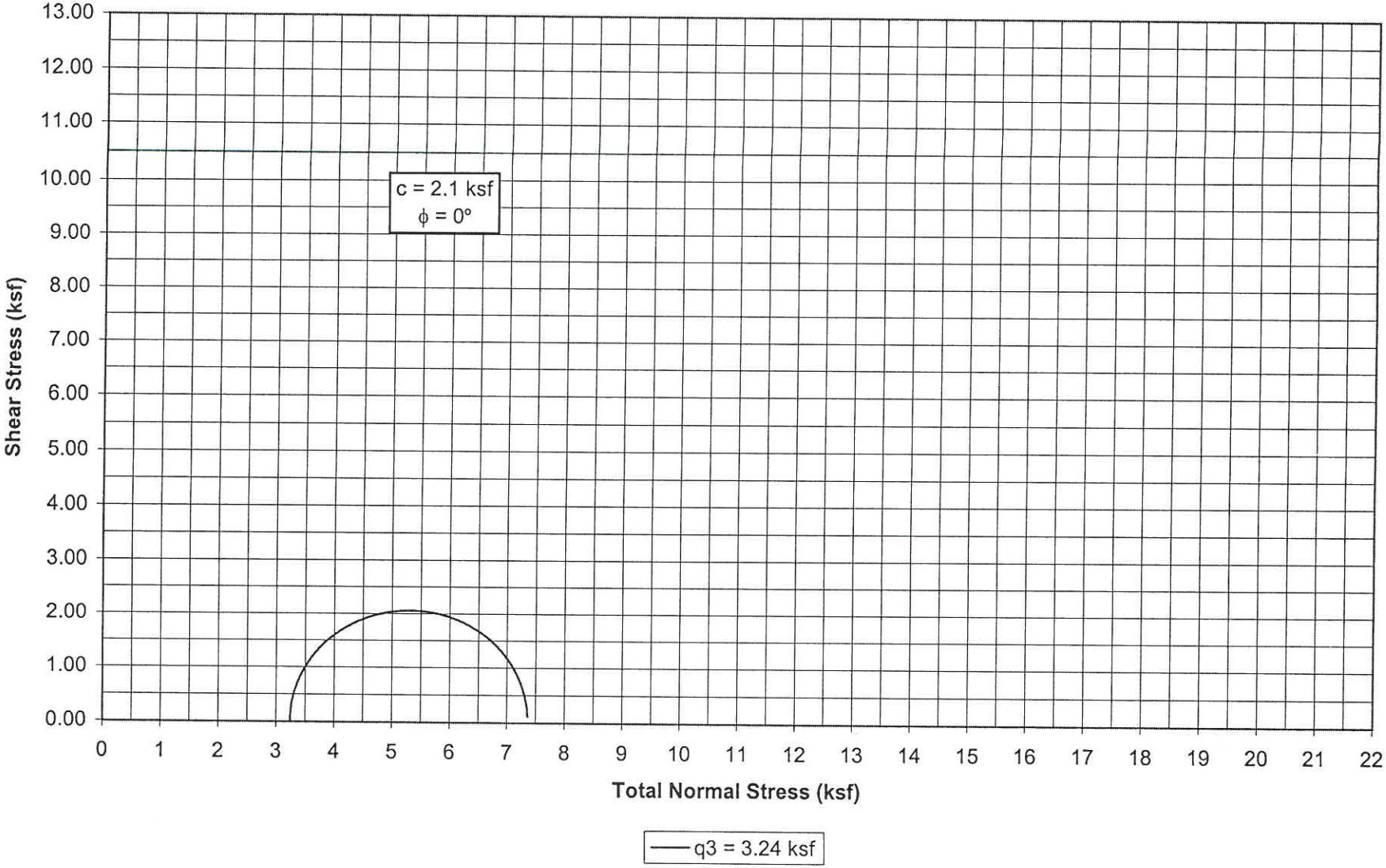
## Triaxial Q Test B7 11'-13'
## ASTM D-2850



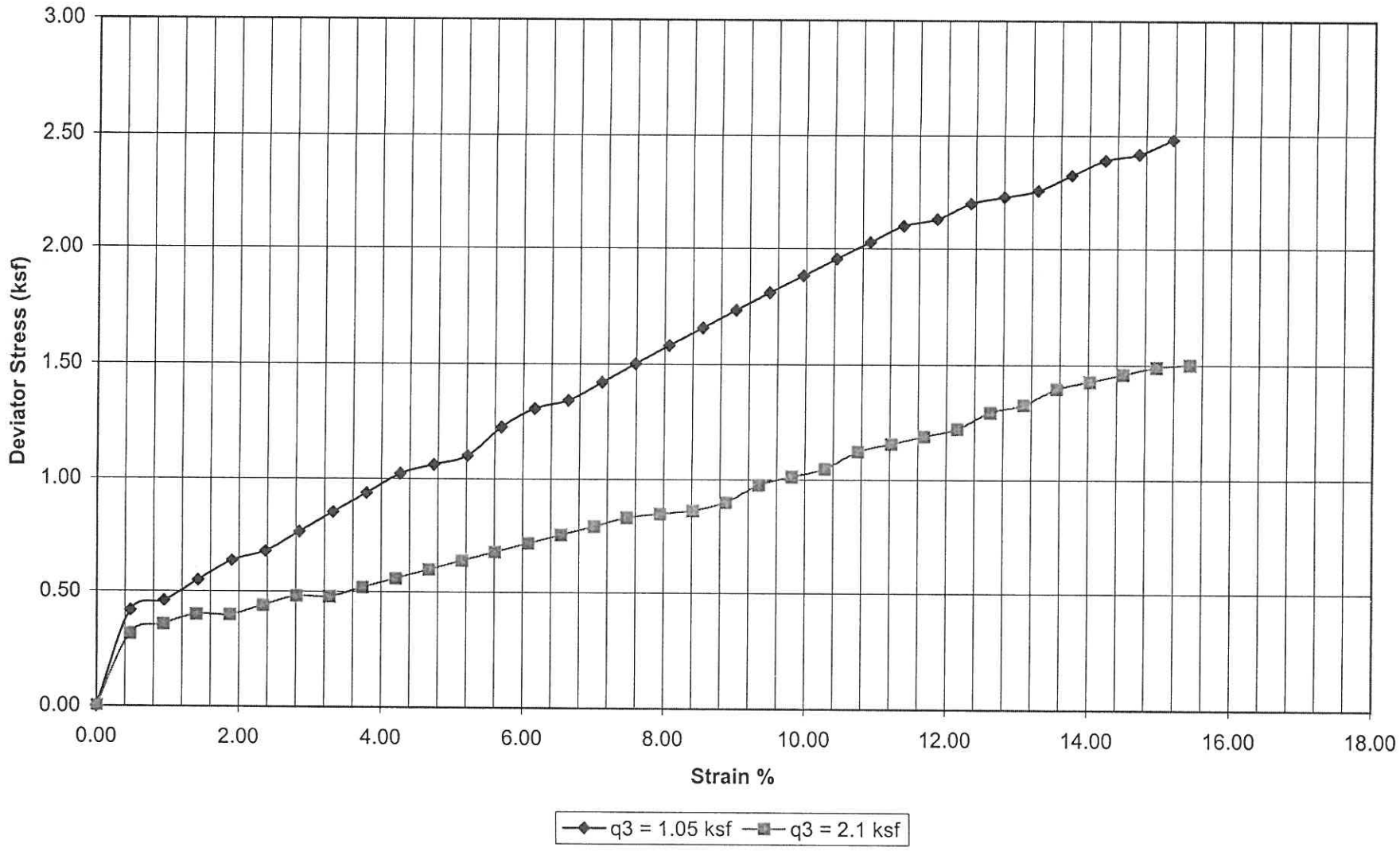
## Triaxial Q Test B8 16'-18'
## ASTM D-2850



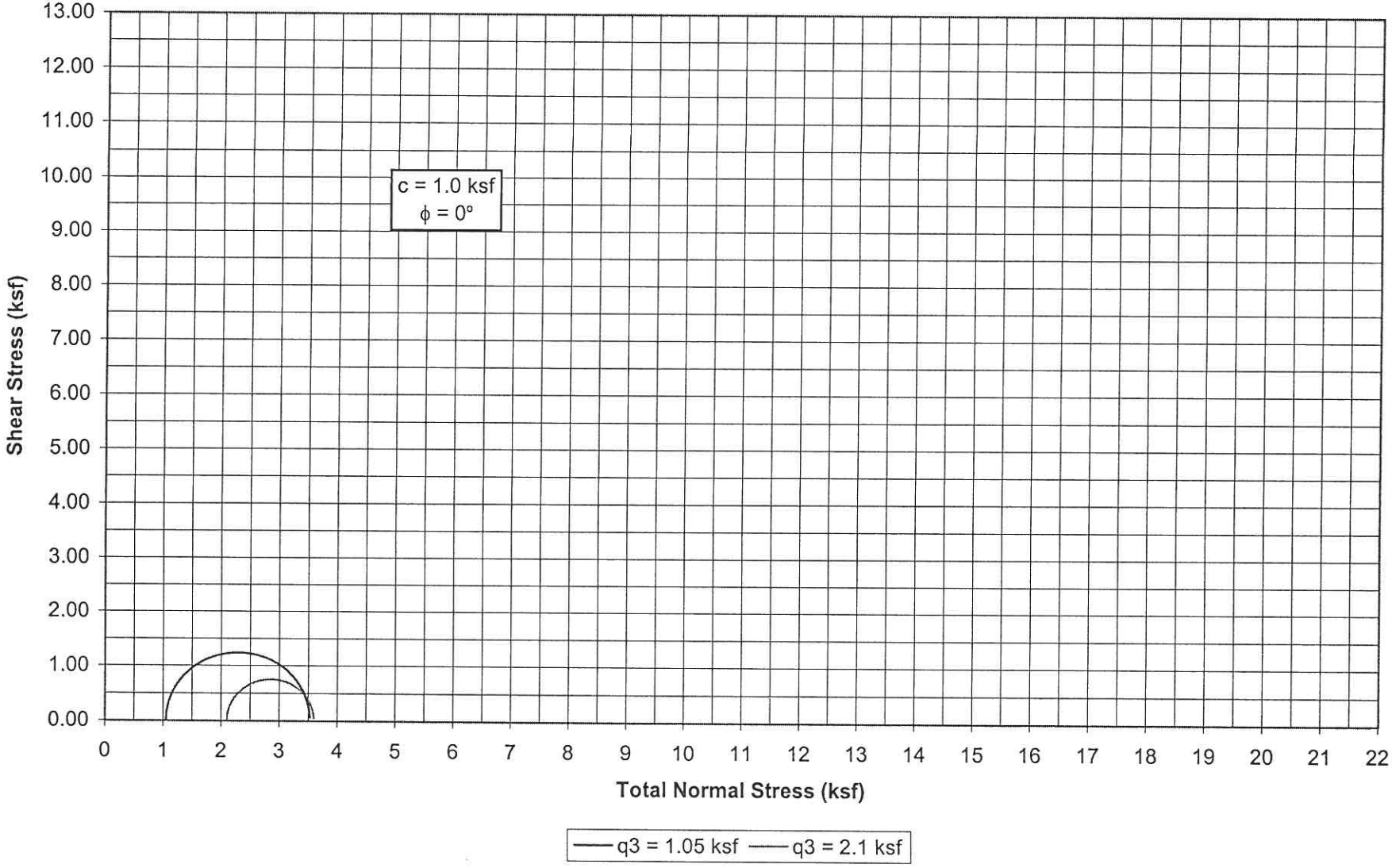
## Triaxial Q Test B8 16'-18'
## ASTM D-2850



## Triaxial Q Test B10 16'-18'
## ASTM D-2850

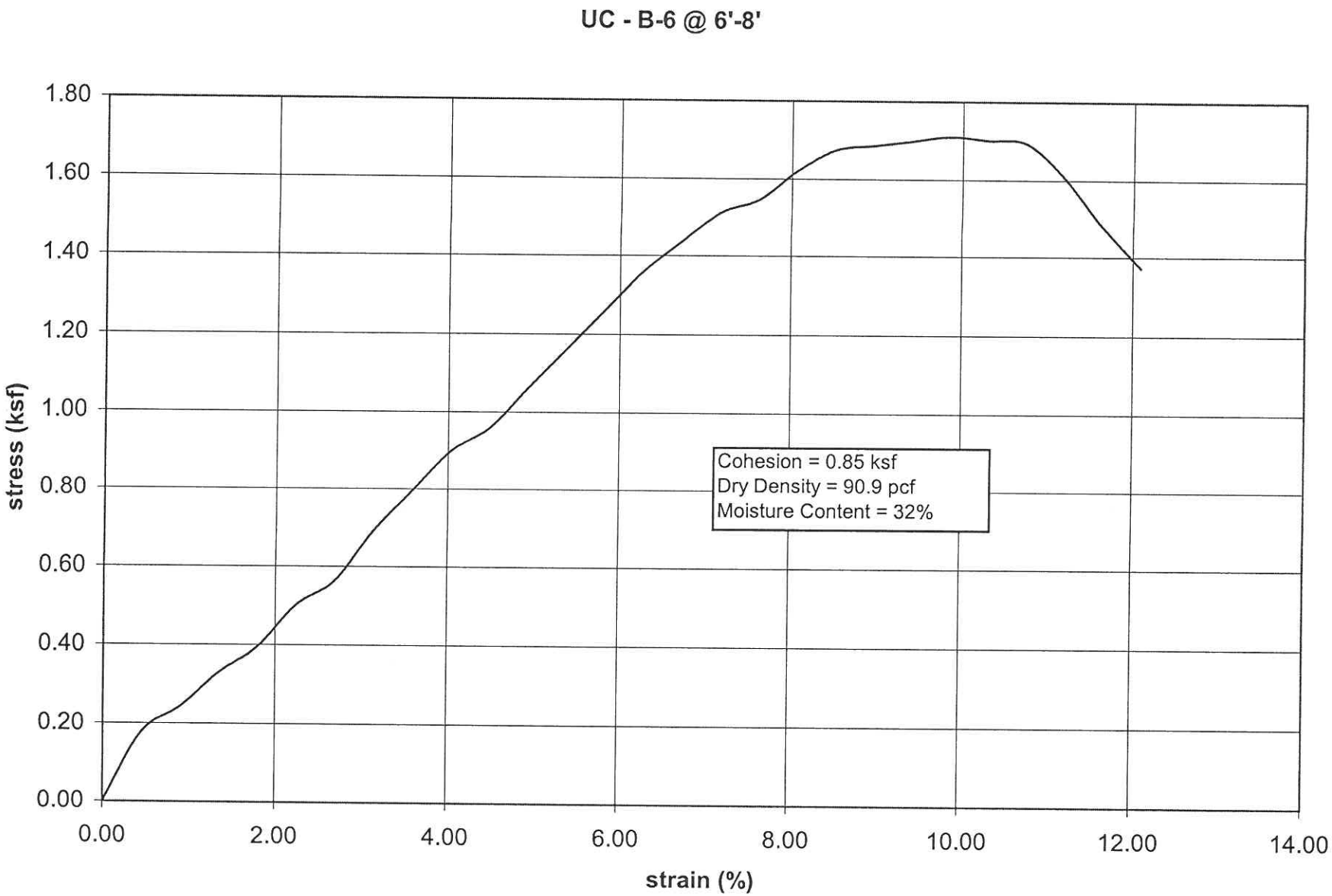


## Triaxial Q Test B10 16'-18'
## ASTM D-2850

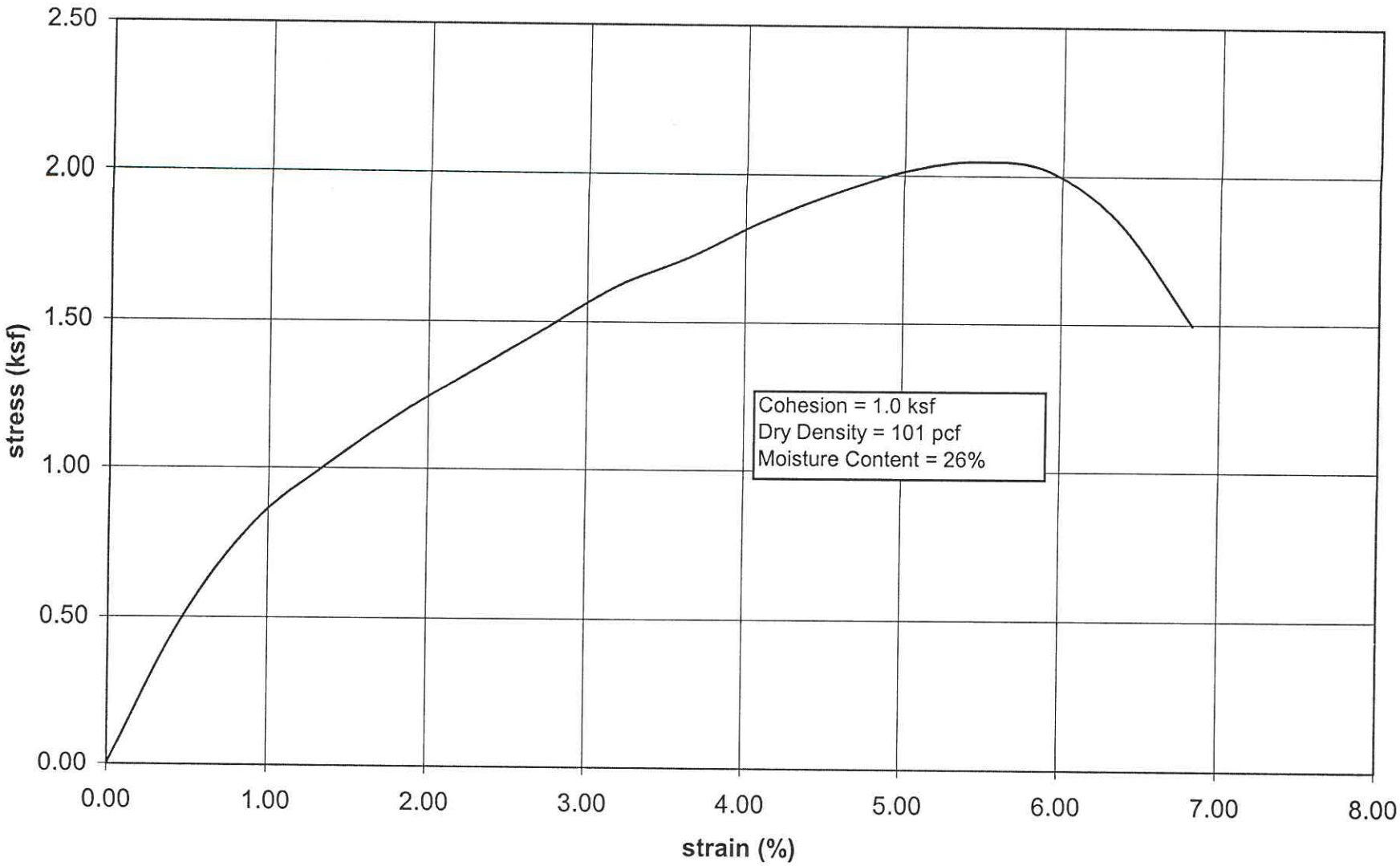


# APPENDIX V

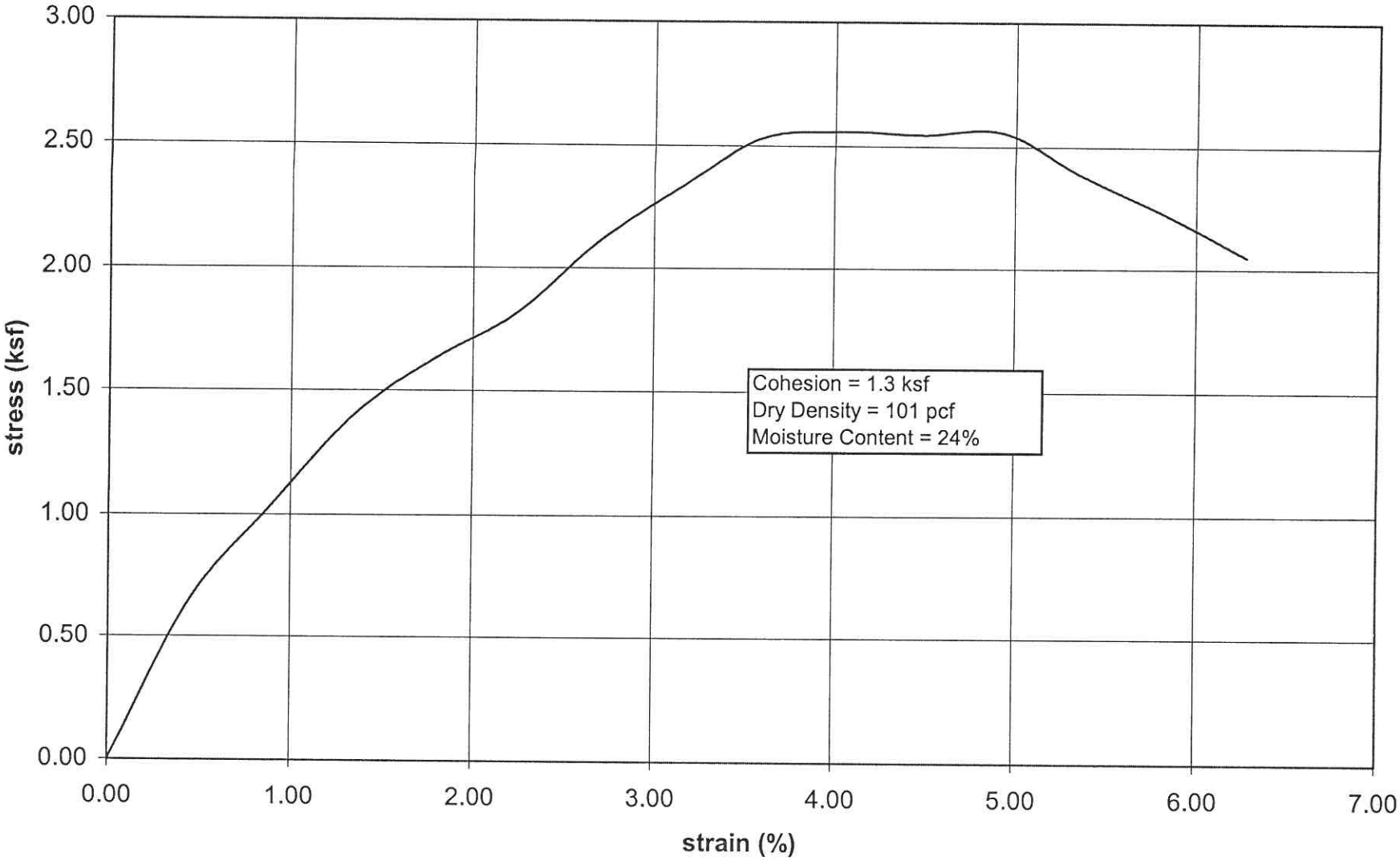
# UNCONFINED COMPRESSION TEST RESULTS


UC - B-6 @ 6'-8'
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
stress (ksf)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
strain (%)
Cohesion = 0.85 ksf
Dry Density = 90.9 pcf
Moisture Content = 32%

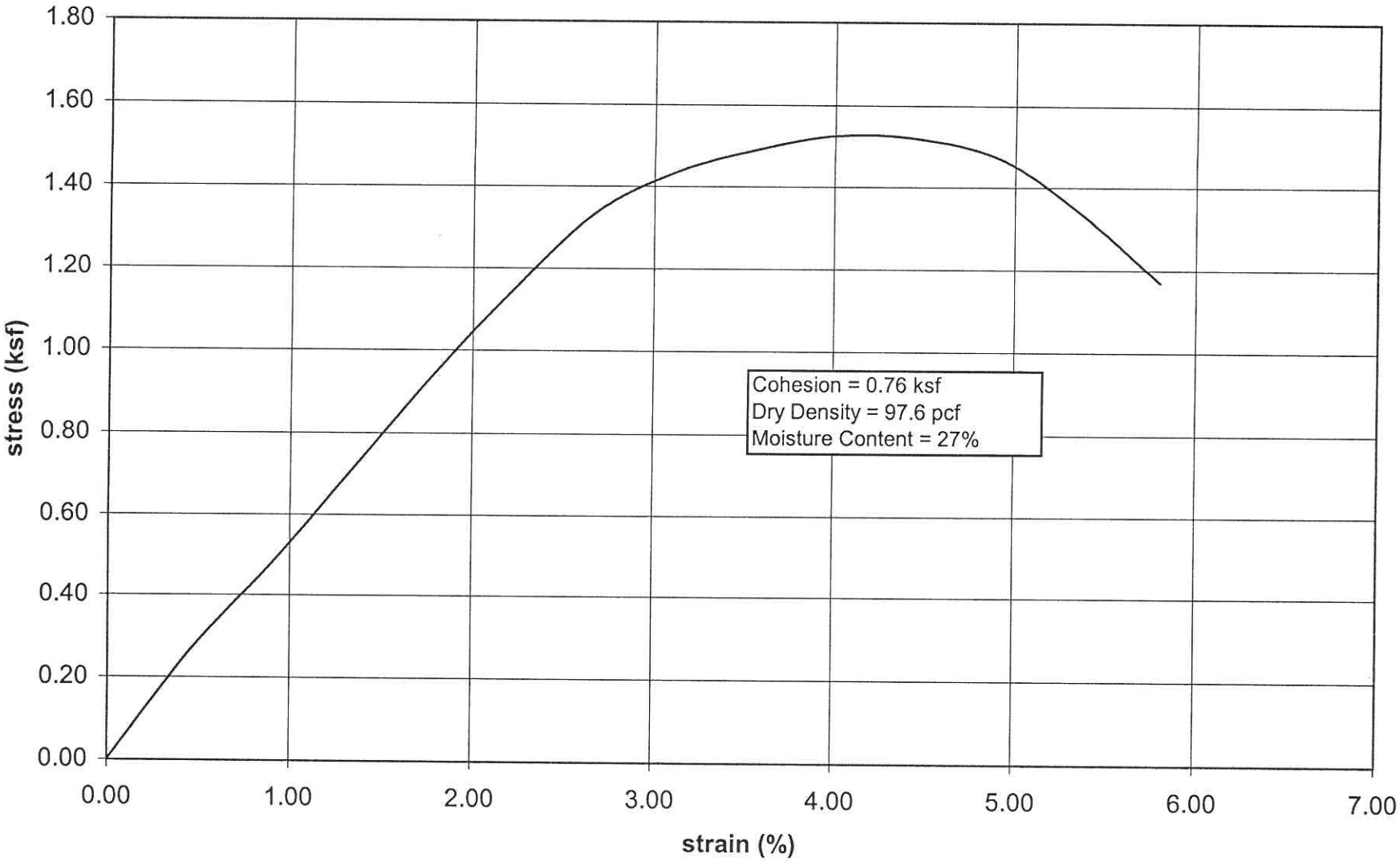
## UC - B-6 @ 21'-23' Sample A



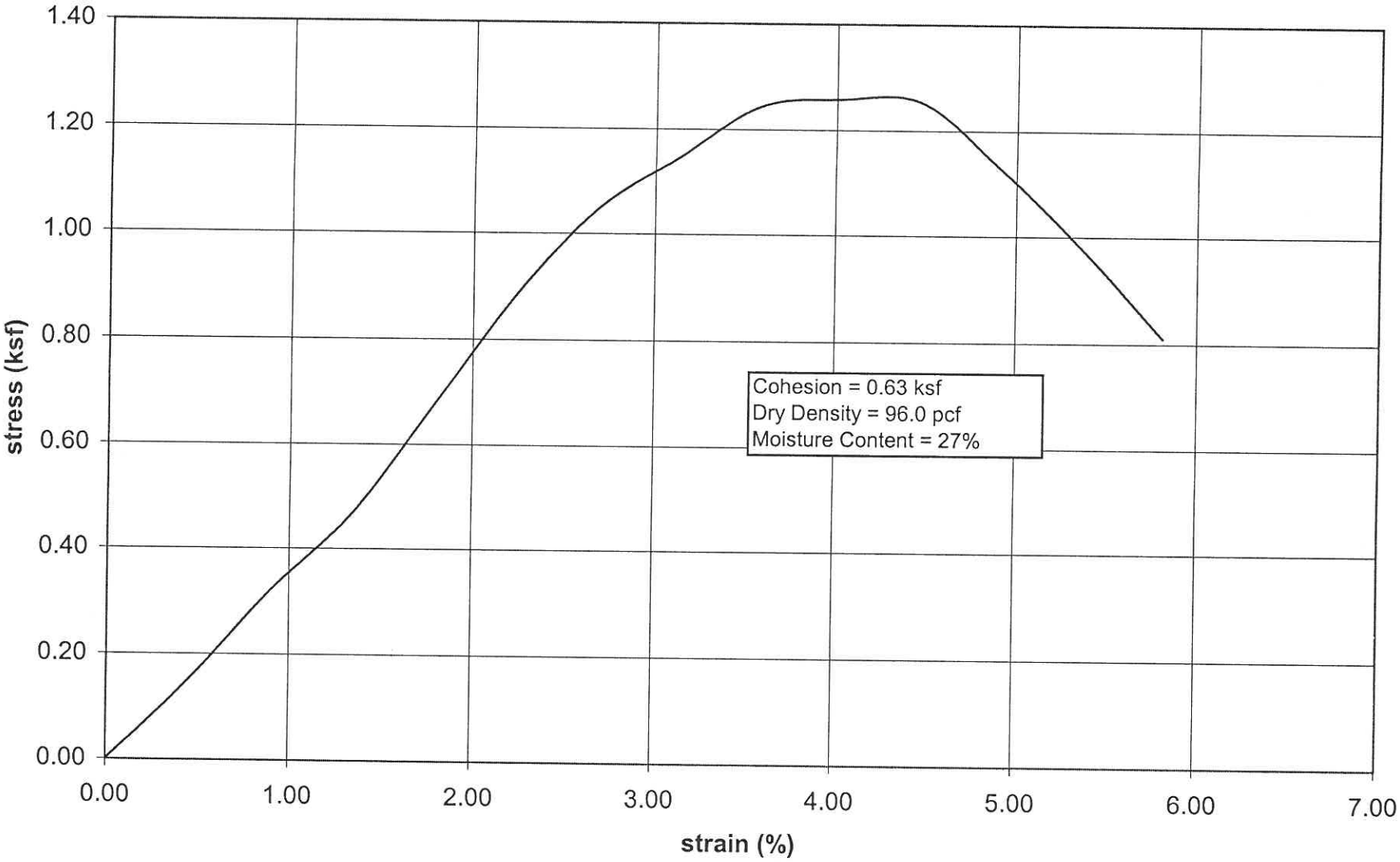
## UC - B-6 @ 21'-23' Sample B



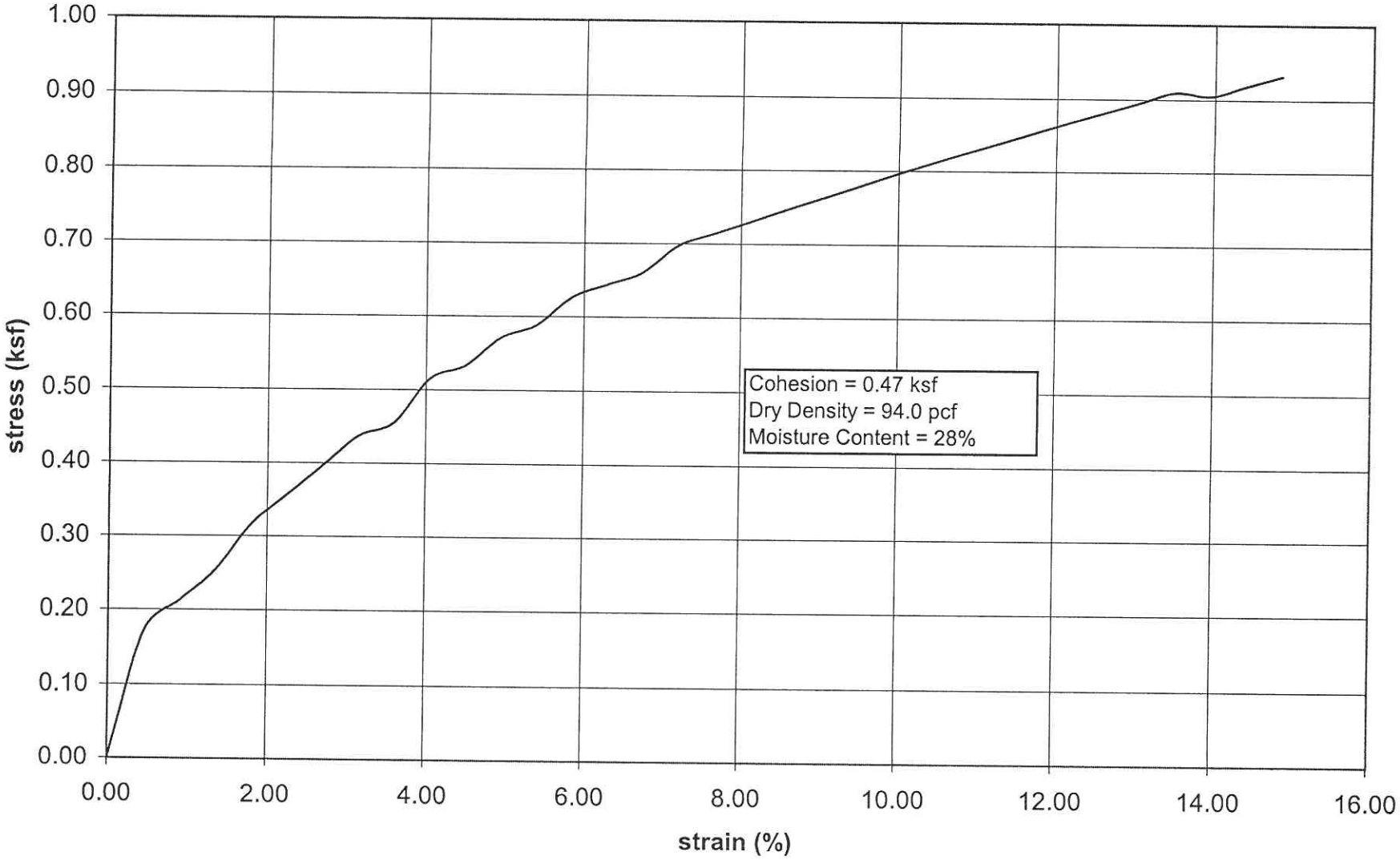
## UC - B-8 @ 6'-8' Sample A



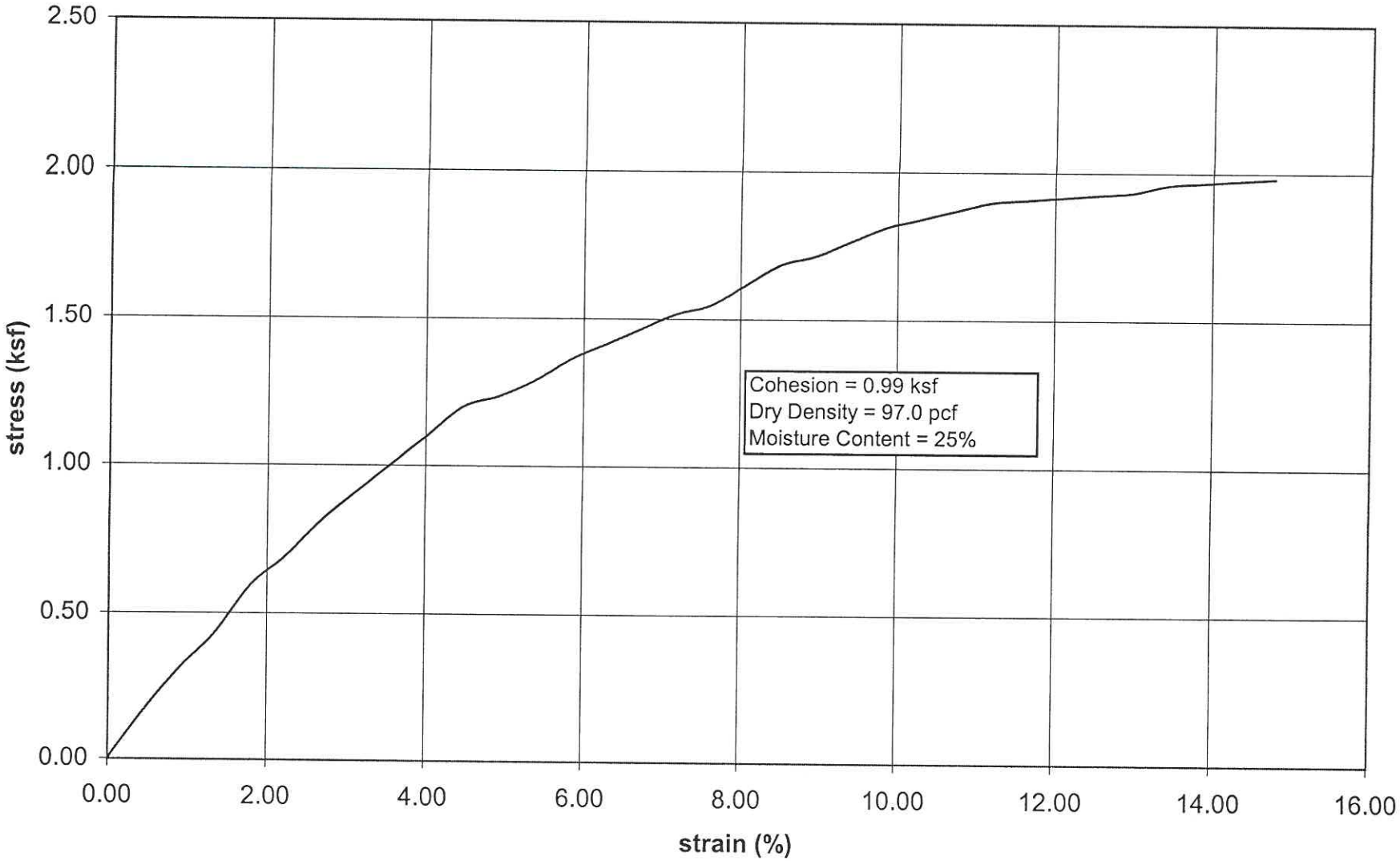
## UC - B-8 @ 6'-8' Sample B



## UC - B-10 @ 4'-6' Sample A



## UC - B-10 @ 4'-6' Sample B

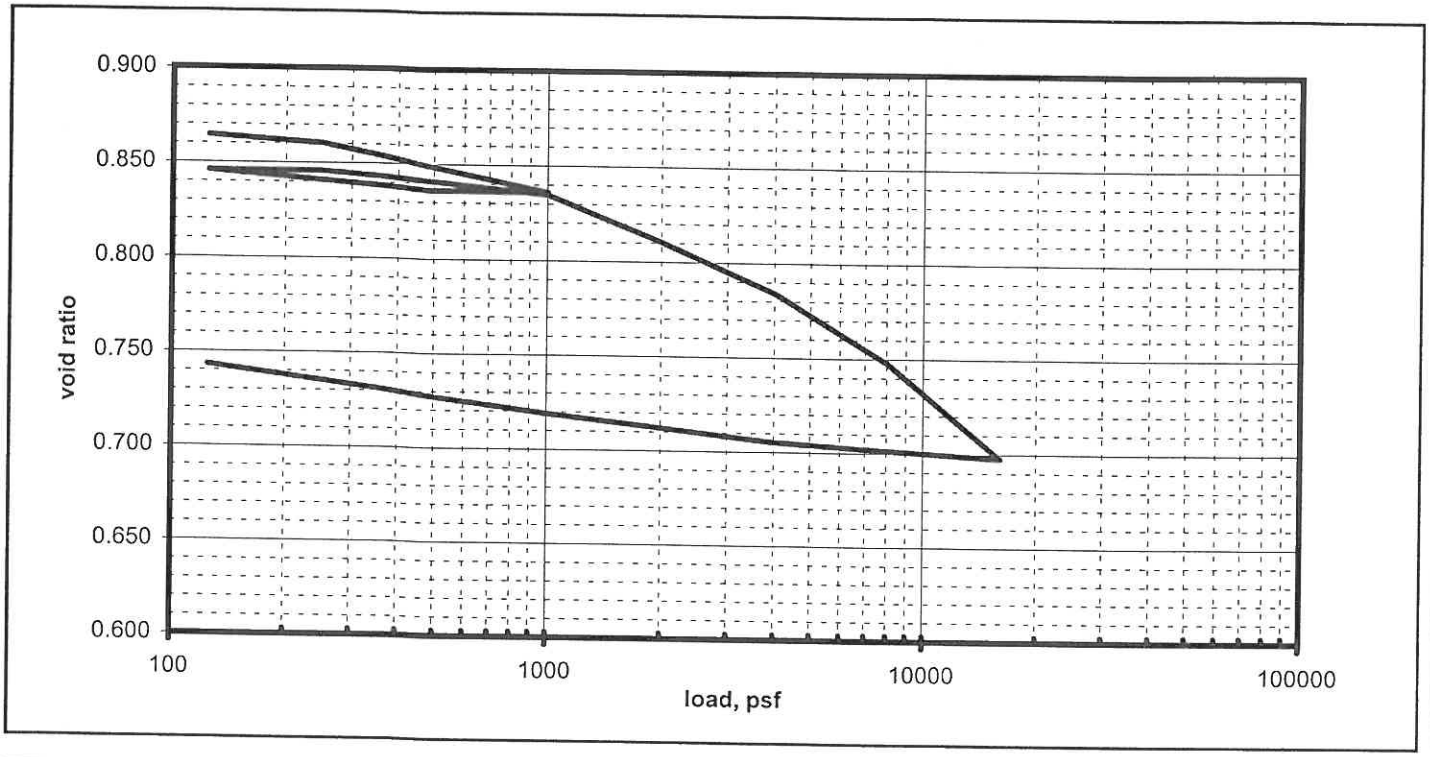


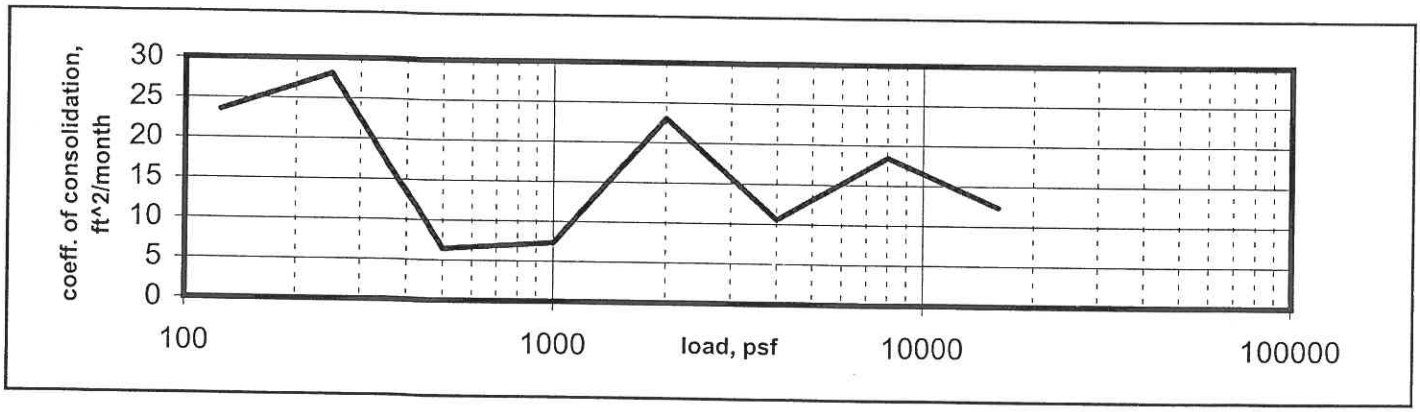
# APPENDIX VI

# CONSOLIDATION TEST RESULTS

psi Information To Build On
Engineering • Consulting • Testing

MEMPHIS GEOTECHNICAL DEPARTMENT



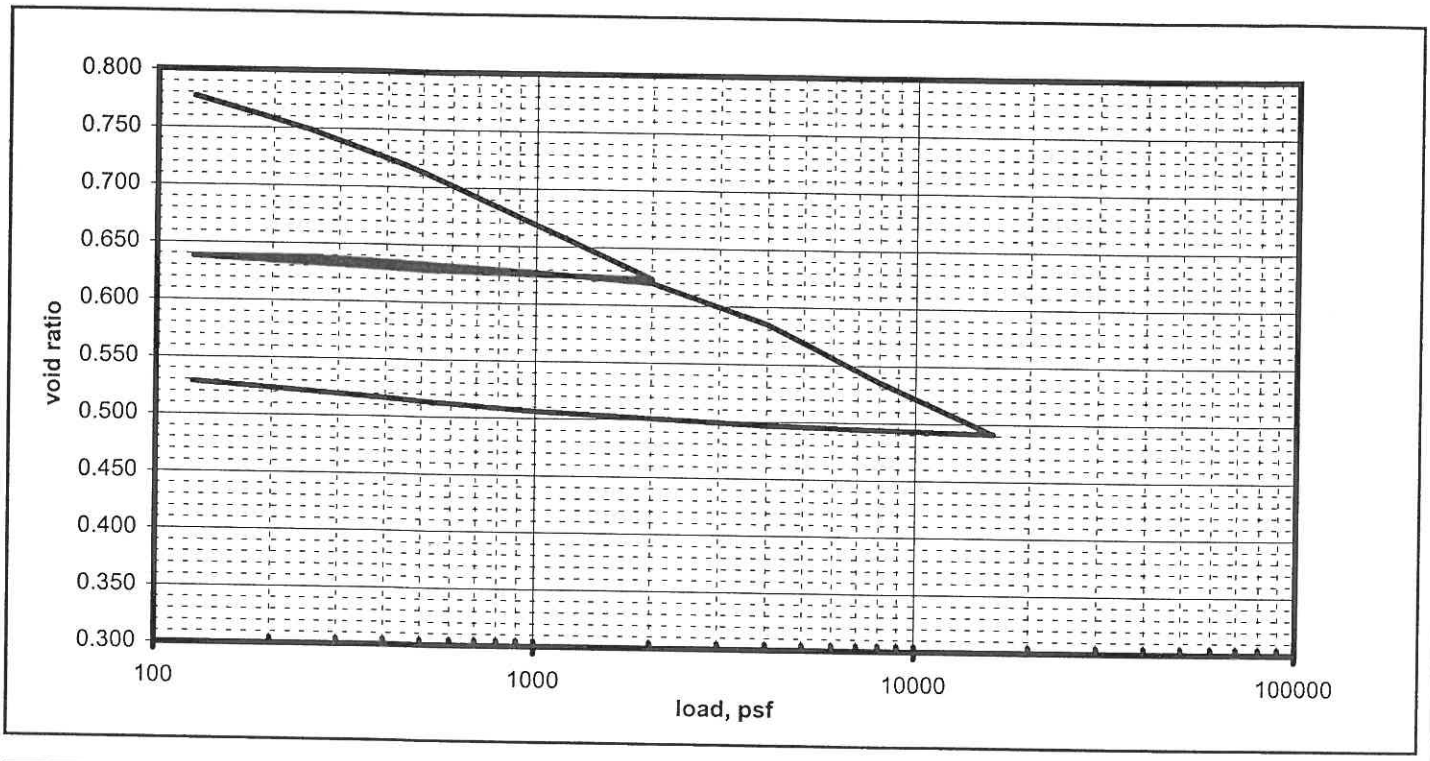

## CONSOLIDATION TEST RESULTS

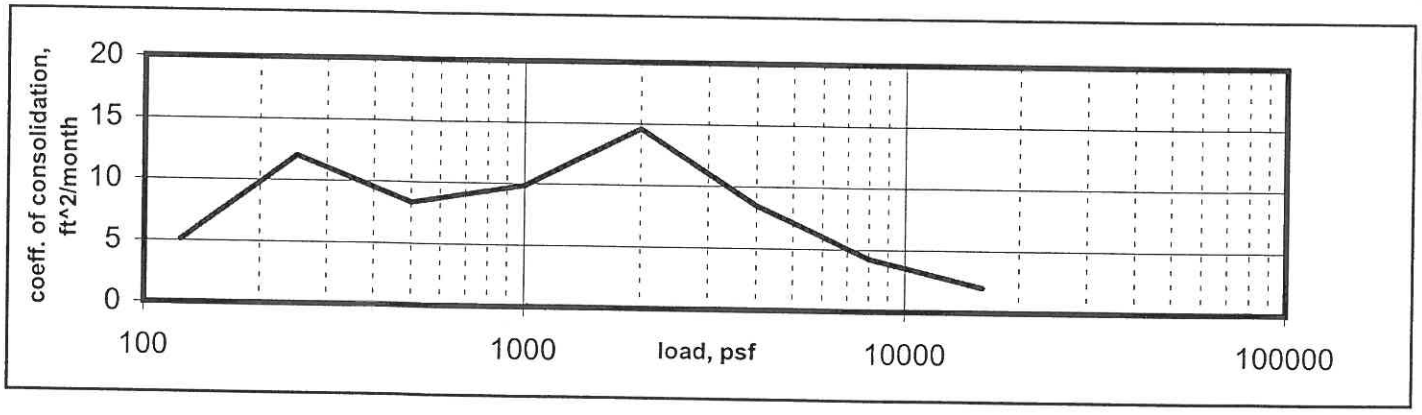
| | | | before test | |
|---|---|---|---|---|
| Sample I.D.: | B-6 6'-8' | | | |
| Sample Classification: | Brown Clayey Silt (ML) | Moisture, %: | 29.4 | |
| Liquid Limit: | 33 | Void Ratio: | 0.870 | |
| Plasticity Index: | 8 | Saturation, %: | 91.1 | |
| Dry Density: | 90.1 pcf | Specific Gravity: | | 2.7 |

| PROJECT: | FILE NO: |
|---|---|
| Fite Road Ext. | 502-35079 |
| | DATE: 6/26/03 |

psi Information To Build On
Engineering • Consulting • Testing

MEMPHIS GEOTECHNICAL DEPARTMENT




## CONSOLIDATION TEST RESULTS

| | | | before test | |
|---|---|---|---|---|
| Sample I.D.: | B-8 16'-18' | | | |
| Sample Classification: | Brown Clayey Silt (ML) | Moisture, %: | 31.3 | |
| Liquid Limit: | 34 | Void Ratio: | 0.848 | |
| Plasticity Index: | 10 | Saturation, %: | 99.7 | |
| Dry Density: | 91.2 pcf | Specific Gravity: | | 2.7 |

| PROJECT: | FILE NO: |
|---|---|
| Fite Road Ext | 502-35079 |
| | DATE: 6/30/03 |

# APPENDIX VII

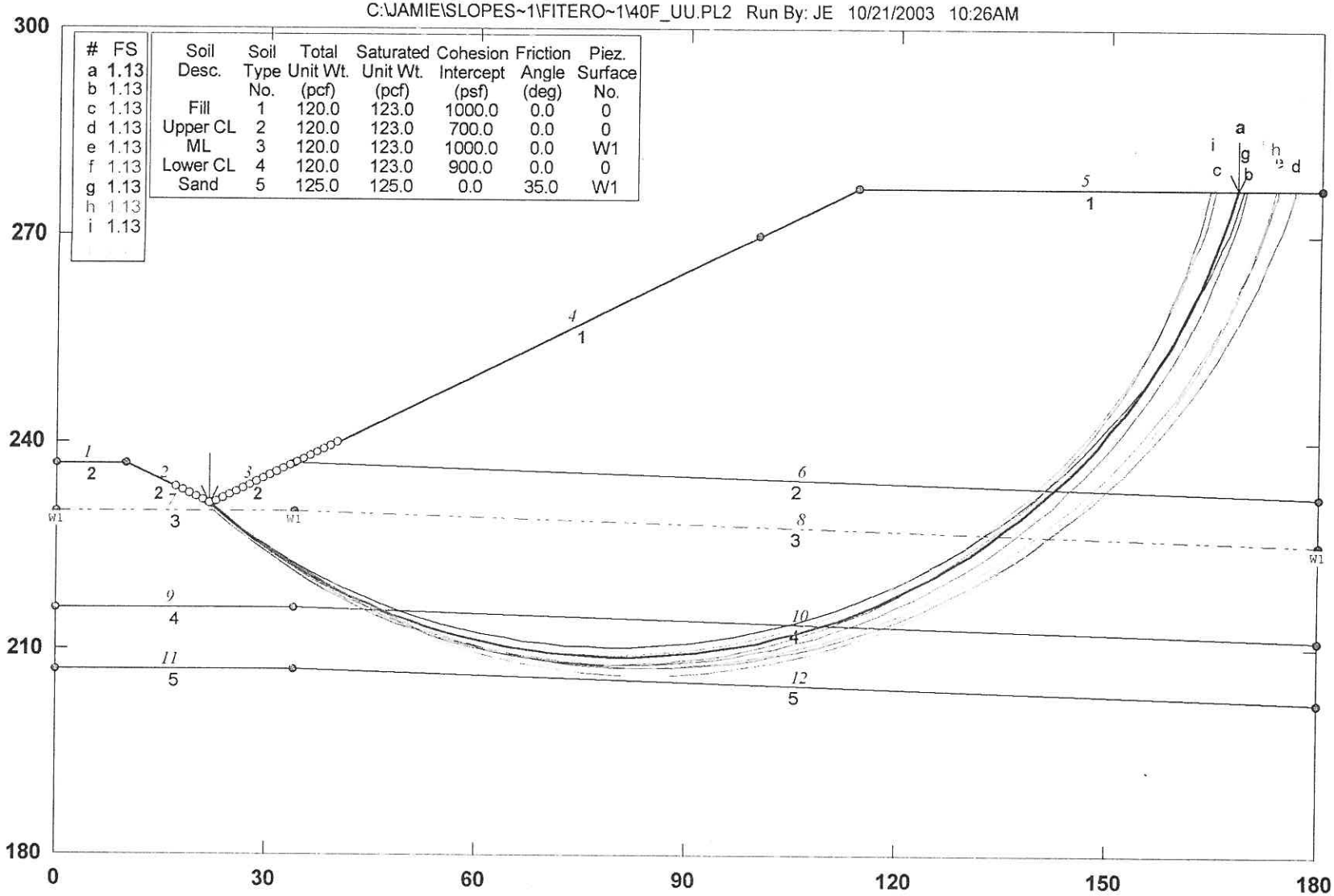
# SLOPE STABILITY ANALYSES RESULTS

# Fite Road Extension - 40-foot Fill DepthStage I - After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\40F_UU.PL2 Run By: JE 10/21/2003 10:26AM

| # | FS |
|---|---|
| a | 1.13 |
| b | 1.13 |
| c | 1.13 |
| d | 1.13 |
| e | 1.13 |
| f | 1.13 |
| g | 1.13 |
| h | 1.13 |
| i | 1.13 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=1.13

Safety Factors Are Calculated By The Modified Bishop Method

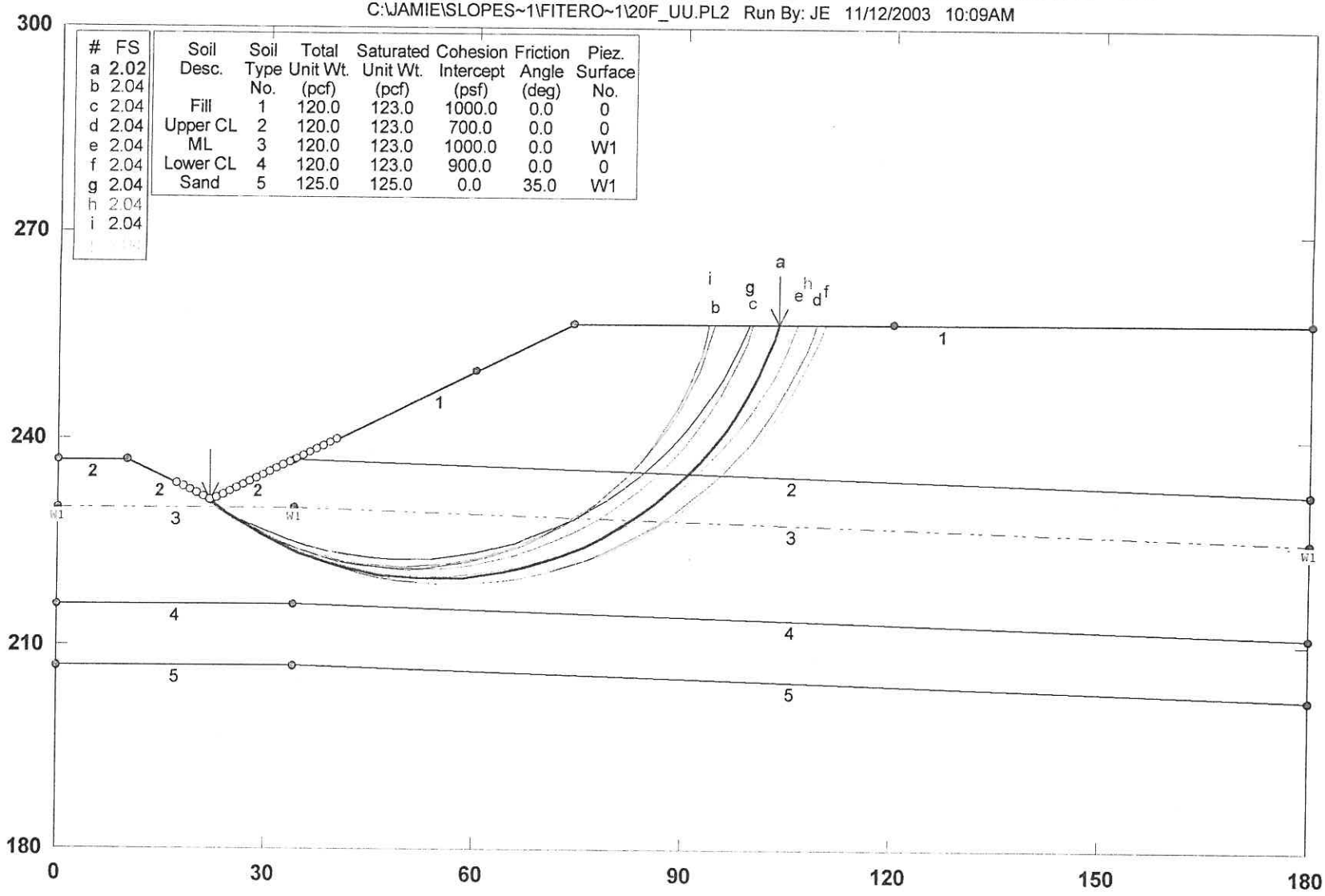
STED

# Fite Road Extension - 20-foot Fill DepthStage I - After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\20F_UU.PL2 Run By: JE 11/12/2003 10:09AM

| # | FS |
|---|---|
| a | 2.02 |
| b | 2.04 |
| c | 2.04 |
| d | 2.04 |
| e | 2.04 |
| f | 2.04 |
| g | 2.04 |
| h | 2.04 |
| i | 2.04 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=2.02

Safety Factors Are Calculated By The Modified Bishop Method

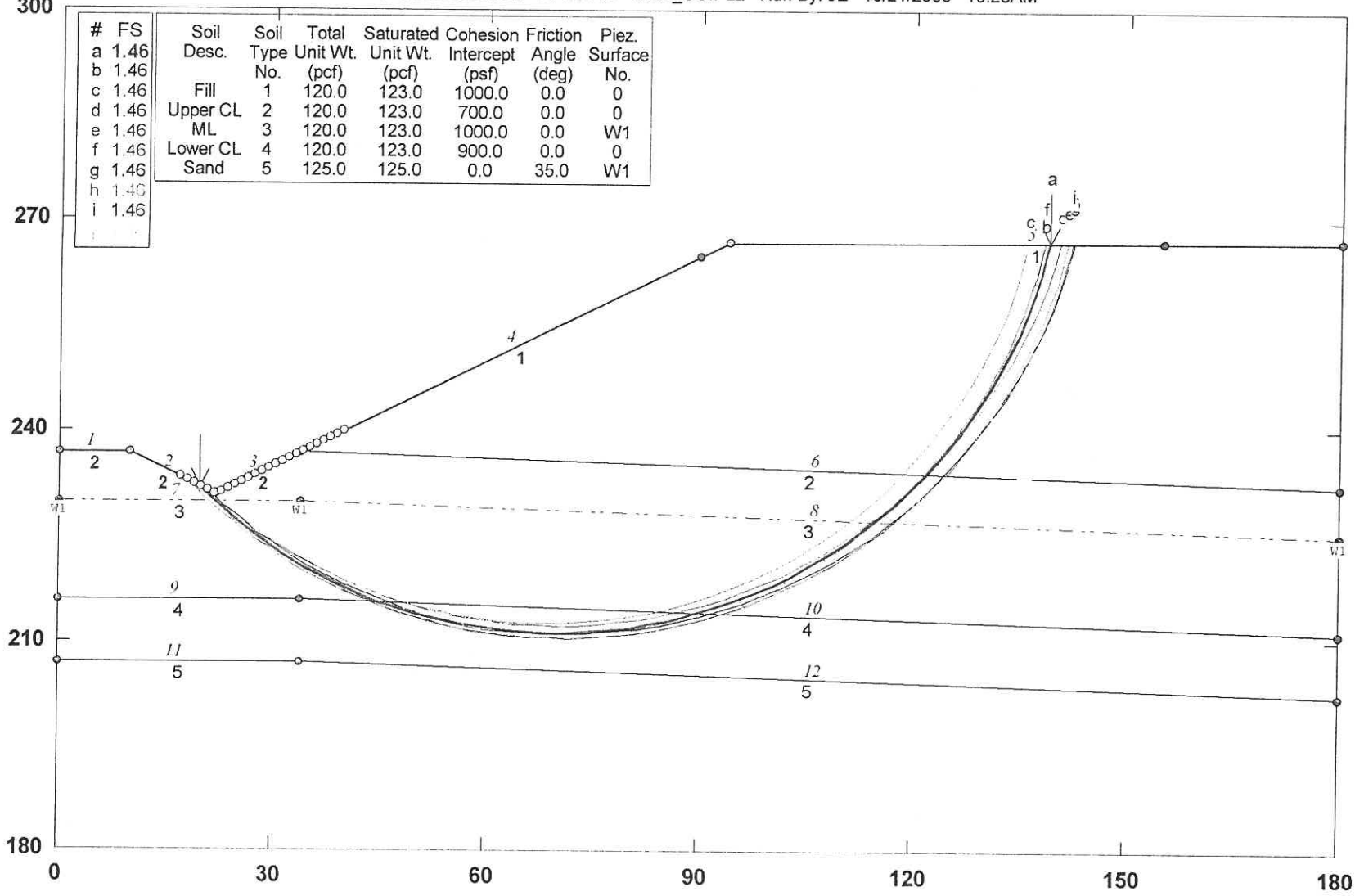
STED

# Fite Road Extension - 30-foot Fill DepthStage I - After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\30F_UU.PL2 Run By: JE 10/21/2003 10:28AM

| # | FS |
|---|---|
| a | 1.46 |
| b | 1.46 |
| c | 1.46 |
| d | 1.46 |
| e | 1.46 |
| f | 1.46 |
| g | 1.46 |
| h | 1.46 |
| i | 1.46 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=1.46

Safety Factors Are Calculated By The Modified Bishop Method

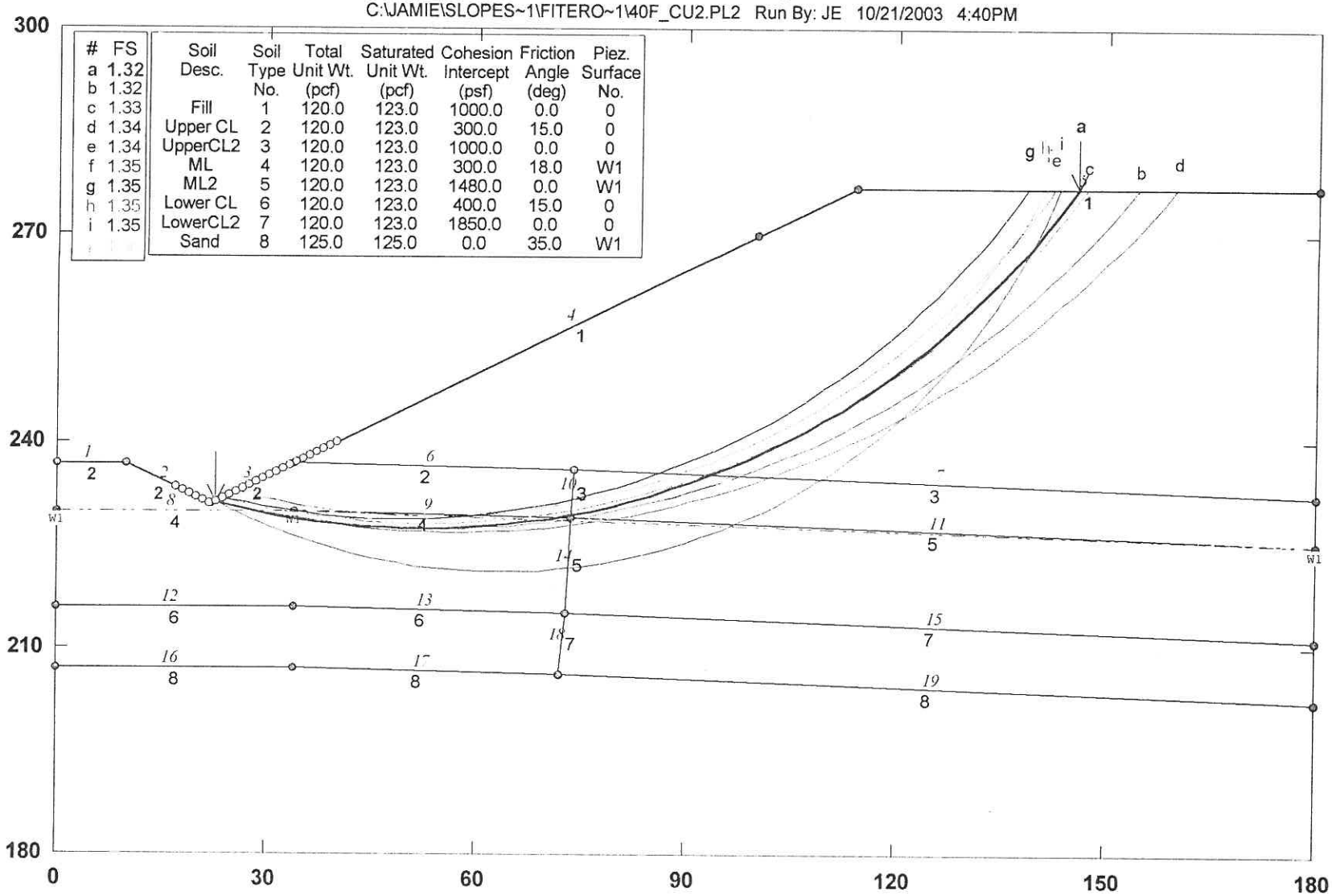
STED

# Fite Road Extension - 40-foot Fill DepthStage 2 - After Construction - CU

C:\JAMIE\SLOPES~1\FITERO~1\40F_CU2.PL2 Run By: JE 10/21/2003 4:40PM

| # | FS |
|---|---|
| a | 1.32 |
| b | 1.32 |
| c | 1.33 |
| d | 1.34 |
| e | 1.34 |
| f | 1.35 |
| g | 1.35 |
| h | 1.35 |
| i | 1.35 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 300.0 | 15.0 | 0 |
| UpperCL2 | 3 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| ML | 4 | 120.0 | 123.0 | 300.0 | 18.0 | W1 |
| ML2 | 5 | 120.0 | 123.0 | 1480.0 | 0.0 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 400.0 | 15.0 | 0 |
| LowerCL2 | 7 | 120.0 | 123.0 | 1850.0 | 0.0 | 0 |
| Sand | 8 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=1.32

Safety Factors Are Calculated By The Modified Bishop Method

STED

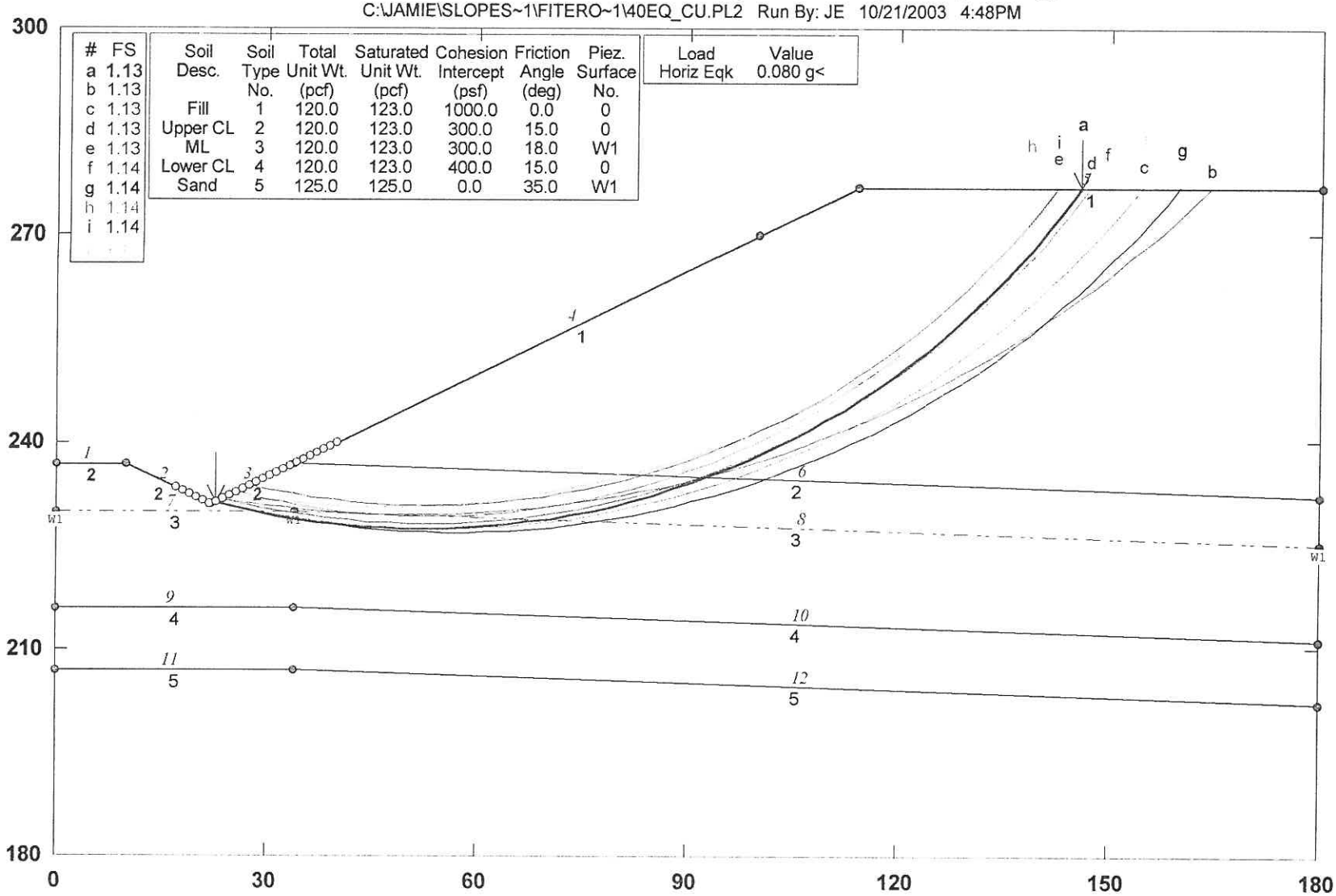
# Fite Road Extension - 40-foot Fill Depth- Earthquake (0.075g) - CU

C:\JAMIE\SLOPES~1\FITERO~1\40EQ_CU.PL2 Run By: JE 10/21/2003 4:48PM

| # | FS |
|---|---|
| a | 1.13 |
| b | 1.13 |
| c | 1.13 |
| d | 1.13 |
| e | 1.13 |
| f | 1.14 |
| g | 1.14 |
| h | 1.14 |
| i | 1.14 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 300.0 | 15.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 300.0 | 18.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 400.0 | 15.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |

| Load | Value |
|---|---|
| Horiz Eqk | 0.080 g< |



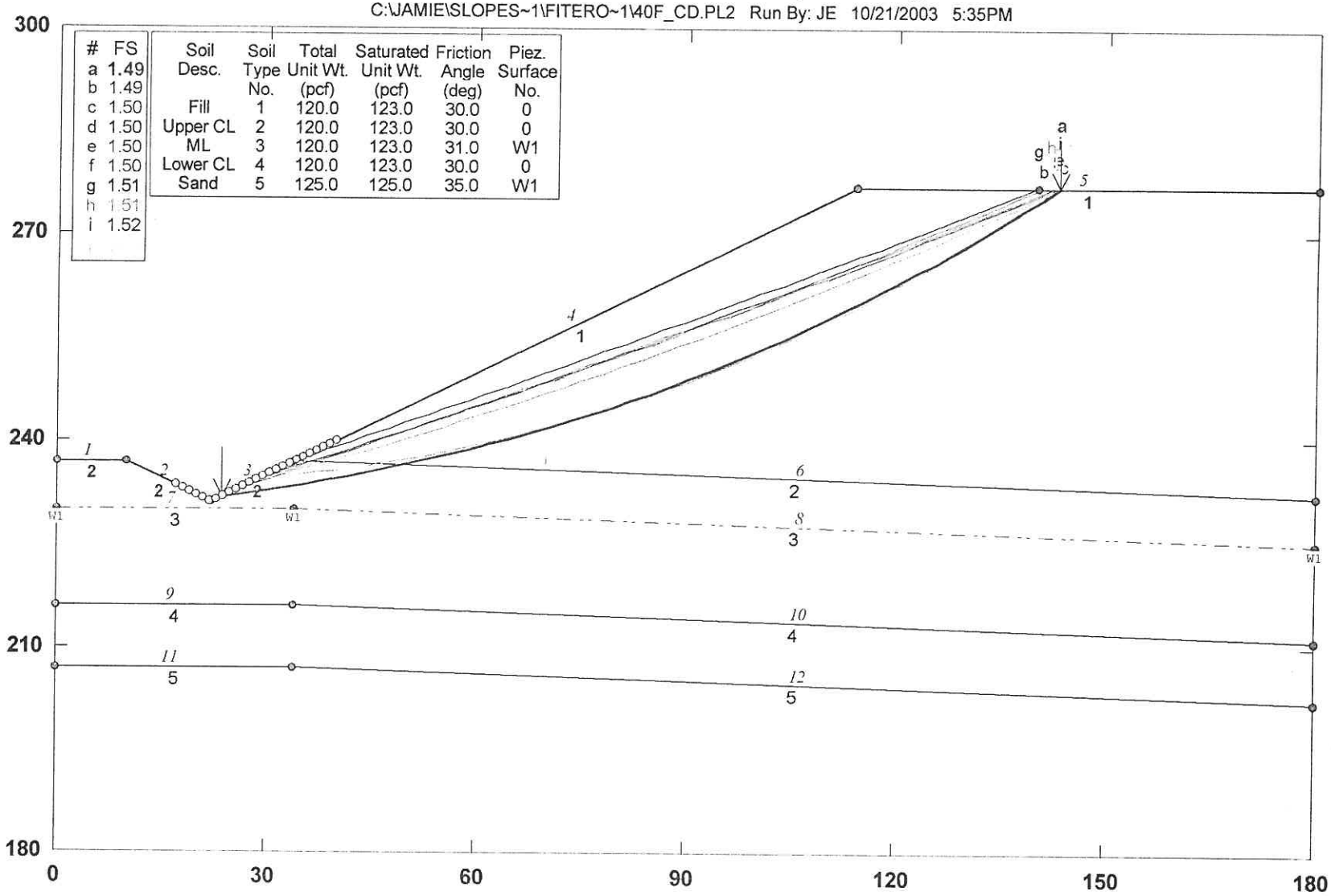

GSTABL7 FSmin=1.13

Safety Factors Are Calculated By The Modified Bishop Method

STED

# Fite Road Extension - 40-foot Fill Depth- Long Term - CD

C:\JAMIE\SLOPES~1\FITERO~1\40F_CD.PL2 Run By: JE 10/21/2003 5:35PM




| # | FS |
|---|---|
| a | 1.49 |
| b | 1.49 |
| c | 1.50 |
| d | 1.50 |
| e | 1.50 |
| f | 1.50 |
| g | 1.51 |
| h | 1.51 |
| i | 1.52 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 30.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 30.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 31.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 30.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 35.0 | W1 |

GSTABL7 FSmin=1.49

Safety Factors Are Calculated By The Modified Bishop Method

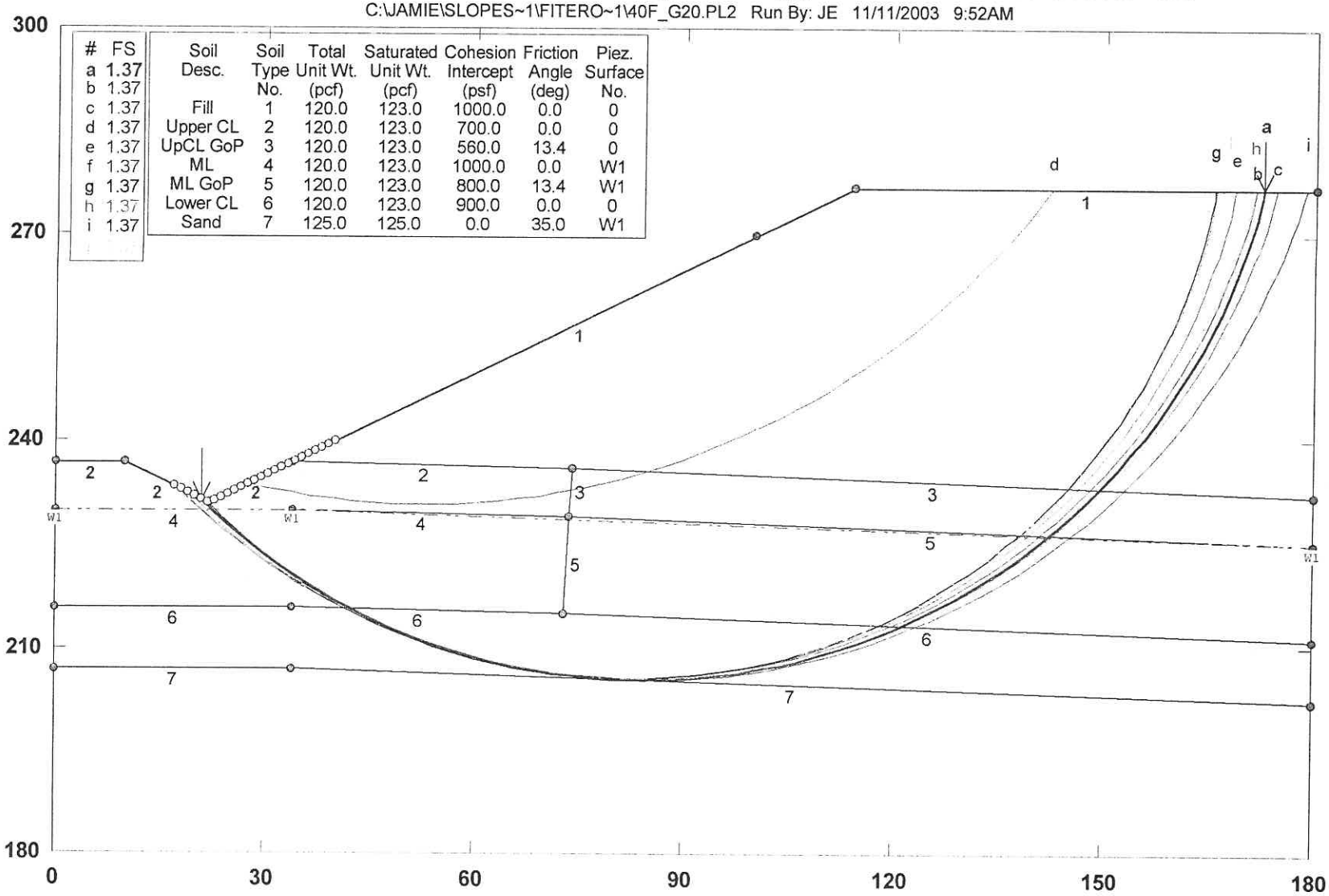
STED

# Fite Road Extension - 40-foot Fill Depth-20' Agg Pier- After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\40F_G20.PL2 Run By: JE 11/11/2003 9:52AM

| # | FS |
|---|---|
| a | 1.37 |
| b | 1.37 |
| c | 1.37 |
| d | 1.37 |
| e | 1.37 |
| f | 1.37 |
| g | 1.37 |
| h | 1.37 |
| i | 1.37 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| UpCL GoP | 3 | 120.0 | 123.0 | 560.0 | 13.4 | 0 |
| ML | 4 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| ML GoP | 5 | 120.0 | 123.0 | 800.0 | 13.4 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| Sand | 7 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=1.37

Safety Factors Are Calculated By The Modified Bishop Method

STED

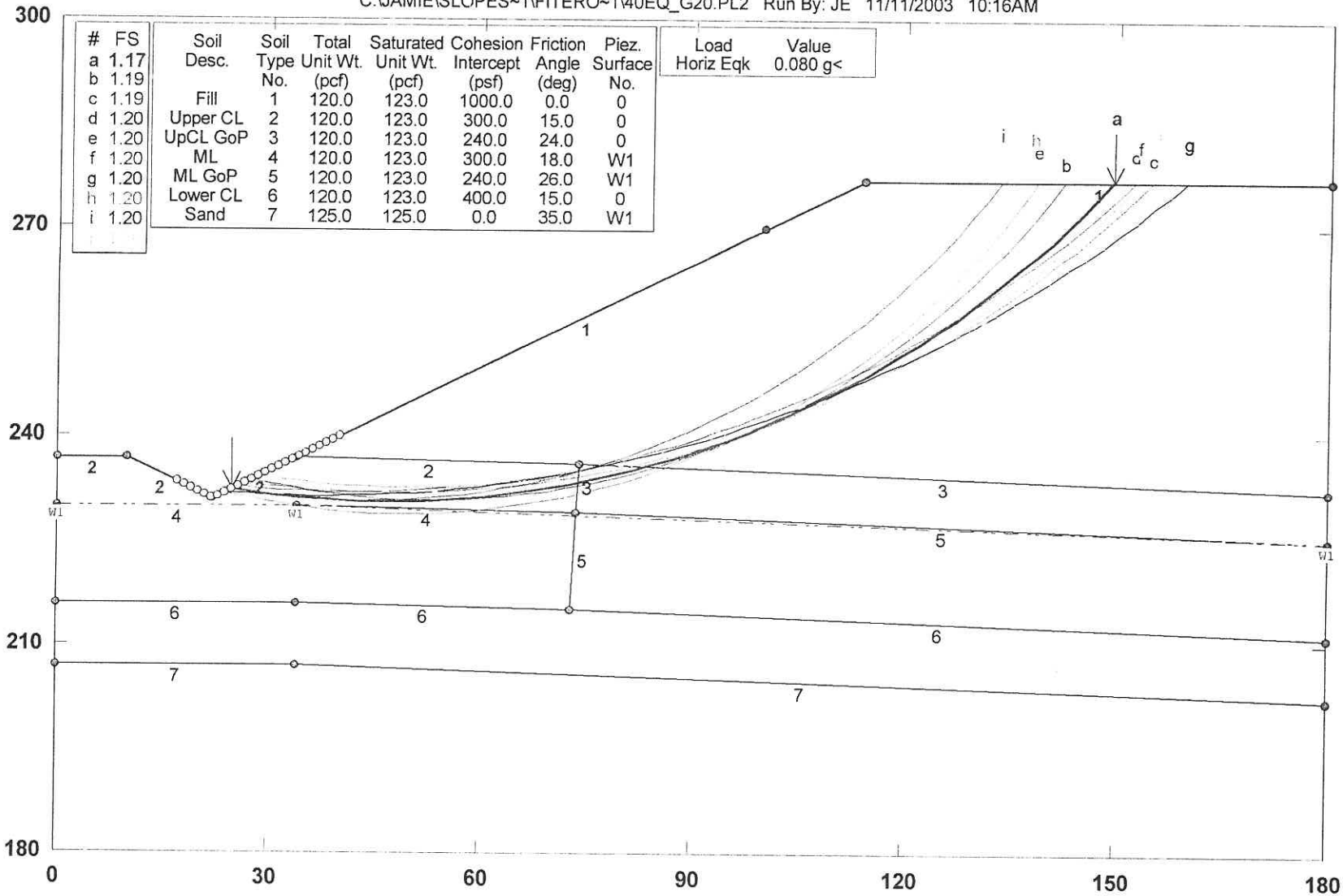
# Fite Road Extension - 40-foot Fill Depth-20' Agg Pier- Earthquake (0.075g) - CU

C:\JAMIE\SLOPES~1\FITERO~1\40EQ_G20.PL2 Run By: JE 11/11/2003 10:16AM

| # | FS |
|---|---|
| a | 1.17 |
| b | 1.19 |
| c | 1.19 |
| d | 1.20 |
| e | 1.20 |
| f | 1.20 |
| g | 1.20 |
| h | 1.20 |
| i | 1.20 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 300.0 | 15.0 | 0 |
| UpCL GoP | 3 | 120.0 | 123.0 | 240.0 | 24.0 | 0 |
| ML | 4 | 120.0 | 123.0 | 300.0 | 18.0 | W1 |
| ML GoP | 5 | 120.0 | 123.0 | 240.0 | 26.0 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 400.0 | 15.0 | 0 |
| Sand | 7 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |

| Load | Value |
|---|---|
| Horiz Eqk | 0.080 g< |



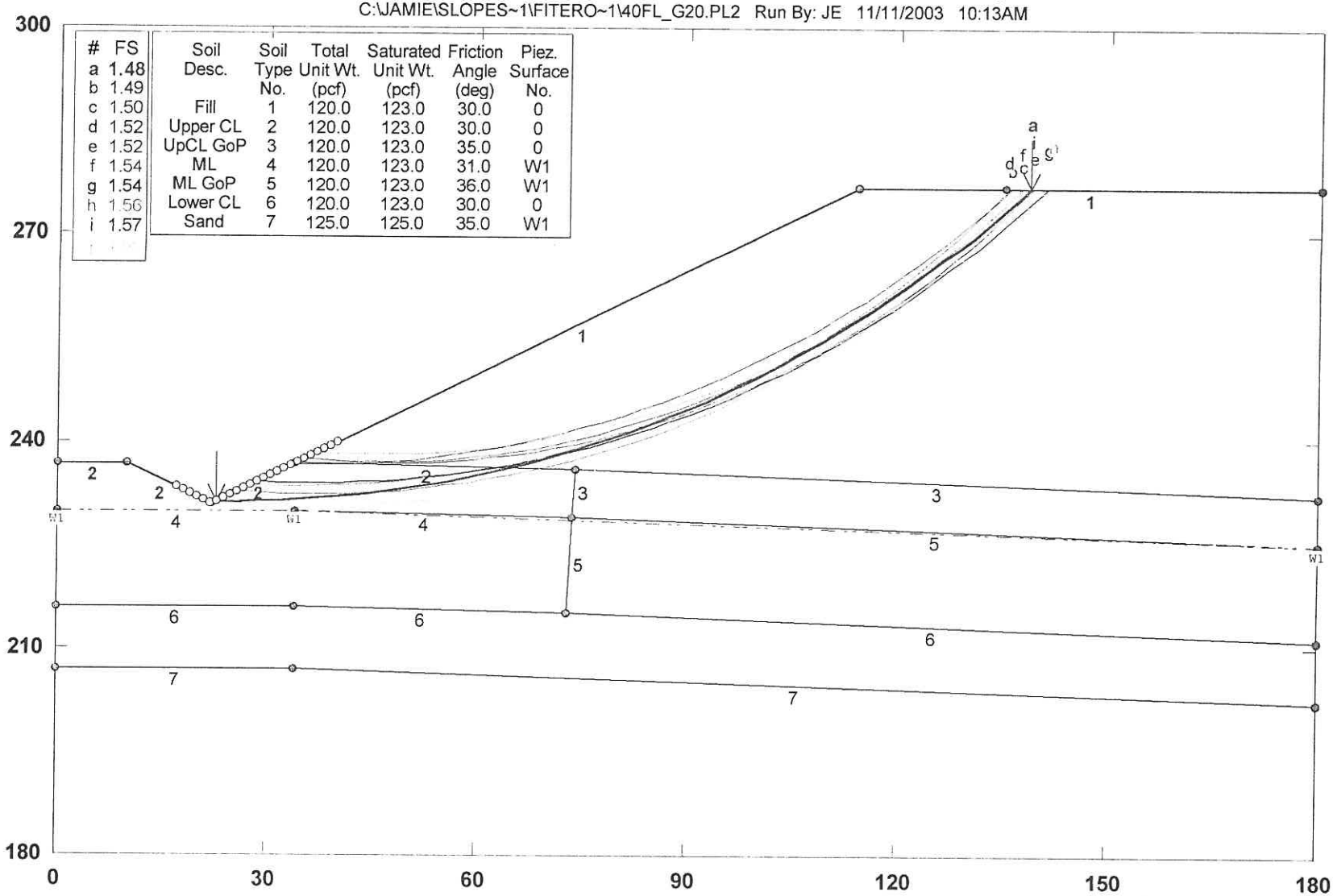

GSTABL7 FSmin=1.17

Safety Factors Are Calculated By The Modified Bishop Method

STED

# Fite Road Extension - 40-foot Fill Depth-20' Agg Pier- Long Term - CD

C:\JAMIE\SLOPES~1\FITERO~1\40FL_G20.PL2 Run By: JE 11/11/2003 10:13AM




| # | FS |
|---|---|
| a | 1.48 |
| b | 1.49 |
| c | 1.50 |
| d | 1.52 |
| e | 1.52 |
| f | 1.54 |
| g | 1.54 |
| h | 1.56 |
| i | 1.57 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 30.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 30.0 | 0 |
| UpCL GoP | 3 | 120.0 | 123.0 | 35.0 | 0 |
| ML | 4 | 120.0 | 123.0 | 31.0 | W1 |
| ML GoP | 5 | 120.0 | 123.0 | 36.0 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 30.0 | 0 |
| Sand | 7 | 125.0 | 125.0 | 35.0 | W1 |

**GSTABL7 FSmin=1.48**

**Safety Factors Are Calculated By The Modified Bishop Method**

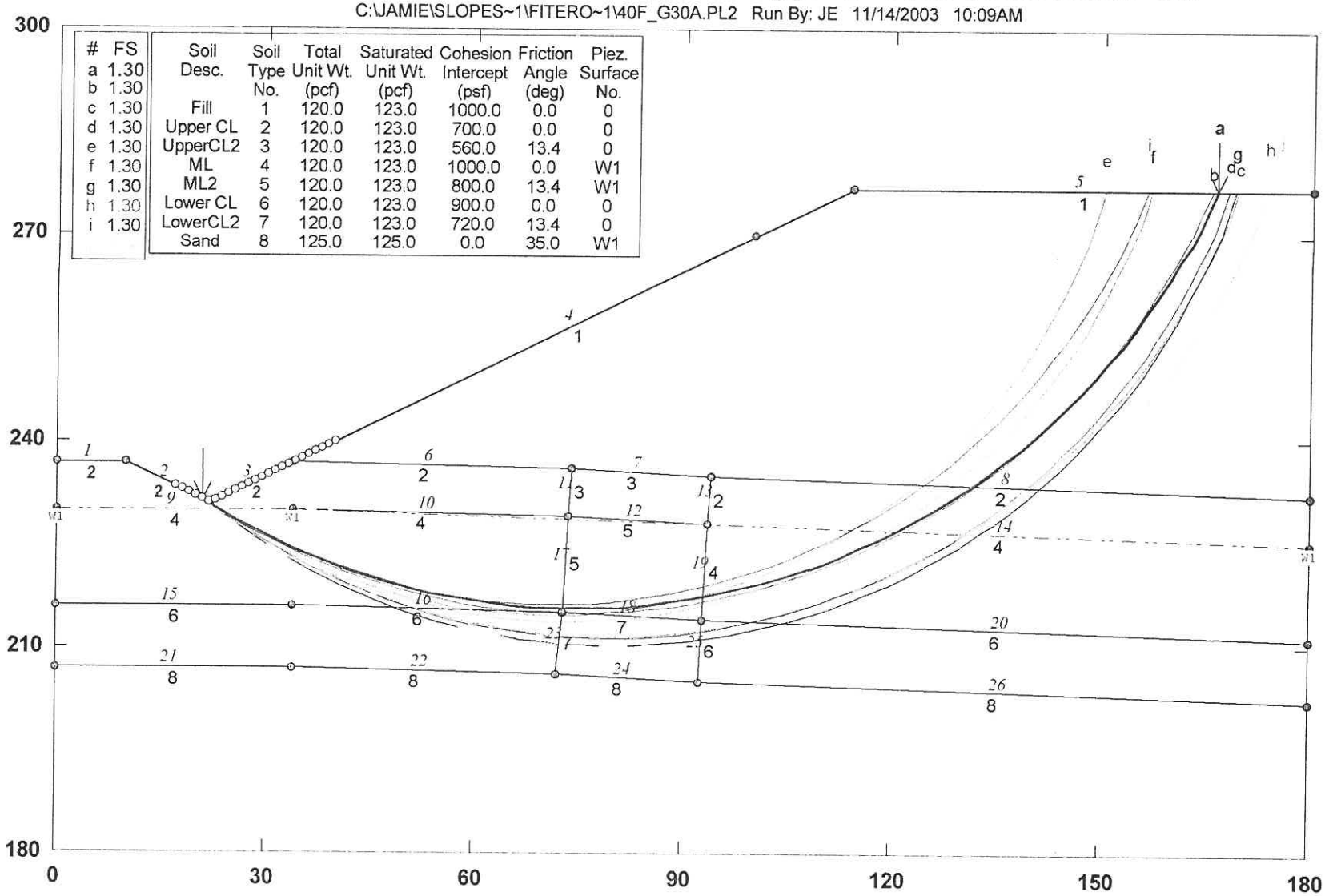
STED

# Fite Road Extension - 40-foot Fill Depth-30' Agg Pier - After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\40F_G30A.PL2 Run By: JE 11/14/2003 10:09AM

| # | FS |
|---|---|
| a | 1.30 |
| b | 1.30 |
| c | 1.30 |
| d | 1.30 |
| e | 1.30 |
| f | 1.30 |
| g | 1.30 |
| h | 1.30 |
| i | 1.30 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| UpperCL2 | 3 | 120.0 | 123.0 | 560.0 | 13.4 | 0 |
| ML | 4 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| ML2 | 5 | 120.0 | 123.0 | 800.0 | 13.4 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| LowerCL2 | 7 | 120.0 | 123.0 | 720.0 | 13.4 | 0 |
| Sand | 8 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=1.30

Safety Factors Are Calculated By The Modified Bishop Method

STED

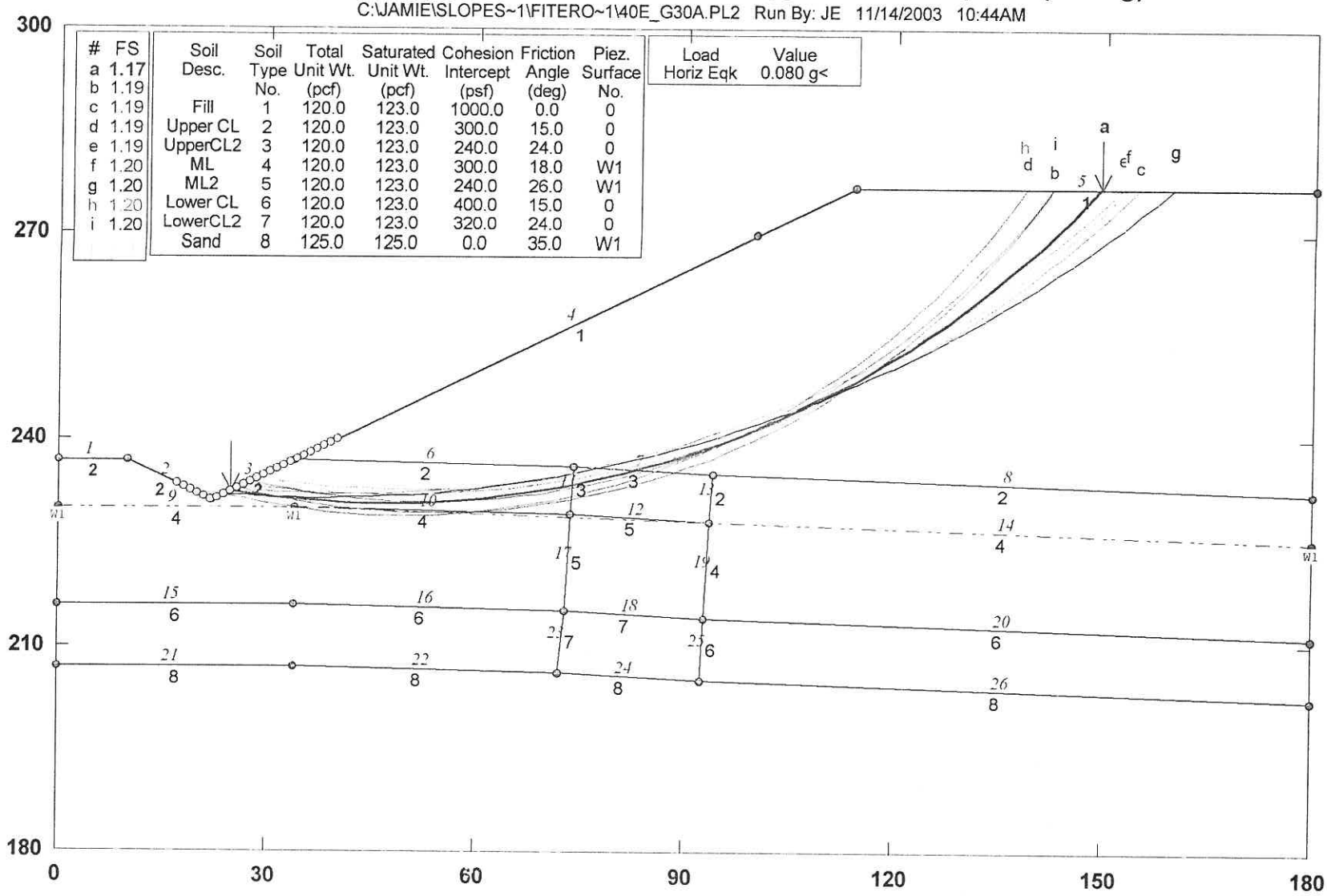
# Fite Road Extension - 40-foot Fill Depth-30' Agg Pier - Earthquake (0.075g) - CU

C:\JAMIE\SLOPES~1\FITERO~1\40E_G30A.PL2 Run By: JE 11/14/2003 10:44AM

| # | FS |
|---|---|
| a | 1.17 |
| b | 1.19 |
| c | 1.19 |
| d | 1.19 |
| e | 1.19 |
| f | 1.20 |
| g | 1.20 |
| h | 1.20 |
| i | 1.20 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 300.0 | 15.0 | 0 |
| UpperCL2 | 3 | 120.0 | 123.0 | 240.0 | 24.0 | 0 |
| ML | 4 | 120.0 | 123.0 | 300.0 | 18.0 | W1 |
| ML2 | 5 | 120.0 | 123.0 | 240.0 | 26.0 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 400.0 | 15.0 | 0 |
| LowerCL2 | 7 | 120.0 | 123.0 | 320.0 | 24.0 | 0 |
| Sand | 8 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |

| Load | Value |
|---|---|
| Horiz Eqk | 0.080 g< |




GSTABL7 FSmin=1.17

Safety Factors Are Calculated By The Modified Bishop Method

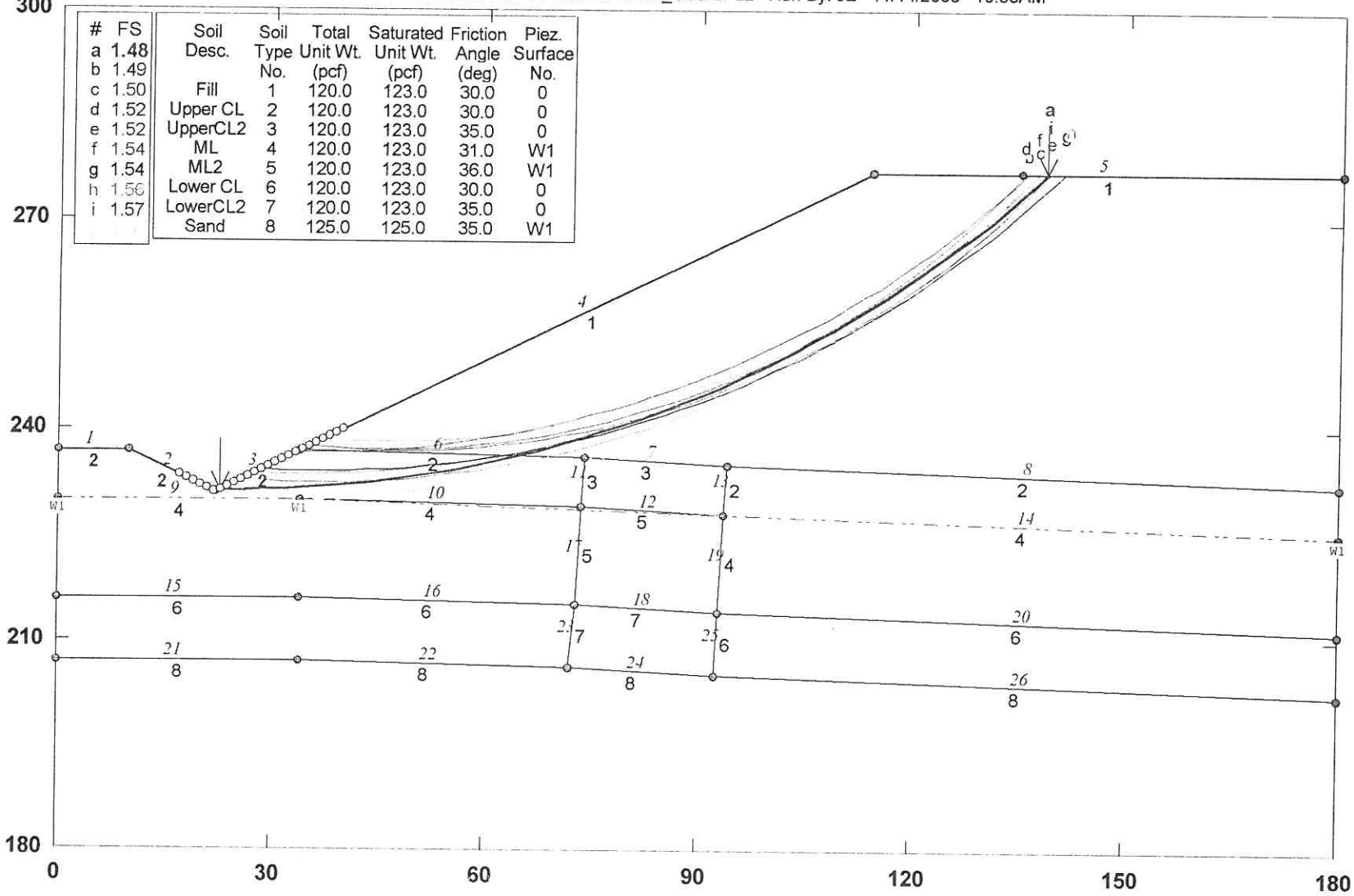
STED

# Fite Road Extension - 40-foot Fill Depth-30' Agg Pier - Long Term - CD

C:\JAMIE\SLOPES~1\FITERO~1\40L_G30A.PL2 Run By: JE 11/14/2003 10:53AM

| # | FS |
|---|---|
| a | 1.48 |
| b | 1.49 |
| c | 1.50 |
| d | 1.52 |
| e | 1.52 |
| f | 1.54 |
| g | 1.54 |
| h | 1.56 |
| i | 1.57 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 30.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 30.0 | 0 |
| UpperCL2 | 3 | 120.0 | 123.0 | 35.0 | 0 |
| ML | 4 | 120.0 | 123.0 | 31.0 | W1 |
| ML2 | 5 | 120.0 | 123.0 | 36.0 | W1 |
| Lower CL | 6 | 120.0 | 123.0 | 30.0 | 0 |
| LowerCL2 | 7 | 120.0 | 123.0 | 35.0 | 0 |
| Sand | 8 | 125.0 | 125.0 | 35.0 | W1 |




GSTABL7 FSmin=1.48

Safety Factors Are Calculated By The Modified Bishop Method

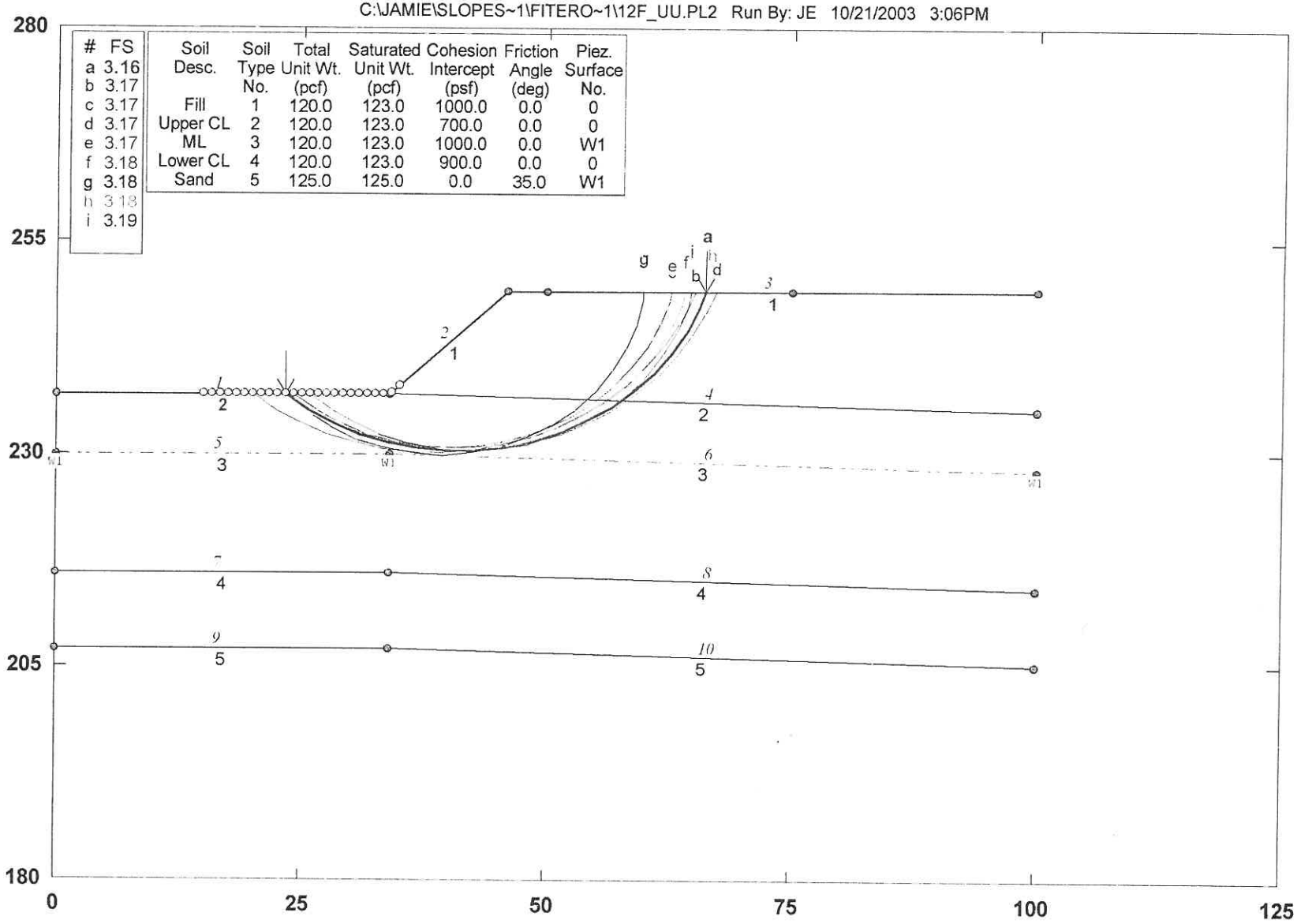
STED

# Fite Road Extension - 12-foot Fill Depth-1:1 slope - After Construction - UU

C:\JAMIE\SLOPES~1\FITERO~1\12F_UU.PL2 Run By: JE 10/21/2003 3:06PM

| # | FS |
|---|---|
| a | 3.16 |
| b | 3.17 |
| c | 3.17 |
| d | 3.17 |
| e | 3.17 |
| f | 3.18 |
| g | 3.18 |
| h | 3.18 |
| i | 3.19 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| Fill | 1 | 120.0 | 123.0 | 1000.0 | 0.0 | 0 |
| Upper CL | 2 | 120.0 | 123.0 | 700.0 | 0.0 | 0 |
| ML | 3 | 120.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Lower CL | 4 | 120.0 | 123.0 | 900.0 | 0.0 | 0 |
| Sand | 5 | 125.0 | 125.0 | 0.0 | 35.0 | W1 |




GSTABL7 FSmin=3.16

Safety Factors Are Calculated By The Modified Bishop Method

STED

# APPENDIX VIII

# PILE FOUNDATION CAPACITY DIAGRAMS

# Pile Capacity Diagram
## PSI File No.: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

| | |
|---|---|
| Project: Fite Road Extension | Boring No.: B-7 |
| Location: Memphis, Tennessee | Elevation: +/-237' |
| Date: 8/29/03 | Water level while drilling: 15' |
| Boring Method: HSA to 35' - MR to 60' | Driller: E. Morris |

| Depth (ft) | | | |
|---|---|---|---|
| | N = 6 | $f_s$ = 0.260 | $q_b$ = 7 |
| | N = 6 | $f_s$ = 0.300 | $q_b$ = 3 |
| 5- | N = 8 | $f_s$ = 0.400 | $q_b$ = 4 |
| 10- | N = 5 | $f_s$ = 0.220 | $q_b$ = 5 |
| 15- | N = 5 | $f_s$ = 0.220 | $q_b$ = 5 |
| 20- | N = 7 | $f_s$ = 0.350 | $q_b$ = 3 |
| 25- | N = 4 | $f_s$ = 0.200 | $q_b$ = 0 |
| 30- | N = 5 | $f_s$ = 0.250 | $q_b$ = 2 |
| 35- | N = 14 | $f_s$ = 0.260 | $q_b$ = 30 |
| 40- | N = 25 | $f_s$ = 0.480 | $q_b$ = 54 |
| 45- | N = 36 | $f_s$ = 0.580 | $q_b$ = 65 |
| 50- | N = 18 | $f_s$ = 0.340 | $q_b$ = 39 |
| 55- | N = 38 | $f_s$ = 0.580 | $q_b$ = 65 |
| 60- | N = 13 | $f_s$ = 0.620 | $q_b$ = 6 |

# Pile Capacity Diagram
## PSI File No.: 502-35079

Information To Build On
Engineering • Consulting • Testing

| | |
|---|---|
| Project: Fite Road Extension | Boring No.: B-8 |
| Location: Memphis, Tennessee | Elevation: +/-237' |
| Date: 8/29/03 | Water level while drilling: NE |
| Boring Method: HSA to 15' - MR to 60' | Driller: R. Strunk |

| Depth (ft) | | | |
|---|---|---|---|
| | N = 6 | $f_s$ = 0.260 | $q_b$ = 7 |
| | N = 10 | $f_s$ = 0.500 | $q_b$ = 5 |
| 5- | N = 8 | $f_s$ = 0.400 | $q_b$ = 4 |
| 10- | N = 7 | $f_s$ = 0.300 | $q_b$ = 8 |
| 15- | N = 7 | $f_s$ = 0.300 | $q_b$ = 8 |
| 20- | N = 7 | $f_s$ = 0.350 | $q_b$ = 3 |
| 25- | N = 6 | $f_s$ = 0.300 | $q_b$ = 3 |
| 30- | N = 18 | $f_s$ = 0.340 | $q_b$ = 39 |
| 35- | N = 28 | $f_s$ = 0.540 | $q_b$ = 61 |
| 40- | N = 28 | $f_s$ = 0.540 | $q_b$ = 61 |
| 45- | N = 22 | $f_s$ = 0.420 | $q_b$ = 48 |
| 50- | N = 49 | $f_s$ = 0.580 | $q_b$ = 65 |
| 55- | N = 74 | $f_s$ = 0.580 | $q_b$ = 65 |
| 60- | N = 48 | $f_s$ = 0.580 | $q_b$ = 65 |

# APPENDIX IX

# LIQUEFACTION ANALYSES

# Liquefaction Analysis
## PSI File No.: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

| | | |
|---|---|---|
| Project: Fite Road Extension | | Boring No.: Avg. Profile |
| Location: Memphis, Tennessee | | Elevation: -- |
| Boring Method: HSA/MR | Water level while drilling: 10 | |
| Magnitude ($M_w$): 6.5 | PGA: 0.15 g | Assumed water level: 10 |
| Simplified Procedure - SPT Analysis (1996 NCEER Modification) | | Hammer: Safety/CH |

| | Depth (ft) | $N_f$ | $(N_1)_{60cs}$ | CSR | CRR | Factor of Safety |
|---|---|---|---|---|---|---|
| | 0.5 | 7 | 7 | NA | NA | NA |
| | 5 | 7 | 7 | NA | NA | NA |
| (CL/ML) | 10 | 7 | 7 | NA | NA | NA |
| | 15 | 7 | 7 | NA | NA | NA |
| | 20 | 7 | 7 | NA | NA | NA |
| | 25 | 7 | 7 | NA | NA | NA |
| | 30 | 14 | 15 | 0.138 | 0.2481 | 1.8 |
| | 35 | 25 | 27 | 0.137 | 0.4891 | 3.6 |
| (SP) | 40 | 27 | 28 | 0.134 | 0.5245 | 3.9 |
| | 45 | 29 | 29 | 0.131 | 0.5695 | 4.4 |
| | 50 | 33 | 32 | 0.126 | 1.5227 | 12.1 |
| | 55 | 56 | 52 | 0.121 | 1.5227 | 12.6 |
| | 60 | 48 | 43 | 0.116 | 1.5227 | 13.1 |
| | 70 | | | | | |
| | 80 | | | | | |

# Liquefaction Analysis
## PSI File No.: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

| | | | |
|---|---|---|---|
| Project: Fite Road Extension | | | Boring No.: Avg. Profile |
| Location: Memphis, Tennessee | | | Elevation: -- |
| Boring Method: HSA/MR | | Water level while drilling: 10 | |
| Magnitude ($M_w$): 6.5 | PGA: 0.15 g | Assumed water level: 10 | |
| Simplified Procedure - SPT Analysis (1996 NCEER Modification) | | | Hammer: Safety/CH |

| | Depth (ft) | $N_f$ | $(N_1)_{60cs}$ | CSR | CRR | Factor of Safety |
|---|---|---|---|---|---|---|
| | 0.5 | 7 | 7 | NA | NA | NA |
| | 5 | 7 | 7 | NA | NA | NA |
| (CL/ML) | 10 | 7 | 7 | NA | NA | NA |
| | 15 | 7 | 7 | NA | NA | NA |
| | 20 | 7 | 7 | NA | NA | NA |
| | 25 | 7 | 7 | NA | NA | NA |
| | 30 | 14 | 15 | 0.069 | 0.2481 | 3.6 |
| | 35 | 25 | 27 | 0.066 | 0.4891 | 7.4 |
| (SP) | 40 | 27 | 28 | 0.066 | 0.5245 | 7.9 |
| | 45 | 29 | 29 | 0.066 | 0.5695 | 8.6 |
| | 50 | 33 | 32 | 0.066 | 1.5227 | 23.0 |
| | 55 | 56 | 52 | 0.066 | 1.5227 | 23.1 |
| | 60 | 48 | 43 | 0.066 | 1.5227 | 23.2 |
| | 70 | | | | | |
| | 80 | | | | | |

Note: Analysis includes 40-foot fill height.

# Liquefaction Analysis
## PSI File No.: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

| | | | |
|---|---|---|---|
| Project: Fite Road Extension | | | Boring No.: B-9 |
| Location: Memphis, Tennessee | | | Elevation: -- |
| Boring Method: HSA/MR@45' | | Water level while drilling: 10 | |
| Magnitude ($M_w$): 6.5 | PGA: 0.15 g | Assumed water level: 10 | |
| Simplified Procedure - SPT Analysis (1996 NCEER Modification) | | | Hammer: Safety/CH |

| | Depth (ft) | $N_f$ | $(N_1)_{60cs}$ | CSR | CRR | Factor of Safety |
|---|---|---|---|---|---|---|
| | 0.5 | 7 | 7 | NA | NA | NA |
| | 5 | 7 | 7 | NA | NA | NA |
| (CL) | 10 | 5 | 5 | NA | NA | NA |
| | 15 | 5 | 5 | NA | NA | NA |
| | 20 | 9 | 9 | NA | NA | NA |
| | 25 | 7 | 7 | NA | NA | NA |
| (SM) | 30 | 9 | 14 | 0.138 | 0.2319 | 1.7 |
| | 35 | 14 | 17 | 0.137 | 0.2757 | 2.0 |
| (SP) | 40 | 21 | 24 | 0.134 | 0.3983 | 3.0 |

# Liquefaction Analysis
## PSI File No.: 502-35079

psi Information To Build On
Engineering • Consulting • Testing

| | | | |
|---|---|---|---|
| Project: Fite Road Extension | | | Boring No.: B-9 |
| Location: Memphis, Tennessee | | | Elevation: -- |
| Boring Method: HSA/MR@45' | | Water level while drilling: 10 | |
| Magnitude ($M_w$): 6.5 | PGA: 0.15 g | Assumed water level: 10 | |
| Simplified Procedure - SPT Analysis (1996 NCEER Modification) | | | Hammer: Safety/CH |

| | Depth (ft) | $N_f$ | $(N_1)_{60cs}$ | CSR | CRR | Factor of Safety |
|---|---|---|---|---|---|---|
| | 0.5 | 7 | 7 | NA | NA | NA |
| | 5 | 7 | 7 | NA | NA | NA |
| (CL) | 10 | 5 | 5 | NA | NA | NA |
| | 15 | 5 | 5 | NA | NA | NA |
| | 20 | 9 | 9 | NA | NA | NA |
| | 25 | 7 | 7 | NA | NA | NA |
| (SM) | 30 | 9 | 14 | 0.069 | 0.2319 | 3.4 |
| | 35 | 14 | 17 | 0.066 | 0.2757 | 4.2 |
| (SP) | 40 | 21 | 24 | 0.066 | 0.3983 | 6.0 |

Note: Analysis includes 40-foot fill height.

GEOTECHNOLOGY INC
FROM THE GROUND UP

February 15, 2012 J019679.01

Mr. John Pankey, P.E.
Fisher & Arnold
9180 Crestwyn Hills Drive
Memphis, Tennessee 38125

Re: Addendum #1
Project No. : STP-M-7900(29)
Geotechnical Engineering Section No.: N/A
County: Shelby Region: IV
Fite Road Retaining Walls No. 1 and 2 – Additional Fill Placement Recommendations

Dear Mr. Pankey:

Per our discussion during the meeting of February 14, 2012, presented is this addendum are additional recommendations regarding fill placement, and retaining wall design and construction for the referenced project. Refer to the geotechnical reports (previously issued) for information regarding the project in general, as well as specific recommendations for mitigation of settlement, liquefaction and protecting against global stability failure.

Preparation of Fill Areas

In areas where filling will be required to bring the site to grade, the following procedures are recommended.

(a) Remove all organic matter, foreign material and debris.

(b) Compact the top 6 inches of cleared subgrade to a minimum of 95% of the maximum dry density as determined by the standard Proctor compaction test (ASTM D 698). If the subgrade is granular material, compact the top 6 inches to a minimum of 70% relative density as determined by the relative density test ASTM D 4253 and D 4254.

(c) If the cleared subgrade is excessively wet, it should be stabilized so that construction traffic can operate without damaging/disturbing the subgrade. This can be accomplished by placing a layer of biaxial geogrid and covering it with a minimum of 12 inches of crushed stone.

Suitable Fill Materials

Fill material should consist of natural soils that have a maximum liquid limit of 45 and a plasticity index of not more than 20. It should be free from organic matter, debris, or other

deleterious materials. In general, the material should have an upper particle size diameter of 2 inches.

Fill and Backfill Placement

Fill or backfill should be placed in lifts of uniform thickness and compacted. The compacted lift thickness, however, should generally not exceed 6 inches. Each lift should be compacted to a minimum of 95% of the maximum dry density as determined by the standard Proctor test. Moisture content should be controlled to within ± 2% of optimum. If granular fill is used, compact each lift to a minimum of 70% of relative density as determined by ASTM D 4253 and D 4254.

The rate of fill placement should be slow enough to allow for increase of strength and stiffness of the native (in place) soil through consolidation process (reducing moisture content and void ratio), which is typically known as staged placement of the fill material. The increase in soil stiffness and strength is related to the rate of excess porewater pressure dissipation and the associated settlement due to fill placement. The suggested rate of placement is 1 to 2 feet per week. However, that rate should be adjusted based on monitoring of the settlement and dissipation of pore pressure. Settlement monitoring can be performed using settlement plates or other appropriate surveying methods. Dissipation of excess pore pressure can be monitored by installation of vibrating wire (VW) piezometers.

Prior to fill placement, global stability analyses should be performed to simulate the stages of fill placement and the consequent gain in soil strength. The rate of fill placement should not result in a safety factor against slope failure that is below acceptable levels. These analyses should incorporate the type of fill material type, strength parameters and side slope configuration.

If a pile-supported retaining wall system is to be utilized, it is recommended that the piles be driven after the fill is completely placed and the fill-induced settlement is practically complete. If the piles are to be driven before fill placement or before completion of the fill-induced settlement, then the edge (toe) of the fill should be maintained a minimum distance from the nearest pile (1/2 of the pile length), otherwise, downdrag effects and settlement should be considered when calculating the pile capacities.

Subgrade Protection

The subgrade soils are very silty and therefore easily disturbed, especially in saturated conditions. For this reason, it is recommended that proper drainage of the construction areas be maintained to protect the prepared subgrade from the detrimental effects of weather conditions during construction. Finished subgrades and excavations should be kept free of standing water at all times, and equipment traffic prohibited.



printed on recycled paper

We are pleased to be of service. Please contact us if you have any questions or if we may be of further service.

Very truly yours,

**GEOTECHNOLOGY, INC.**

Ashraf Elsayed, Ph.D., P.E.
Branch Manager – Memphis Branch

ASE/JKH/JAB

Copies submitted: (1) WORD copy
(1) PDF copy



printed on recycled paper

# SUBSURFACE EXPLORATION REPORT
# FITE ROAD RETAINING WALL #1
# MEMPHIS, TENNESSEE

*Prepared for:*

**FISHER & ARNOLD**
Memphis, Tennessee

*Prepared by:*

**GEOTECHNOLOGY, INC.**
Memphis, Tennessee

Geotechnology Report No. J019679.01

February 11, 2012

GEOTECHNOLOGY INC
FROM THE GROUND UP

February 11, 2012

J019679.01

Mr. John Pankey, P.E.
Fisher & Arnold
9180 Crestwyn Hills Drive
Memphis, Tennessee 38125

Re: Project No. : STP-M-7900(29)
Geotechnical Engineering Section No. : N/A
County : Shelby Region : IV Date Drilled : 1/12
Roadway Description : Retaining Wall- Fite Road
Structure : Retaining Structure No. 1 from Station 77+72.19 to Station 80+80.00

Dear Mr. Pankey:

Presented herein are findings from our exploration of the subsurface conditions at the subject location. The services documented in this report were provided in accordance with the terms, conditions and scope of services described in the Geotechnology, Inc. September 28, 2011 proposal.

## SCOPE OF SERVICES

The recommendations given in this report are intended for the design of the proposed retaining wall at the above referenced location. These recommendations are professional opinions based on a subsurface exploration conducted at the location of the planned retaining wall. The exploration included drilling of test borings in the general area of the retaining wall. Enclosed are the boring logs and laboratory test results. The report complies with the current geotechnical requirements set forth in the Tennessee Department of Transportation (TDOT) Earth Retaining Structures Manual.

## INTENT AND DESCRIPTION OF THE STRUCTURE

The purpose of Wall No. 1 is to retain the proposed fill from Station 77+72.19 to Station 80+80.00. The structure is necessary due to the proposed relocation of Fite Road. The retaining wall alignment will be between 100 feet left and 150 feet to the right of the centerline. The wall height will vary from approximately 8 feet to 23 feet.

## SOIL PROFILE

Two borings (R-1 and R-2) were drilled to depths ranging from approximately 30 to 40 feet to define the subsurface conditions along the proposed retaining wall alignment (See wall plan). The station and offset at the location of each boring are shown on each boring log.

Layers of soft to stiff, silty clay (CL), clayey silt (ML) and clay (CL) were encountered in the upper 28 to 38 feet. At Boring R-2, these materials were underlain by medium dense silty sand (SM) to the depth of termination (40 feet). Groundwater was encountered in the borings at depths of 13 and 18, respectively. It is noted that due to the proximity of the wall to an existing stream, fluctuations in water elevations can be expected.

## ENGINEERING ANALYSIS

### LIQUEFACTION ANALYSIS

The potential for liquefaction and dynamic settlement along the wall alignment was evaluated. Both field and laboratory data were used to perform the analysis. The field measurements include SPT "N" values, which were obtained typically at 5-foot depth intervals in each boring, and the depth of the water table. The laboratory data include USCS soil classification, soil unit weight, and percent fines of soil samples obtained from various strata. An earthquake magnitude ($M_w$) of 7.5 (probability of exceedance of 7% in 75 years, or 1,000-year return interval) was considered in accordance with the latest requirements for seismic design of highway bridges[1]. A corresponding peak ground acceleration of 0.523g, as determined by published information from the USGS[2], was used in the analysis. Subsurface conditions (as characterized by the field and laboratory data) and earthquake characteristics were used to determine the factors of safety against liquefaction in each soil layer, as well as the associated dynamic settlement during the design seismic event. Based on the analysis, no potentially liquefiable soils are present in the analyzed boring. However, potentially liquefiable soils were found while evaluating the conditions for Wall # 2. Therefore this hazard should be further evaluated while conducting the wall design.

### GLOBAL STABILITY

A preliminary analysis was performed to evaluate the global stability of the wall. The preliminary analysis was based on the subsurface conditions as encountered in the borings, the wall height as previously stated in this report, and standard assumptions regarding the wall

---

[1] American Association of State Highway and Transportation Officials LRFD Bridge Design Specifications, 4th Edition, 2007

[2] Earthquake Hazards Program Ground Motion Parameter Calculator- United States Geological Survey

dimensions. The preliminary analysis indicated inadequate safety factors for both non-seismic and seismic conditions. Therefore, global stability of the wall should be thoroughly evaluated once the wall design is complete, and the wall type and configurations are determined.

### SETTLEMENT DUE TO FILL PLACEMENT

Fill material will be placed to construct the embankment. The maximum depth of the controlled fill placement will vary, but will approach 40 feet in some areas. Soft to medium stiff soils with relatively low shear strengths were encountered to depths ranging from 28 to 30 feet. The weight of the fill will induce settlement, mainly due to the compression of the soft, silty soils. The estimated fill-induced settlement is approximately 12 inches near the planned wall location. Refer to subsequent sections for settlement mitigation recommendations.

## RECOMMENDATIONS

### RECOMMENDED WALL TYPES

The different types of earth retaining structures listed below are considered suitable for the site:

- Gravity Wall
- Cast-in-Place Reinforced Concrete Wall
- MSE Wall
- Gabion Wall
- Cast-in-Place Concrete Cantilever Gravity Wall
- Sheet Pile Wall

### EXCAVATION AND BACKFILL

Temporary construction slopes should have a maximum allowable slope of 1V:1H. The contractor shall ensure that these temporary back slopes are not and do not become unstable. If a slope is unstable, becomes unstable, or is unacceptable for other reasons, then temporary shoring shall be used. All walls must follow the design guidelines established in the TDOT Earth Retaining Structures Manual (available version at the time of letting).

The 1V:1H temporary construction slope should be backfilled with select backfill as specified later in this report. Refer to the Select Backfill Material table presented in the subsequent section for engineering properties. The engineer shall approve potential backfill materials before use. The backfill should extend vertically to the full height of the wall.

The backfill is to be placed in accordance with TDOT's *Standard Specifications for Road and Bridge Construction* (March 1, 2006). Prior to fill placement, the foundation soil and areas receiving fill shall be observed by the engineer. Any soft zones or unsuitable materials shall be removed and the resulting excavation backfilled with approved fill materials.

RECOMMENDED SOIL PARAMETERS

Recommended soil parameters to be used in the design are provided in the following table.

| SELECT BACKFILL | | | | | | |
|---|---|---|---|---|---|---|
| Material | Undrained Condition (Short Term) | | | Drained Condition (Long Term) | | |
| | $\phi$(°) | Cohesion (psf) | Density (pcf) | $\phi$(°) | Cohesion (psf) | Density (pcf) |
| Coarse-grained (select) Backfill | 34 | 0 | - | 34 | 0 | - |
| Fine-grained Backfill | 0 | 1000 | 120 | 28 | 0 | 120 |

The sliding coefficient values shall be as follows:

| | |
|---|---|
| Fine-grained material: | 0.35 |
| Select granular material: | 0.50 |

The select fill shall conform to the specifications outlined in Item 4.5 of Section F, Chapter 3 of the TDOT Earth Retaining Structures Manual (available version at the time of letting). It should also be reasonably free (maximum of 0.1%) from organic and otherwise deleterious materials. To utilize the angle of internal friction ($\phi$) of the select backfill, the backfill must extend behind the wall for a minimum zone formed by a 1V:1H slope behind the back edge of footing or reinforced zone. The unit weight of the select backfill is to be determined by the contractor/wall designer depending upon the actual backfill material used.

FACTORS OF SAFETY

The following safety factors should be incorporated the wall design.

| Mode of Failure | Minimum Safety Factors | |
|---|---|---|
| | Non-Seismic Condition | Seismic Condition |
| Sliding | 1.5 | 1.2 |
| Overturning | 2.0 | 1.5 |
| Bearing Capacity | 2.5 For MSE Walls | 1.9 |
| | 3.0 For All Other Types | 2.3 |

BEARING CAPACITY RECOMMENDATIONS

The maximum allowable bearing pressure is as follows:

Length of Wall = 1200 psf
(based on ultimate bearing pressure of 3700 psf and a Factor of Safety of 3.0)

It is recommended that the geotechnical engineer be present to observe the excavation of the footings for the retaining structures. If the observed bearing conditions are not sufficient to support the wall, soil improvement will be necessary.

SETTLEMENT MITIGATION

A relatively large magnitude of settlement is expected. This can be mitigated by either staging the fill placement or by using soil reinforcement. Staging the fill consists of placing the fill at a controlled rate to allow the in situ soils to gain strength and stiffness. Settlement should be monitored using settlement plates or other appropriate means. Construction of the roadway can only commence after the settlement due to fill placement is complete.

Soil improvement by other means, such as stone columns or rammed aggregate piers, can be utilized to mitigate settlement. Such systems are proprietary and are typically provided on a design/build basis.

BEARING CAPACITY IMPROVEMENT

The allowable bearing capacity can be increased by means of soil reinforcement techniques, such as stone columns or rammed aggregate piers. Such systems can increase bearing capacity to 4000 or 4500 psf.

MITIGATION OF GLOBAL STABILITY

The preliminary analysis indicated insufficient factors of safety against global stability failure. Mitigation can be accomplished by utilizing a soil reinforcement technique, using a sheet pile wall system or by placing the fill at a controlled rate (staged construction) to increase the strength of the foundation soils. If this approach is utilized, additional global stability analyses should be performed to evaluate the stability at each stage.

SPECIFIC DESIGN REQUIREMENTS

The wall shall have a drainage gutter at the top designed to carry surface runoff to either or both ends of the walls. Actual details are to be provided in the contractor's wall design plans. If a concrete cantilever wall is used, the wall designer must provide for a drainage layer behind the wall stem with adequate drainage provided via weep holes.

SPECIAL NOTE REGARDING RETAINING WALL

Unless specifically stated otherwise in the contract plans, the bidding for, the design of and the construction of retaining walls shown in the plans shall be governed by the TDOT Earth Retaining Structures Manual (available version at the time of letting). This manual is available on the TDOT web site under the Information for Contractors link. The TDOT manual shall be considered as one of those documents which the bidder/contractor has examined and made himself familiar with as described in Section 102.04 – Examination of the Site, the Work, the Plans, and the Specifications in the TDOT Standard Specifications for Road and Bridge Construction.

We are pleased to be of service. Please contact us if you have any questions or if we may be of further service.

Very truly yours,

**GEOTECHNOLOGY, INC.**

ASHRAF ELSAYED
REGISTERED ENGINEER
AGRICULTURE
No. 106521
STATE OF TENNESSEE

Ashraf Elsayed, Ph.D., P.E.
Branch Manager, Memphis Branch

ASE/JKH

Copies submitted: (3) Hard copies
(1) PDF copy



printed on recycled paper

Surface Elevation: 233.87

Datum MSL

Completion Date: 1/9/12

Station 80+56.69

Offset: -137.81

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586): ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL ⊢ ● ⊣ LL (10, 20, 30, 40, 50)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Soft to medium stiff, mottled brown and gray, silty CLAY- CL trace roots | 1-2-3 | SS1 |
| 5 | | 2-3-3 | SS2 |
| | | 91 | ST3 |
| | brown-orange and gray | 2-2-2 | SS4 |
| 10 | Medium stiff, brown and gray, clayey SILT (ML) | 93 | ST5 |
| 15 | Medium stiff, mottled brown and gray, silty CLAY - CL | 2-2-3 | SS6 |
| 20 | Medium stiff, gray CLAY- CL | 2-2-4 | SS7 |
| 25 | | 2-2-3 | SS8 |
| 30 | Medium dense, gray, silty SAND- SM | 7-9-11 | SS9 |
| 35 | | 7-12-18 | SS10 |
| 40 | | 8-8-12 | SS11 |
| | Boring terminated at 40 feet. | | |
| 45 | | | |
| 50 | | | |
| 55 | | | |
| 60 | | | |

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

ENCOUNTERED AT 13 FEET ▽

**DRILLING DATA**

__ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/10/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-1**

**Project No. J019679.01**

Surface Elevation: 235.31

Datum MSL

Completion Date: 1/9/12

Station: 78+57.36

Offset: -109.39

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Soft to medium stiff, brown, silty CLAY- CL | 2-2-2 | SS1 |
| | | 2-2-2 | SS2 |
| 5 | light brown and gray | 2-2-3 | SS3 |
| 10 | | 2-2-3 | SS4 |
| 15 | orange-brown and gray | 2-2-2 | SS5 |
| | Soft to stiff, gray CLAY- CL | 2-2-3 | SS6 |
| 20 | | | |
| 25 | | 2-2-2 | SS7 |
| 30 | Boring terminated at 30 feet. | 3-4-6 | SS8 |
| 35 | | | |
| 40 | | | |
| 45 | | | |
| 50 | | | |
| 55 | | | |
| 60 | | | |

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

ENCOUNTERED AT 18 FEET ▽

**DRILLING DATA**

___ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/10/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-2**

**Project No. J019679.01**

# BORING LOG: TERMS AND SYMBOLS

## GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

## ABBREVIATIONS

| | |
|---|---|
| UU/2 | *Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)* |
| QU/2 | *Shear Strength from Unconfined Compression Test (ASTM D2166)* |
| SV | *Shear Strength from Field Vane (ASTM D2573)* |
| PL | *Plastic Limit (ASTM D4318)* |
| LL | *Liquid Limit (ASTM D4318)* |

## LEGEND

| | |
|---|---|
| CS | Continuous Sampler |
| GB | Grab Sample Taken From Auger Cuttings Or Wash Water Return |
| NX 100/42 | NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column |
| PST | Three Inch Diameter Piston Tube Sample |
| SS | Split Spoon Sample (Standard Penetration Test) |
| ST | Three Inch Diameter Shelby Tube Sample |
| * | Sample Not Recovered |
| SV | Field Vane Test |

## SPLIT – BARREL SAMPLER DRIVING RECORD

| *Blow Per Foot (N-Value)* | *Description* |
|---|---|
| *25* | *25 blows drove sampler 12 inches after initial 6 inches of seating.* |
| *75/10"* | *75 blows drove sampler 10 inches after initial 6 inches of seating.* |
| *50/S3"* | *50 blows drove sampler 3 inches during initial 6 inch seating interval.* |

*NOTES:* 1. *To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. *N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.*

## RELATIVE COMPOSITION

*Trace.....0-10 %*
*With/Some.....11-35 %*
*Soil modifier such..... > 35 %*
*As silty, clayey, sandy, etc.*

## DENSITY OF GRANULAR SOILS

| ***Descriptive Term:*** | ***N—Value*** |
|---|---|
| *Very Loose* | *0 - 4* |
| *Loose* | *5 - 10* |
| *Medium Dense* | *11 - 30* |
| *Dense* | *31 - 50* |
| *Very Dense* | *> 50* |

## STRENGTH OF COHESIVE SOILS

| **Consistency** | **Undrained Shear Strength Tons Per Sq. Ft.** | **Field Test** | **Approximate N-Value Range** |
|---|---|---|---|
| *Very Soft* | *less than 0.12* | *Thumb will penetrate soil more than 1"* | *0 - 1* |
| *Soft* | *13 to 0.25* | *Thumb will penetrate soil about 1"* | *2 - 4* |
| *Medium Stiff* | *0.26 to 0.50* | *Thumb will penetrate soil about ¼"* | *5 – 8* |
| *Stiff* | *0.51 to 1.00* | *Thumb hardly indents soil* | *9 – 15* |
| *Very Stiff* | *1.01 to 2.00* | *Thumb will not indent soil, but readily indented with thumbnail* | *16 – 30* |
| *Hard* | *greater than 2.00* | *Thumbnail will not indent soil* | *> 30* |

## SOIL GRAIN SIZE

U.S. STANDARD SIEVE

| 12" | 3" | ¾" | 4 | 10 | 40 | 200 |
|---|---|---|---|---|---|---|

| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

| 300 | 76.2 | 19.1 | 4.76 | 2.00 | 0.42 | 0.074 | 0.002 |
|---|---|---|---|---|---|---|---|

SOIL GRAIN SIZE IN MILLIMETERS

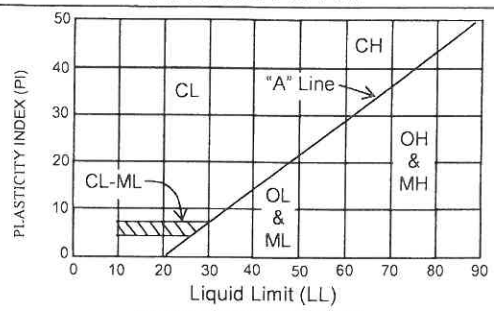
## SOIL STRUCTURE

***Calcareous*** *– Having appreciable quantities of carbonate.*
***Fissured*** *– Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*
***Slickensided*** *– Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*
***Layer*** *-- Inclusion greater than 3 inches thick.*
***Seam*** *– Inclusion 1/8 inch to 3 inches thick extending through the sample*
***Parting*** *– Inclusion less than 1/8 inch thick.*
***Pocket*** *– Inclusion of material of different texture that is smaller than the diameter of the sample.*
***Interlayered*** *– Soil samples composed of alternating layers of different soil types.*
***Intermixed*** *– Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*
***Laminated*** *– Soil sample composed of alternating partings or seams of different soil type.*

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | SYMBOL | DESCRIPTION |
|---|---|---|---|---|
| Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size) | Gravel and Gravelly Soils | Clean Gravels Little or no Fines | GW | Well-Graded Gravel, Gravel-Sand Mixture |
| | | | GP | Poorly –Graded Gravel, Gravel-Sand Mixture |
| | | Gravels with Appreciable Fines | GM | Silty Gravel, Gravel-Sand-Silt Mixture |
| | | | GC | Clayey-Gravel, Gravel-Sand-Clay Mixture |
| | Sand and Sandy Soils | Clean Sands Little or no Fines | SW | Well-Graded Sand, Gravelly Sand |
| | | | SP | Poorly Graded Sand, Gravelly Sand |
| | | Sands with Appreciable Fines | SM | Silty Sand, Sand-Silt Mixture |
| | | | SC | Clayey Sand, Sand-Clay Mixture |
| Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size) | Silts and Clays | Liquid Limit Less Than 50 | ML | Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity |
| | | | CL | Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity |
| | | | OL | Organic Silts, or Silty Clays of Low Plasticity |
| | Silts and Clays | Liquid Limit More Than 50 | MH | Silt, Fine Sandy or Silt Soil with High Plasticity |
| | | | CH | Clay, High Plasticity |
| | | | OH | Organic Clay of Medium to High Plasticity |
| | Highly Organic Soils | | PT | Peat, Humus, Swamp Soil |

PLASTICITY CHART




RELATIVE PLASTICITY

| | |
|---|---|
| Nonplastic | Cannot Roll Into Ball |
| Trace Plasticity | Barely Roll Into Ball |
| Medium Plastic | Can be Rolled Into Ball |
| Highly Plastic | No Rupture by Kneading |

# VISUAL DESCRIPTION CRITERIA*

*TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES*

| Description | Criteria |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | Particles are similar to angular description but have rounded edges |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | Particles have smoothly curved sides and no edges |

*TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE*

| Description | Criteria |
|---|---|
| Flat | Particles with width/thickness X3 |
| Elongated | Particles with length/width X3 |
| Flat and Elongated | Particles meet criteria for both flat and elongated |

*TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION*

| Description | Criteria |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp, but no visible water |
| Wet | Visible free water, usually soil is below the water table |

*TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL*

| Description | Criteria |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming rapidly |

*TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION*

| Description | Criteria |
|---|---|
| Weak | Crumbles or breaks with handling or little finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

*TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH*

| Description | Criteria |
|---|---|
| None | The dry specimen crumbles into powder with mere pressure of handling |
| Low | The dry specimen crumbles into powder with some finger pressure |
| Medium | The dry specimen breaks into pieces or crumbles with considerable finger pressure |
| High | The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface. |
| Very High | The dry specimen cannot be broken between the thumb and a hard surface |

*TABLE 9: CRITERIA FOR DESCRIBING DILATANCY*

| Description | Criteria |
|---|---|
| None | No visible change in the specimen |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing. |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing. |

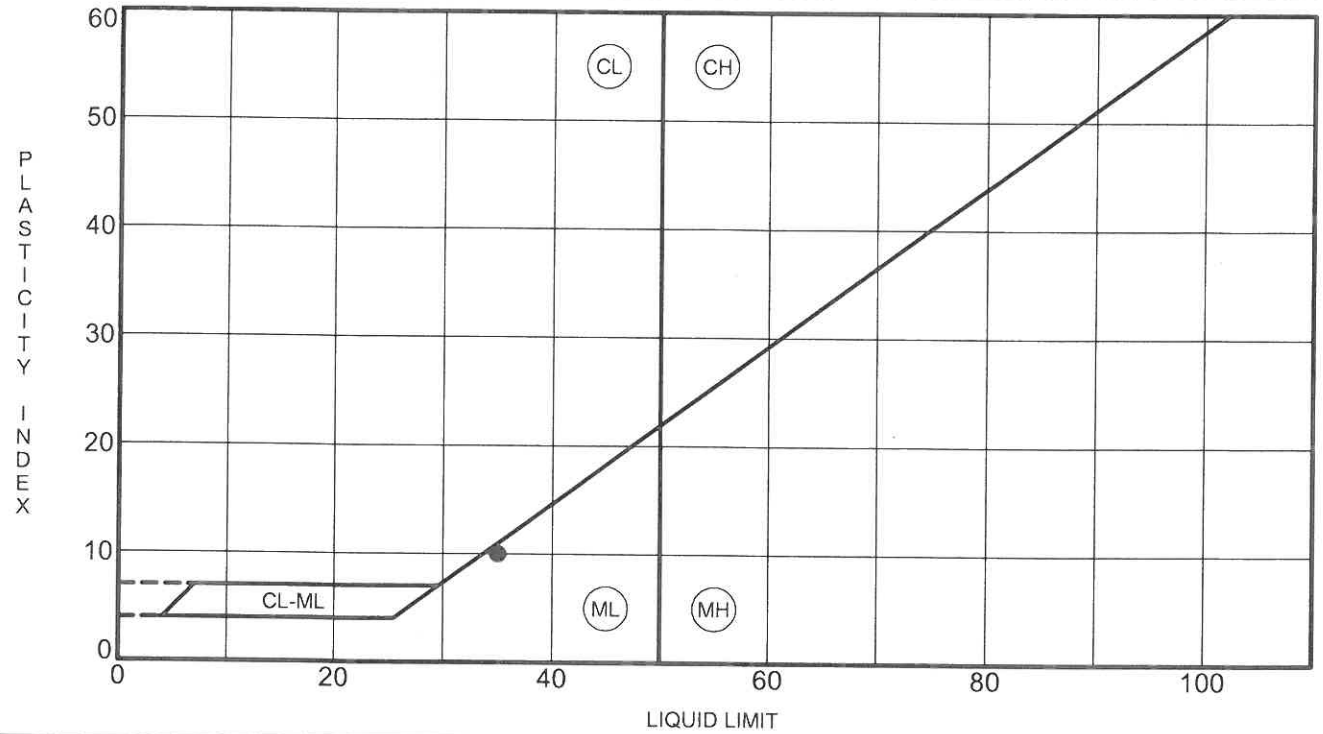
*TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS*

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft. |
| Medium | Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness |
| High | Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness |

*TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS*

| Soil Symbol | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|
| ML | None to low | Slow to rapid | Low or thread cannot be formed |
| CL | Medium to high | None to slow | Medium |
| MH | Low to medium | None to slow | Low to medium |
| CH | High to very high | none | High |

*NOTES: 1. Tables adapted from ASTM D2488 "Description and identification of Soils" (Visual-Manual Procedure)
2. Tables 5, 7 and 11 incorporated into other information on this plate.



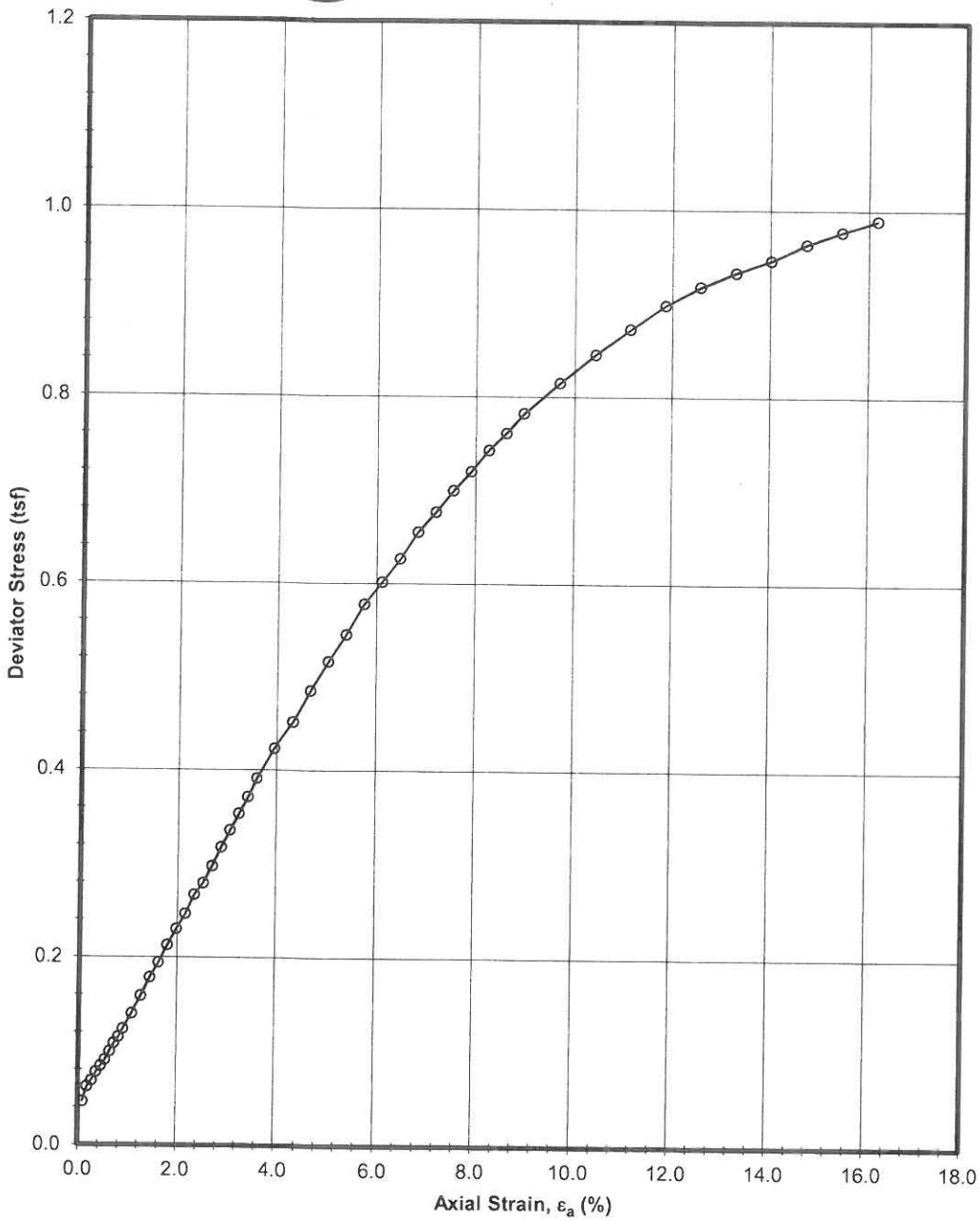

| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | **R-1** | **10.0** | **35** | **25** | **10** | | **SILT (ML)** |

GEOTECHNOLOGY INC
FROM THE GROUND UP

# ATTERBERG LIMITS RESULTS

**Fite Road Retaining Wall**
**Fisher & Arnold**
**J019679.01**

GEOTECHNOLOGY INC
FROM THE GROUND UP




**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**

ASTM D 2850

Project No.: J019679.01

Boring: R-1

Sample: ST-5 - Depth: 10 ft.

# SUBSURFACE EXPLORATION REPORT
# FITE ROAD RETAINING WALL #2
# MEMPHIS, TENNESSEE

*Prepared for:*

**FISHER & ARNOLD**
Memphis, Tennessee

*Prepared by:*

**GEOTECHNOLOGY, INC.**
Memphis, Tennessee

Geotechnology Report No. J019679.01

February 10, 2012

GEOTECHNOLOGY INC
FROM THE GROUND UP

February 10, 2012

J019679.01

Mr. John Pankey, P.E.
Fisher & Arnold
9180 Crestwyn Hills Drive
Memphis, Tennessee 38125

Re: Project No. : STP-M-7900(29)
Geotechnical Engineering Section No. : N/A
County : Shelby Region : IV Date Drilled : 1/12
Roadway Description : Retaining Wall- Fite Road
Structure : Retaining Structure No. 2 from Station 77+72.19 to Station 87+25 (Wall Station 10+00 to 20+09.44)

Dear Mr. Pankey:

Presented herein are findings from our exploration of the subsurface conditions at the subject location. The services documented in this report were provided in accordance with the terms, conditions and scope of services described in the Geotechnology, Inc, September 28, 2011 proposal.

## SCOPE OF SERVICES

The recommendations given in this report are intended for the design of the proposed retaining wall at the above referenced location. These recommendations are professional opinions based on a subsurface exploration conducted at the location of the planned retaining wall. The exploration included drilling of test borings in the general area of the retaining wall. Enclosed are the boring logs and laboratory test results. The report complies with the current geotechnical requirements set forth in the Tennessee Department of Transportation (TDOT) Earth Retaining Structures Manual.

## INTENT AND DESCRIPTION OF THE STRUCTURE

The purpose of Wall No. 2 is to retain the proposed fill from Station 77+73.15 to Station 87+85 (Wall Station 10+00 to 20+09.44). The structure is necessary due to the proposed relocation of Fite Road. The retaining wall alignment will be between 34 and 146 feet to the right of the centerline. The wall height will vary from approximately 7 feet to 35 feet.

## SOIL PROFILE

Five borings (R-3 through R-7) were drilled to depths ranging from approximately 30 to 60 feet to define the subsurface conditions along the proposed retaining wall alignment (See wall plan). The station and offset at the location of each boring are shown on each boring log.

Layers of soft to stiff, silty clay (CL), clayey silt (ML), clay (CL), fat clay (CH), and sandy silt (ML) were encountered in the upper 28 to 38 feet of each boring. These materials were underlain by loose to medium dense silty sand (SM) to the depth of termination (60 feet). Groundwater was encountered in Borings R-3 and R-7 at depths of 30 and 34. It is noted that due to the proximity of the wall to an existing stream, fluctuations in water elevations can be expected.

## ENGINEERING ANALYSIS

### LIQUEFACTION ANALYSIS

The potential for liquefaction and dynamic settlement along the wall alignment was evaluated. Both field and laboratory data were used to perform the analysis. The field measurements include SPT "N" values, which were obtained typically at 5-foot depth intervals in each boring, and the depth of the water table. The laboratory data include USCS soil classification, soil unit weight, and percent fines of soil samples obtained from various strata. An earthquake magnitude ($M_w$) of 7.5 (probability of exceedance of 7% in 75 years, or 1,000-year return interval) was considered in accordance with the latest requirements for seismic design of highway bridges[1]. A corresponding peak ground acceleration of 0.523g, as determined by published information from the USGS[2], was used in the analysis. Subsurface conditions (as characterized by the field and laboratory data) and earthquake characteristics were used to determine the factors of safety against liquefaction in each soil layer, as well as the associated dynamic settlement during the design seismic event. Based on the analysis, potentially liquefiable soils are present at depths of 38 to 43 feet. The estimated dynamic settlement is approximately 1 inch. Please note that the estimated settlements are independent of the settlement resulting from sustained structural loads.

### GLOBAL STABILITY

A preliminary analysis was performed to evaluate the global stability of the wall. The preliminary analysis was based on the subsurface conditions as encountered in the borings, the wall height as previously stated in this report, and standard assumptions regarding the wall

---

[1] American Association of State Highway and Transportation Officials LRFD Bridge Design Specifications, 4th Edition, 2007

[2] Earthquake Hazards Program Ground Motion Parameter Calculator- United States Geological Survey

dimensions. The preliminary analysis indicated inadequate safety factors for both non-seismic and seismic conditions. Therefore, global stability of the wall should be thoroughly evaluated once the wall design is complete, and the wall type and configurations are determined.

### SETTLEMENT DUE TO FILL PLACEMENT

Fill material will be placed to construct the embankment. The maximum depth of the controlled fill placement will vary, but will approach 40 feet in some areas. Soft to medium stiff soils with relatively low shear strengths were encountered to depths ranging from 28 to 30 feet. The weight of the fill will induce settlement, mainly due to the compression of the soft, silty soils. The estimated fill-induced settlement is approximately 12 inches near the planned wall location. Refer to subsequent sections for settlement mitigation recommendations.

## RECOMMENDATIONS

### RECOMMENDED WALL TYPES

The different types of earth retaining structures listed below are considered suitable for the site:

- Gravity Wall
- Cast-in-Place Reinforced Concrete Wall
- MSE Wall
- Gabion Wall
- Cast-in-Place Concrete Cantilever Gravity Wall
- Sheet Pile Wall

### EXCAVATION AND BACKFILL

Temporary construction slopes should have a maximum allowable slope of 1V:1H. The contractor shall ensure that these temporary back slopes are not and do not become unstable. If a slope is unstable, becomes unstable, or is unacceptable for other reasons, then temporary shoring shall be used. All walls must follow the design guidelines established in the TDOT Earth Retaining Structures Manual (available version at the time of letting).

The 1V:1H temporary construction slope should be backfilled with select backfill as specified later in this report. Refer to the Select Backfill Material table presented in the subsequent section for engineering properties. The engineer shall approve potential backfill materials before use. The backfill should extend vertically to the full height of the wall.

The backfill is to be placed in accordance with TDOT's *Standard Specifications for Road and Bridge Construction* (March 1, 2006). Prior to fill placement, the foundation soil and areas receiving fill shall be observed by the engineer. Any soft zones or unsuitable materials shall be removed and the resulting excavation backfilled with approved fill materials.

## RECOMMENDED SOIL PARAMETERS

Recommended soil parameters to be used in the design are provided in the following table.

| SELECT BACKFILL | | | | | | |
|---|---|---|---|---|---|---|
| Material | Undrained Condition (Short Term) | | | Drained Condition (Long Term) | | |
| | $\phi$(°) | Cohesion (psf) | Density (pcf) | $\phi$(°) | Cohesion (psf) | Density (pcf) |
| Coarse-grained (select) Backfill | 34 | 0 | - | 34 | 0 | - |
| Fine-grained Backfill | 0 | 1000 | 120 | 28 | 0 | 120 |

The sliding coefficient values shall be as follows:

| | |
|---|---|
| Fine-grained material: | 0.35 |
| Select granular material: | 0.50 |

The select fill shall conform to the specifications outlined in Item 4.5 of Section F, Chapter 3 of the TDOT Earth Retaining Structures Manual (available version at the time of letting). It should also be reasonably free (maximum of 0.1%) from organic and otherwise deleterious materials. To utilize the angle of internal friction ($\phi$) of the select backfill, the backfill must extend behind the wall for a minimum zone formed by a 1V:1H slope behind the back edge of footing or reinforced zone. The unit weight of the select backfill is to be determined by the contractor/wall designer depending upon the actual backfill material used.

## FACTORS OF SAFETY

The following safety factors should be incorporated the wall design.

| Mode of Failure | Minimum Safety Factors | |
|---|---|---|
| | Non-Seismic Condition | Seismic Condition |
| Sliding | 1.5 | 1.2 |
| Overturning | 2.0 | 1.5 |
| Bearing Capacity | 2.5 For MSE Walls | 1.9 |
| | 3.0 For All Other Types | 2.3 |

BEARING CAPACITY RECOMMENDATIONS

The maximum allowable bearing pressure is as follows:

Length of Wall = 1300 psf
(based on ultimate bearing pressure of 4000 psf and a Factor of Safety of 3.0)

It is recommended that the geotechnical engineer be present to observe the excavation of the footings for the retaining structures. If the observed bearing conditions are not sufficient to support the wall, soil improvement will be necessary.

SETTLEMENT MITIGATION

A relatively large magnitude of settlement is expected. This can be mitigated by either staging the fill placement or by using soil reinforcement. Staging the fill consists of placing the fill at a controlled rate to allow the in situ soils to gain strength and stiffness. Settlement should be monitored using settlement plates or other appropriate means. Construction of the roadway can only commence after the settlement due to fill placement is complete.

Soil improvement by other means, such as stone columns or rammed aggregate piers, can be utilized to mitigate settlement. Such systems are proprietary and are typically provided on a design/build basis.

BEARING CAPACITY IMPROVEMENT

The allowable bearing capacity can be increased by means of soil reinforcement techniques, such as stone columns or rammed aggregate piers. Such systems can increase bearing capacity to 4000 or 4500 psf.

LIQUEFACTION MITIGATION

Additional liquefaction analysis should be performed based on the actual fill placement and the final wall configurations. Liquefaction hazard mitigation can be achieved by several ground improvement methods such as densification and reinforcement techniques (compaction grouting, stone columns, vibration methods, or compaction piles), grouting and mixing techniques (such as permeation grouting, jet grouting, or soil mixing), or drainage techniques (not recommended). Placement of fill as planned can also mitigate liquefaction. Mitigation can also be accomplished by driving large displacement piles (precast concrete piles or pipe piles driven closed-ended). If liquefaction hazard mitigation is to be considered, Geotechnology should be contacted for further recommendations.

MITIGATION OF GLOBAL STABILITY

The preliminary analysis indicated insufficient factors of safety against global stability failure. Mitigation can be accomplished by utilizing a soil reinforcement technique, using a sheet pile wall system or by placing the fill at a controlled rate (staged construction) to increase the strength of the foundation soils. If this approach is utilized, additional global stability analyses should be performed to evaluate the stability at each stage.

SPECIFIC DESIGN REQUIREMENTS

The wall shall have a drainage gutter at the top designed to carry surface runoff to either or both ends of the walls. Actual details are to be provided in the contractor's wall design plans. If a concrete cantilever wall is used, the wall designer must provide for a drainage layer behind the wall stem with adequate drainage provided via weep holes.

SPECIAL NOTE REGARDING RETAINING WALL

Unless specifically stated otherwise in the contract plans, the bidding for, the design of and the construction of retaining walls shown in the plans shall be governed by the TDOT Earth Retaining Structures Manual (available version at the time of letting). This manual is available on the TDOT web site under the Information for Contractors link. The TDOT manual shall be considered as one of those documents which the bidder/contractor has examined and made himself familiar with as described in Section 102.04 – Examination of the Site, the Work, the Plans, and the Specifications in the TDOT Standard Specifications for Road and Bridge Construction.

We are pleased to be of service. Please contact us if you have any questions or if we may be of further service.

Very truly yours,

**GEOTECHNOLOGY, INC.**

Ashraf Elsayed, Ph.D., P.E.
Branch Manager – Memphis Branch

ASE/JKH/AAB

Copies submitted: (3) Hard copies
(1) PDF copy

Surface Elevation: 232.44

Datum MSL

Completion Date: 1/9/12

Station 78+19.79

Offset: 109.69

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Medium stiff, brown and gray CLAY (CL) | 3-4-4 | SS1 |
| 5 | | 100 | ST2 |
| | Medium stiff, mottled brown and gray, silty CLAY - CL | 2-3-4 | SS3 |
| 10 | | 95 | ST4 |
| 15 | | 2-3-4 | SS5 |
| | Soft to medium stiff, orange-brown CLAY- CL | 2-2-3 | SS6 |
| 20 | | | |
| 25 | gray | 2-2-2 | SS7 |
| | Medium dense to dense, gray, SAND with SILT (SP-SM) ∇ | 3-6-5 | SS8 |
| 30 | | | |
| 35 | | 8-14-20 | SS9 |
| | Boring terminated at 35 feet. | | |
| 40 | | | |
| 45 | | | |
| 50 | | | |
| 55 | | | |
| 60 | | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

ENCOUNTERED AT 30 FEET ∇

**DRILLING DATA**

__ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM 30 FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/10/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-3**

**Project No. J019679.01**

Surface Elevation: 235.18

Datum MSL

Completion Date: 1/11/12

Station: 80+11.68

Offset: 110.87

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Soft to medium stiff, brown, silty CLAY- CL | | |
| | | 1-1-1 | SS1 |
| | | 1-2-2 | SS2 |
| 5 | brown and gray | | |
| | brown | 2-3-3 | SS3 |
| 10 | | 2-3-3 | SS4 |
| 15 | | 2-1-2 | SS5 |
| 20 | brown and gray | 3-2-4 | SS6 |
| | Soft, gray CLAY- CL | | |
| 25 | | 2-2-2 | SS7 |
| | Medium dense, orange-gray, silty SAND- SM | | |
| 30 | Boring terminated at 30 feet. | 8-9-16 | SS8 |
| 35 | | | |
| 40 | | | |
| 45 | | | |
| 50 | | | |
| 55 | | | |
| 60 | | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM 5 FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/12/12 | Date: | Date: |

GEOTECHNOLOGY INC

FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-4**

**Project No. J019679.01**

Surface Elevation: 234.09

Datum MSL

Completion Date: 1/10/12

Station: 82+33.65 Northing: 0

Offset: 51.75 Easting: 5

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Soft to medium stiff, brown and gray, silty CLAY (CL) | 2-1-1 | SS1 |
| | | 93 | ST2 |
| 5 | | 2-3-4 | ST3 |
| | | 1-2-2 | SS4 |
| 10 | | | |
| | | 2-3-3 | SS5 |
| 15 | | | |
| | Medium stiff, gray CLAY (CL) | 2-2-3 | SS6 |
| 20 | | 96 | ST7 |
| | | 1-2-2 | SS8 |
| 25 | | | |
| | | 2-3-3 | SS9 |
| 30 | | | |
| | Stiff, gray sandy SILT- ML | 6-4-10 | SS10 |
| 35 | | | |
| | Medium dense to dense, orange-gray to gray, SILTY SAND (SM) | 14-12-13 | SS11 |
| 40 | | | |
| | | 7-8-9 | SS12 |
| 45 | | | |
| | | 16-24-26 | SS13 |
| 50 | Boring terminated at 50 feet. | | |
| 55 | | | |
| 60 | | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ● LL

10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM 5 FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/12/12 | Date: | Date: |

GEOTECHNOLOGY INC

FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-5**

**Project No. J019679.01**

Surface Elevation: 234.09

Datum MSL

Completion Date: 1/10/12

Station 82+33.65

Offset: 51.75

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Soft to medium stiff, brown and gray, silty CLAY (CL) | 2-1-1 | SS1 |
| 5 | | 93 | ST2 |
| | | 2-3-4 | ST3 |
| 10 | | 1-2-2 | SS4 |
| 15 | | 2-3-3 | SS5 |
| 20 | Medium stiff, gray CLAY (CL) | 2-2-3 | SS6 |
| | | 96 | ST7 |
| 25 | | 1-2-2 | SS8 |
| 30 | | 2-3-3 | SS9 |
| 35 | Stiff, gray sandy SILT- ML | 6-4-10 | SS10 |
| 40 | Medium dense to dense, orange-gray to gray, SILTY SAND (SM) | 14-12-13 | SS11 |
| 45 | | 7-8-9 | SS12 |
| 50 | | 16-24-26 | SS13 |
| | Boring terminated at 50 feet. | | |
| 55 | | | |
| 60 | | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM 5 FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/12/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-5**

**Project No. J019679.01**

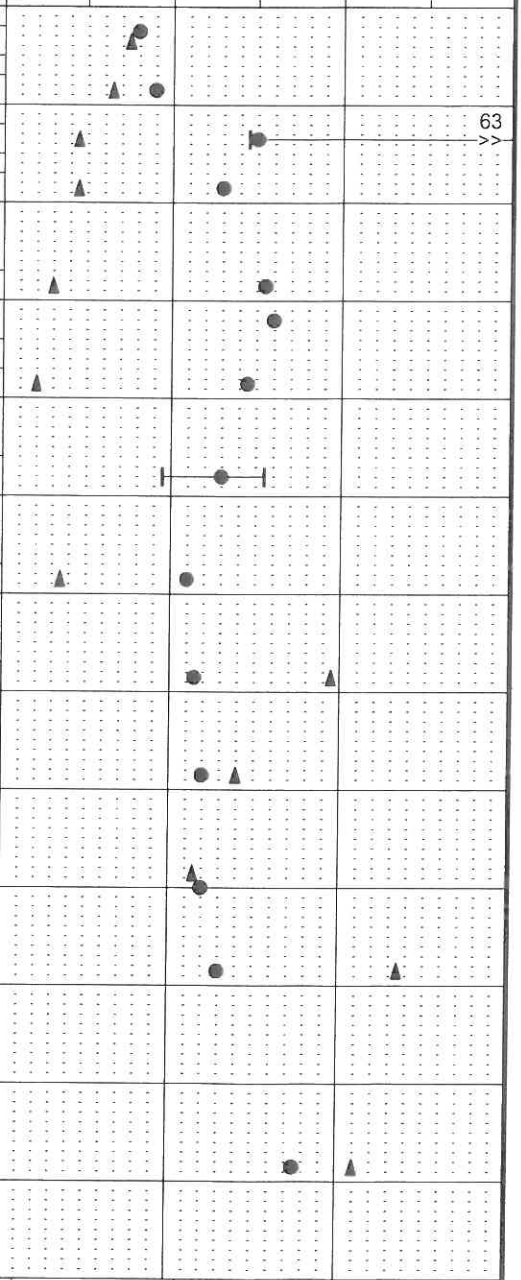
Surface Elevation: 235.27 | Completion Date: 1/11/12
Datum MSL | Station: 84+99.78 | Offset: 47.59

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586): ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL ⊢●⊣ LL (10, 20, 30, 40, 50)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | ASPHALT to 13 inches | | |
| | BASE MATERIAL TO 2 feet | 11-9-6 | SS1 |
| | Stiff, brown and gray, silty CLAY- CL | 2-6-7 | SS2 |
| 5 | | | |
| | Stiff, black-brown, FAT CLAY (CH) | 3-3-6 | SS3 |
| 10 | gray and black | 3-4-5 | SS4 |
| | Soft to stiff, brown-gray, silty CLAY (CL) | | |
| 15 | | 2-2-4 | SS5 |
| | | 92 | ST6 |
| 20 | | 2-2-2 | SS7 |
| 25 | | 99 | ST8 |
| 30 | Loose, gray, silty SAND- SM | 2-2-5 | SS9 |
| 35 | Medium dense to dense, orange and tan SAND with SILT-SP-SM | 11-16-23 | SS10 |
| 40 | gray and tan | 14-13-15 | SS11 |
| 45 | | 9-10-13 | SS12 |
| 50 | gray | 15-18-29 | SS13 |
| 55 | | | |
| 60 | Boring terminated at 60 feet. | 11-18-24 | SS14 |




NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 1/4" HOLLOW STEM
WASHBORING FROM 5 FEET
MH DRILLER JKH LOGGER
D50 DRILL RIG
HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/12/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-6**

**Project No. J019679.01**

Surface Elevation: 235.30

Datum MSL

Completion Date: 1/10/12

Station: 86+75.53

Offset: 34.58

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | ASPHALT to 1 foot | | |
| | FILL: Gray clayey SILT with gravel- ML | 20-17-10 | SS1 |
| | apparent chemical odor | | |
| 5 | apparent chemical odor | 8-4-2 | SS2 |
| | Soft to medium stiff, gray-brown, silty CLAY (CL) | 91 | ST3 |
| 10 | | 2-3-4 | SS4 |
| 15 | orange-gray | 2-1-2 | SS5 |
| 20 | | 3-3-3 | SS6 |
| | Soft to medium stiff, gray CLAY- CL | | |
| 25 | | 2-2-2 | SS7 |
| 30 | | 3-3-3 | SS8 |
| 35 | Loose, gray, silty SAND- SM | 1-4-5 | SS9 |
| | Boring terminated at 35 feet. | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

ENCOUNTERED AT 34 FEET ▽

**DRILLING DATA**

___ AUGER 3 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MH DRILLER JKH LOGGER

D50 DRILL RIG

HAMMER TYPE Auto

**REMARKS:**

| Drawn by: JKH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 1/12/12 | Date: | Date: |

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Fite Road Retaining Wall**
**Fisher & Arnold**

**LOG OF BORING: R-7**

**Project No. J019679.01**

# BORING LOG: TERMS AND SYMBOLS

## GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

## ABBREVIATIONS

| | |
|---|---|
| UU/2 | *Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)* |
| QU/2 | *Shear Strength from Unconfined Compression Test (ASTM D2166)* |
| SV | *Shear Strength from Field Vane (ASTM D2573)* |
| PL | *Plastic Limit (ASTM D4318)* |
| LL | *Liquid Limit (ASTM D4318)* |

## LEGEND

| | |
|---|---|
| CS | Continuous Sampler |
| GB | Grab Sample Taken From Auger Cuttings Or Wash Water Return |
| NX 100/42 | NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column |
| PST | Three Inch Diameter Piston Tube Sample |
| SS | Split Spoon Sample (Standard Penetration Test) |
| ST | Three Inch Diameter Shelby Tube Sample |
| * | Sample Not Recovered |
| SV | Field Vane Test |

## SPLIT – BARREL SAMPLER DRIVING RECORD

| *Blow Per Foot (N-Value)* | *Description* |
|---|---|
| *25* | *25 blows drove sampler 12 inches after initial 6 inches of seating.* |
| *75/10"* | *75 blows drove sampler 10 inches after initial 6 inches of seating.* |
| *50/S3"* | *50 blows drove sampler 3 inches during initial 6 inch seating interval.* |

*NOTES:* 1. *To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. *N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.*

## RELATIVE COMPOSITION

| | |
|---|---|
| *Trace* | *0-10 %* |
| *With/Some* | *11-35 %* |
| *Soil modifier such As silty, clayey, sandy, etc.* | *> 35 %* |

## DENSITY OF GRANULAR SOILS

| ***Descriptive Term:*** | ***N—Value*** |
|---|---|
| *Very Loose* | *0 - 4* |
| *Loose* | *5 - 10* |
| *Medium Dense* | *11 - 30* |
| *Dense* | *31 - 50* |
| *Very Dense* | *> 50* |

## STRENGTH OF COHESIVE SOILS

| **Consistency** | **Undrained Shear Strength Tons Per Sq. Ft.** | **Field Test** | **Approximate N-Value Range** |
|---|---|---|---|
| *Very Soft* | *less than 0.12* | *Thumb will penetrate soil more than 1"* | *0 - 1* |
| *Soft* | *13 to 0.25* | *Thumb will penetrate soil about 1"* | *2 - 4* |
| *Medium Stiff* | *0.26 to 0.50* | *Thumb will penetrate soil about ¼"* | *5 – 8* |
| *Stiff* | *0.51 to 1.00* | *Thumb hardly indents soil* | *9 – 15* |
| *Very Stiff* | *1.01 to 2.00* | *Thumb will not indent soil, but readily indented with thumbnail* | *16 – 30* |
| *Hard* | *greater than 2.00* | *Thumbnail will not indent soil* | *> 30* |

## SOIL GRAIN SIZE

U.S. STANDARD SIEVE

| | 12" | 3" | ¾" | 4 | 10 | 40 | 200 | |
|---|---|---|---|---|---|---|---|---|
| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |
| 300 | 76.2 | 19.1 | 4.76 | 2.00 | 0.42 | 0.074 | 0.002 | |

SOIL GRAIN SIZE IN MILLIMETERS

## SOIL STRUCTURE

***Calcareous*** – *Having appreciable quantities of carbonate.*

***Fissured*** – *Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*

***Slickensided*** – *Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*

***Layer*** -- *Inclusion greater than 3 inches thick.*

***Seam*** – *Inclusion 1/8 inch to 3 inches thick extending through the sample*

***Parting*** – *Inclusion less than 1/8 inch thick.*

***Pocket*** – *Inclusion of material of different texture that is smaller than the diameter of the sample.*

***Interlayered*** – *Soil samples composed of alternating layers of different soil types.*

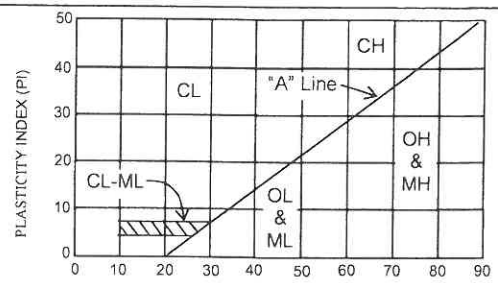
***Intermixed*** – *Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*

***Laminated*** – *Soil sample composed of alternating partings or seams of different soil type.*

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | SYMBOL | DESCRIPTION |
|---|---|---|---|---|
| Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size) | Gravel and Gravelly Soils | Clean Gravels Little or no Fines | GW | Well-Graded Gravel, Gravel-Sand Mixture |
| | | | GP | Poorly –Graded Gravel, Gravel-Sand Mixture |
| | | Gravels with Appreciable Fines | GM | Silty Gravel, Gravel-Sand-Silt Mixture |
| | | | GC | Clayey-Gravel, Gravel-Sand-Clay Mixture |
| | Sand and Sandy Soils | Clean Sands Little or no Fines | SW | Well-Graded Sand, Gravelly Sand |
| | | | SP | Poorly Graded Sand, Gravelly Sand |
| | | Sands with Appreciable Fines | SM | Silty Sand, Sand-Silt Mixture |
| | | | SC | Clayey Sand, Sand-Clay Mixture |
| Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size) | Silts and Clays | Liquid Limit Less Than 50 | ML | Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity |
| | | | CL | Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity |
| | | | OL | Organic Silts, or Silty Clays of Low Plasticity |
| | Silts and Clays | Liquid Limit More Than 50 | MH | Silt, Fine Sandy or Silt Soil with High Plasticity |
| | | | CH | Clay, High Plasticity |
| | | | OH | Organic Clay of Medium to High Plasticity |
| | Highly Organic Soils | | PT | Peat, Humus, Swamp Soil |

PLASTICITY CHART




RELATIVE PLASTICITY

| | |
|---|---|
| Nonplastic | Cannot Roll Into Ball |
| Trace Plasticity | Barely Roll Into Ball |
| Medium Plastic | Can be Rolled Into Ball |
| Highly Plastic | No Rupture by Kneading |

# VISUAL DESCRIPTION CRITERIA*

*TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES*

| Description | Criteria |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | Particles are similar to angular description but have rounded edges |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | Particles have smoothly curved sides and no edges |

*TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE*

| Description | Criteria |
|---|---|
| Flat | Particles with width/thickness X3 |
| Elongated | Particles with length/width X3 |
| Flat and Elongated | Particles meet criteria for both flat and elongated |

*TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION*

| Description | Criteria |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp, but no visible water |
| Wet | Visible free water, usually soil is below the water table |

*TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL*

| Description | Criteria |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming rapidly |

*TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION*

| Description | Criteria |
|---|---|
| Weak | Crumbles or breaks with handling or little finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

*NOTES: 1. Tables adapted from ASTM D2488 "Description and identification of Soils" (Visual-Manual Procedure)
2. Tables 5, 7 and 11 incorporated into other information on this plate.

*TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH*

| Description | Criteria |
|---|---|
| None | The dry specimen crumbles into powder with mere pressure of handling |
| Low | The dry specimen crumbles into powder with some finger pressure |
| Medium | The dry specimen breaks into pieces or crumbles with considerable finger pressure |
| High | The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface. |
| Very High | The dry specimen cannot be broken between the thumb and a hard surface |

*TABLE 9: CRITERIA FOR DESCRIBING DILATANCY*

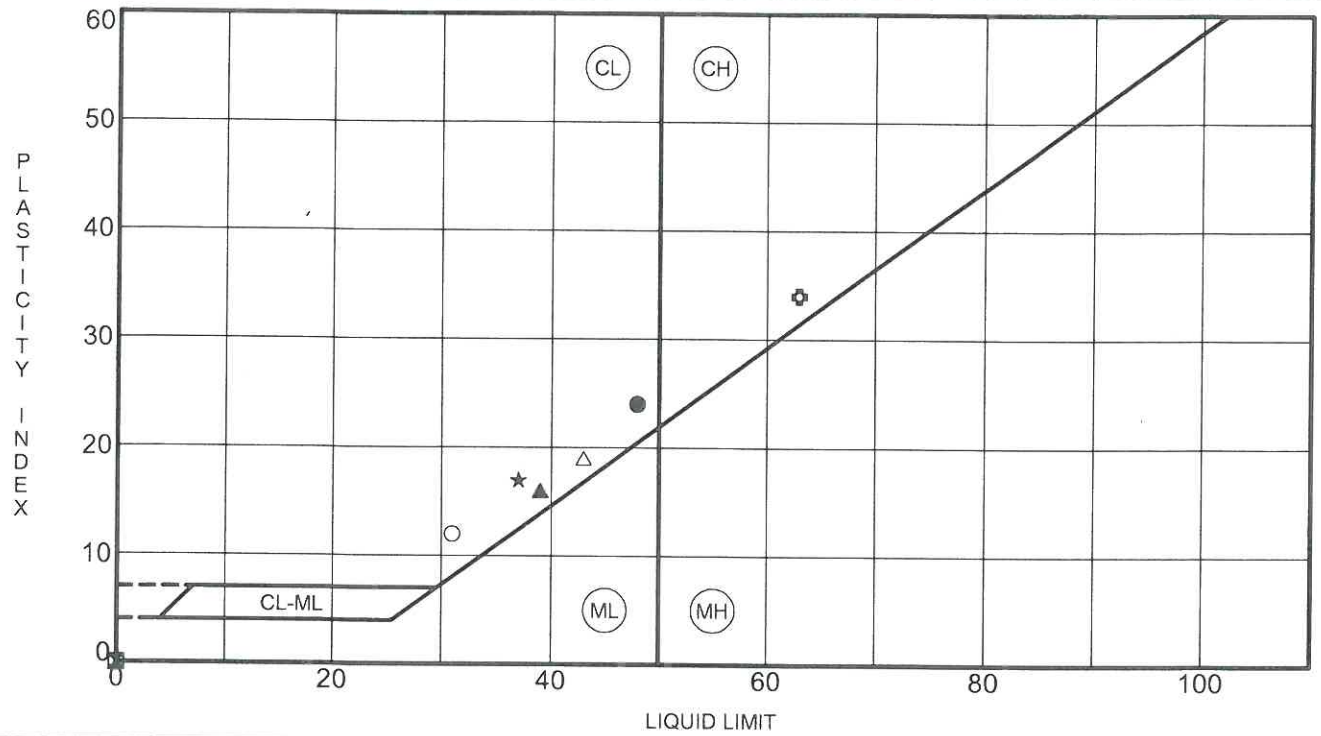
| Description | Criteria |
|---|---|
| None | No visible change in the specimen |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing. |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing. |

*TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS*

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft. |
| Medium | Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness |
| High | Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness |

*TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS*

| Soil Symbol | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|
| ML | None to low | Slow to rapid | Low or thread cannot be formed |
| CL | Medium to high | None to slow | Medium |
| MH | Low to medium | None to slow | Low to medium |
| CH | High to very high | none | High |



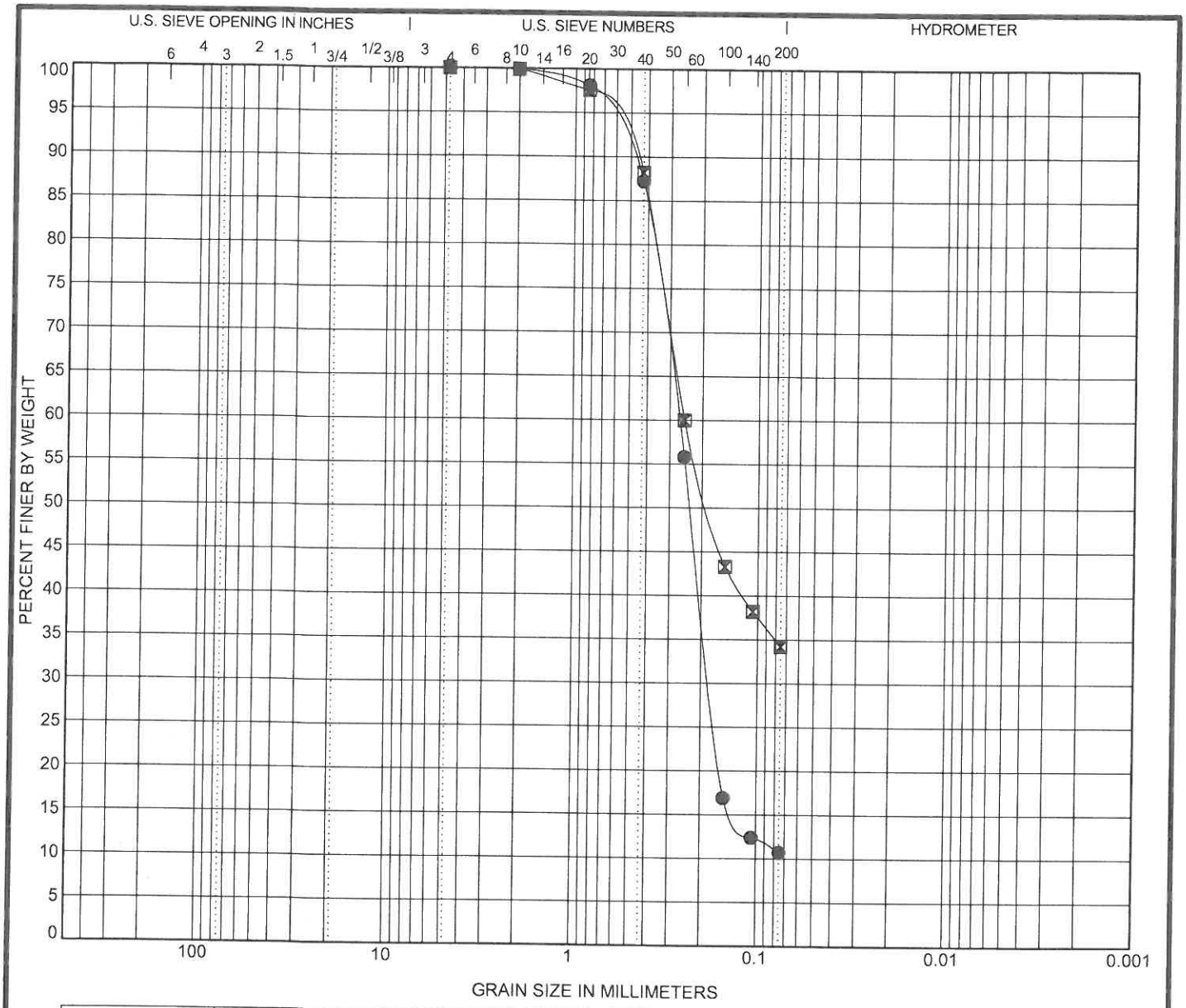

| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | R-3 | 3.0 | 48 | 24 | 24 | | LEAN CLAY (CL) |
| ⊠ | R-3 | 28.5 | NP | NP | NP | 11 | POORLY GRADED SAND with SILT (SP-SM) |
| ▲ | R-5 | 3.0 | 39 | 23 | 16 | | LEAN CLAY (CL) |
| ★ | R-5 | 20.0 | 37 | 20 | 17 | | LEAN CLAY (CL) |
| ⊙ | R-5 | 43.5 | NP | NP | NP | 34 | SILTY SAND (SM) |
| ✿ | R-6 | 6.0 | 63 | 29 | 34 | | FAT CLAY (CH) |
| ○ | R-6 | 23.0 | 31 | 19 | 12 | | LEAN CLAY (CL) |
| △ | R-7 | 5.0 | 43 | 24 | 19 | | LEAN CLAY (CL) |

GEOTECHNOLOGY INC
FROM THE GROUND UP

# ATTERBERG LIMITS RESULTS

Fite Road Retaining Wall
Fisher & Arnold
J019679.01

US ATTERBERG LIMITS J019679.01.GPJ GINT STD US LAB.GDT 2/10/12




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | R-3 | 28.5 | POORLY GRADED SAND with SILT (SP-SM) | NP | NP | NP | 1.82 | 4.13 |
| ⊠ | R-5 | 43.5 | SILTY SAND (SM) | NP | NP | NP | | |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | R-3 | 28.5 | 4.75 | 0.268 | 0.178 | | 0.0 | 89.3 | 10.7 | |
| ⊠ | R-5 | 43.5 | 4.75 | 0.25 | | | 0.0 | 65.8 | 34.2 | |

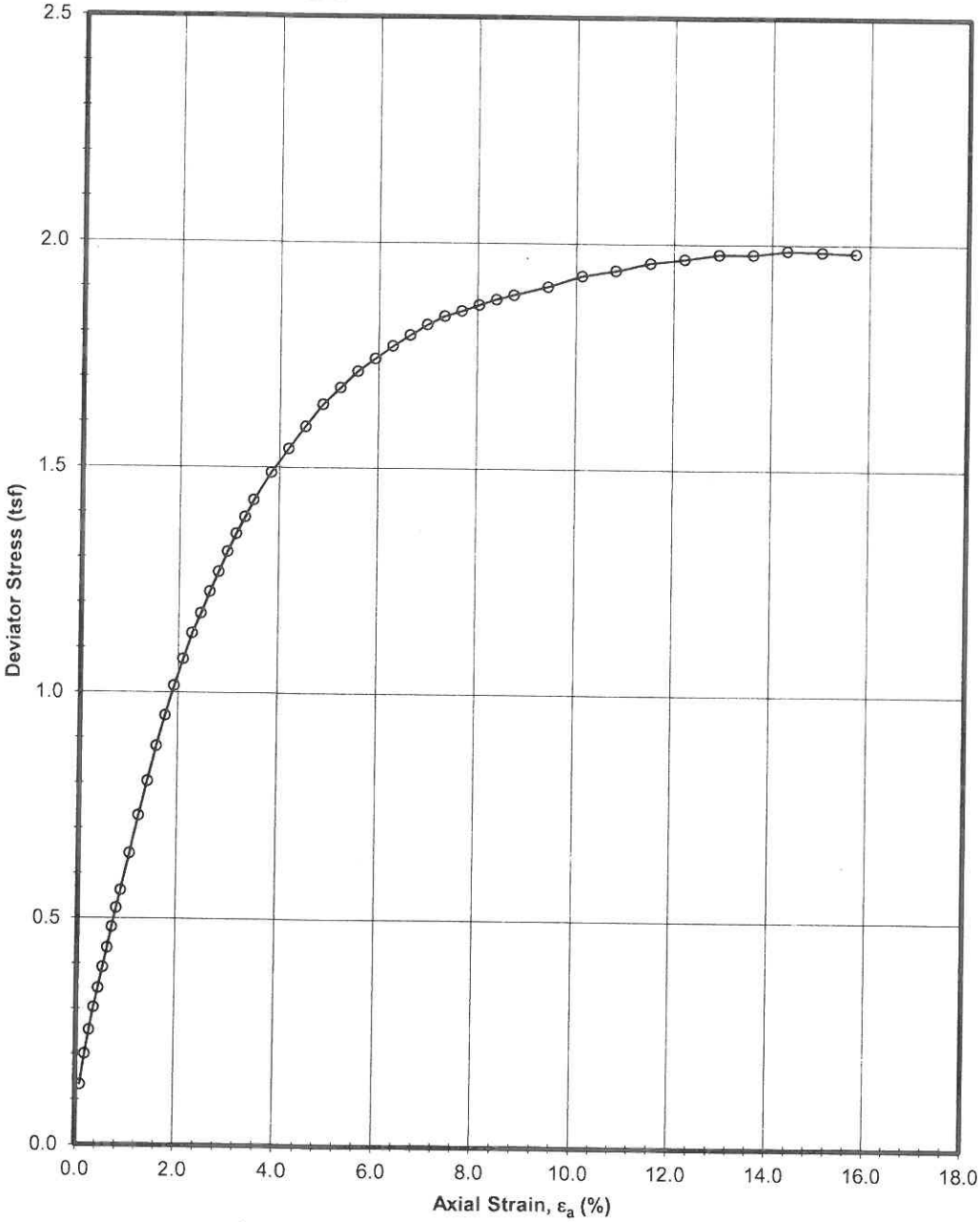
GEOTECHNOLOGY INC
FROM THE GROUND UP

# GRAIN SIZE DISTRIBUTION

**Fite Road Retaining Wall**
**Fisher & Arnold**
**J019679.01**

US_GRAIN_SIZE_J019679.01.GPJ US_LAB.GDT 2/6/12

GEOTECHNOLOGY INC
FROM THE GROUND UP




**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**

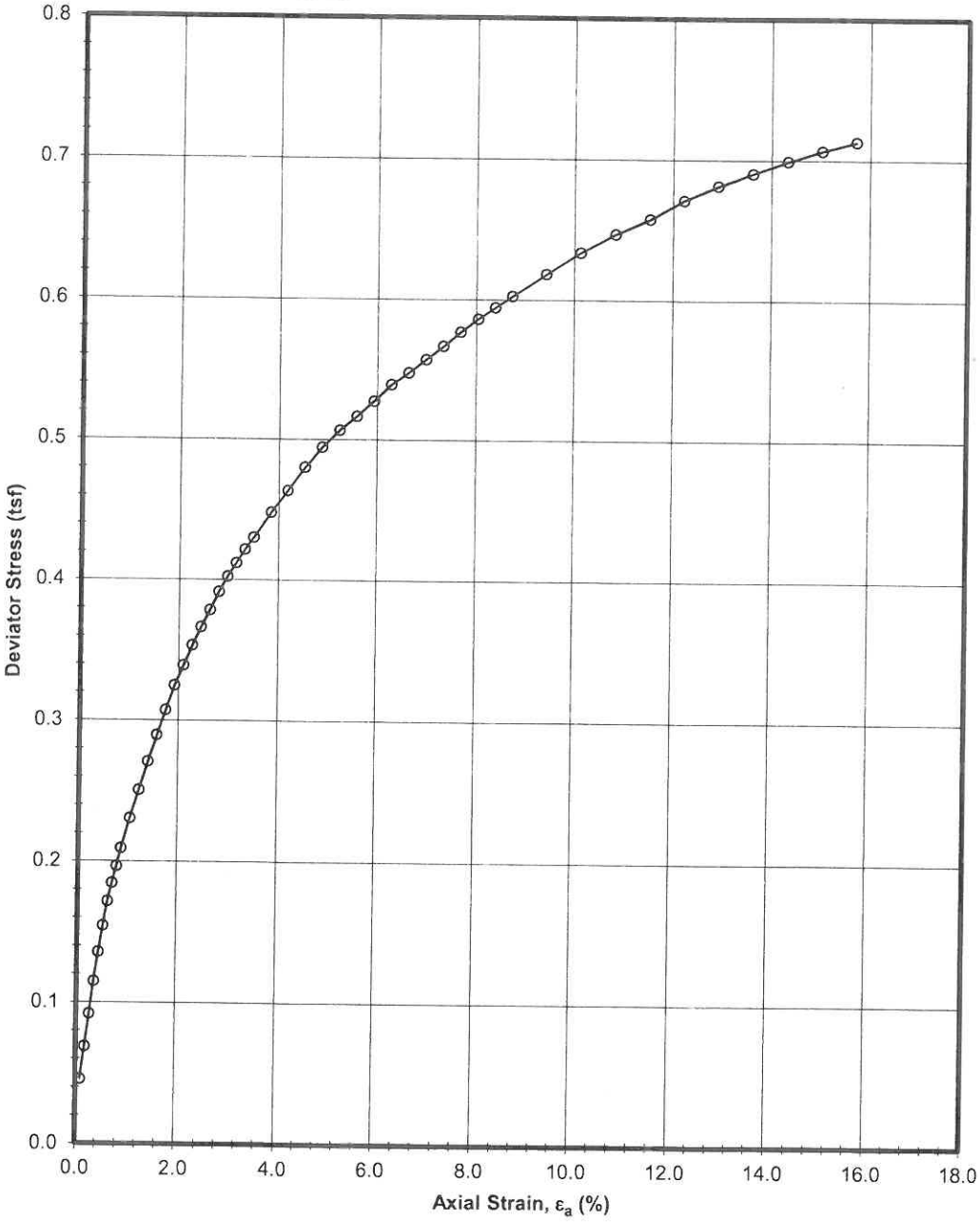
ASTM D 2850

Project No.: J019679.01

Boring: R-3

Sample: ST-1 - Depth: 3 ft.

GEOTECHNOLOGY INC
FROM THE GROUND UP




**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**

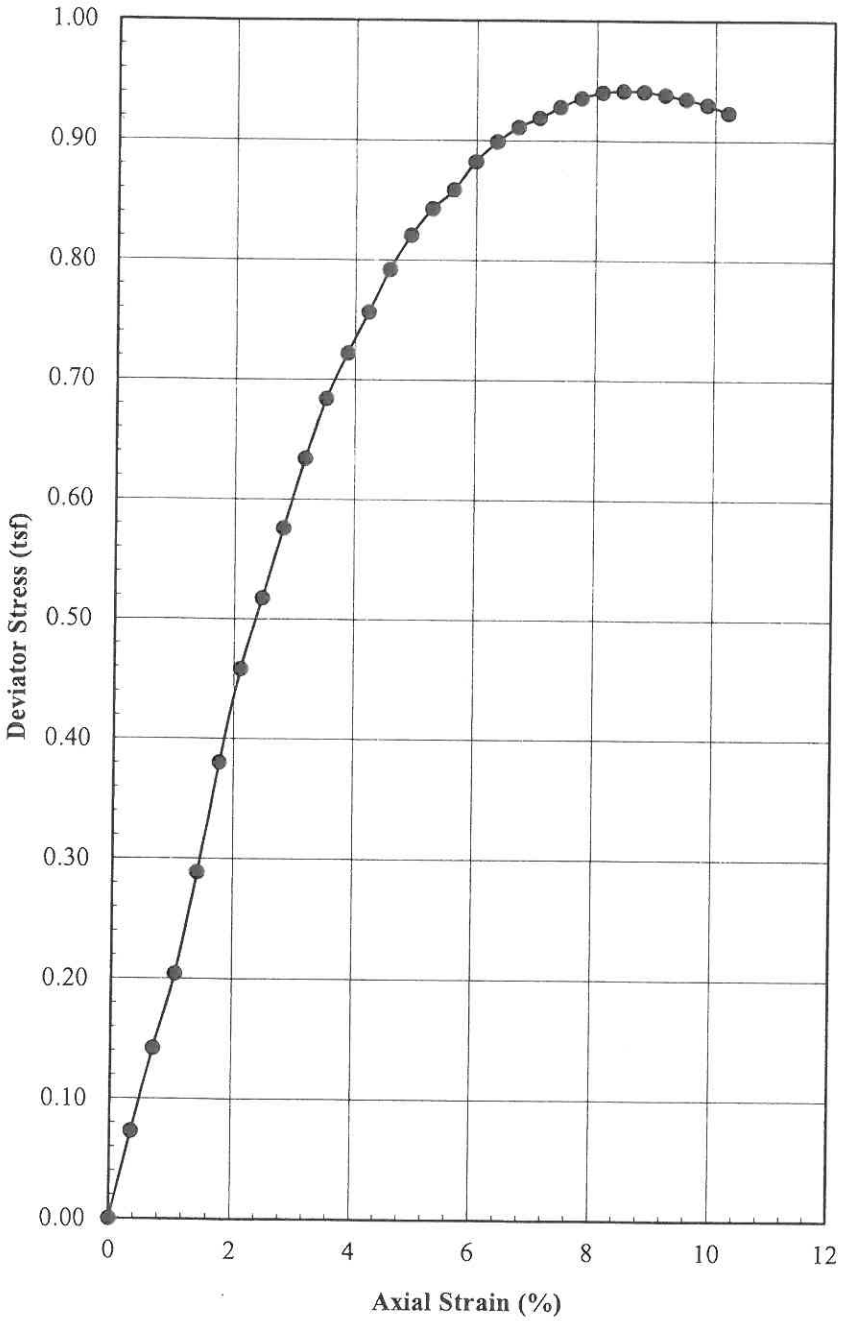
ASTM D 2850

Project No.: J019679.01

Boring: R-5

Sample: ST-2 - Depth: 20 ft.

GEOTECHNOLOGY INC
FROM THE GROUND UP




**UNCONFINED COMPRESSION TEST**

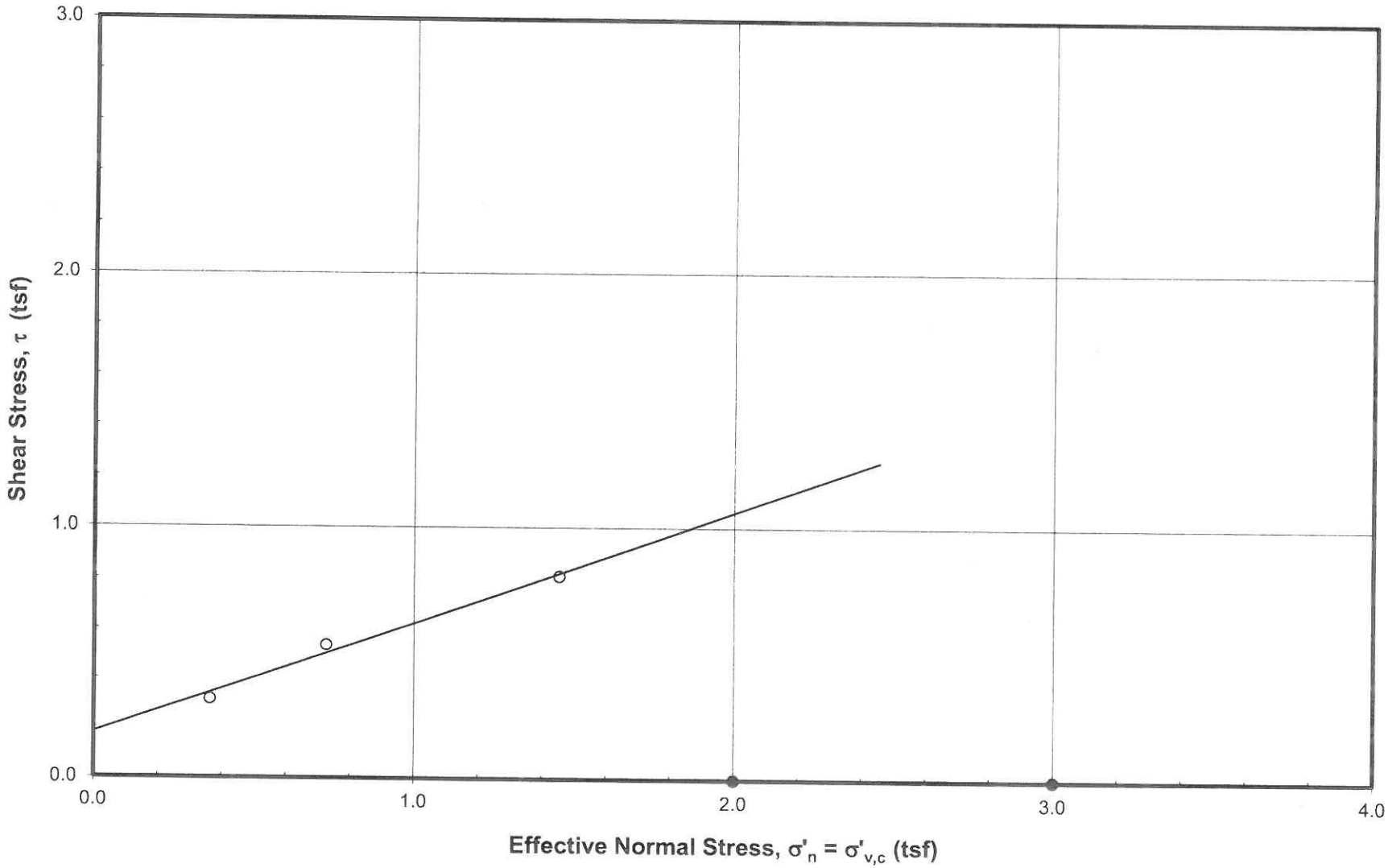
ASTM D 2166

Project No.: J019679.01

Boring: R-6

Sample: ST-8 - Depth: 23 ft.

GEOTECHNOLOGY INC
FROM THE GROUND UP




**DRAINED DIRECT SHEAR TEST**

ASTM D 3080

Boring: R-7

P706a (12/14/10)

J019679.01-R-7_3DS.xls, c-phi plot, 2/8/2012

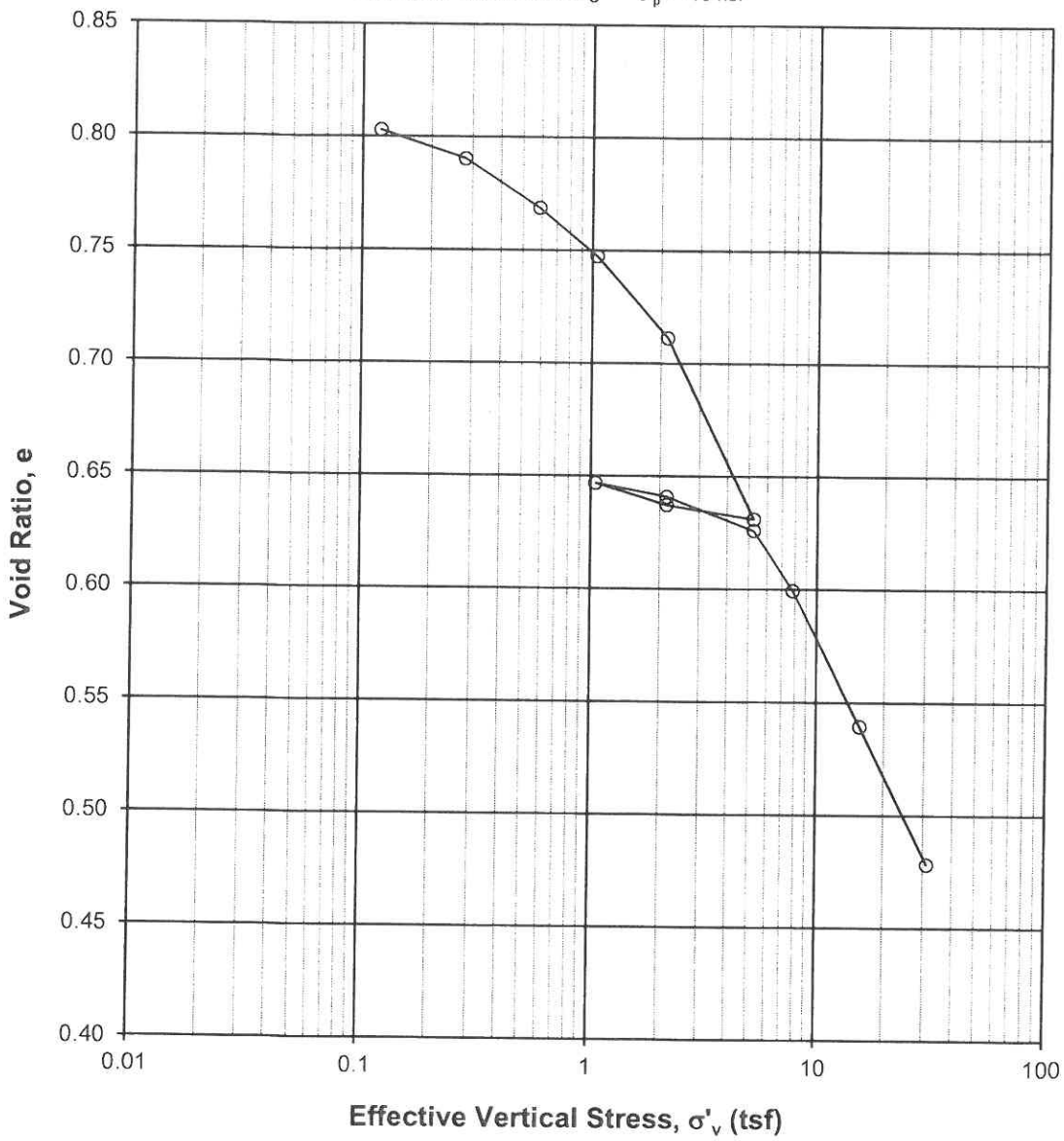
GEOTECHNOLOGY INC
FROM THE GROUND UP

Liquid Limit= 37 Plastic Limit= 20 Plastic Index = 17 USCS: CL

Compression Index, $C_c$ = 0.25 Void Ratio, $e_o$ = 0.8

Recompression Index, $C_r$ = 0.05 Preconsolidation Pressure = 1.3 tsf

Stress to Prevent Swelling — $\sigma'_p$ = 16 ksf




**1-D CONSOLIDATION TEST: INCREMENTAL**

ASTM D 2435

Project No.: J019679.01

Boring: R-5

Sample: ST-2 - Depth: 20-22