APPENDIX A

GEOTECHNICAL DESIGN FORMS

GEOTECHNICAL DESIGN MANUAL

January 2022

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APPENDIX A

GEOTECHNICAL DESIGN FORMS

A.1 INTRODUCTION

This Appendix presents forms that are to be used in geotechnical design by the GEOR and is comprised of the following forms

Table A-1, Geotechnical Design Forms

GDF 000 Geotechnical Scoping Form
GDF 001 Bridge Load Data Sheet
GDF 002 Consultant Seismic Information Request
GDF 003 Deleted
GDF 004 Request for Right-of-Way Access Permission
GDF 500 Deleted
GDF 501 Standard Request for Lab Test & Rock Break Memo
GDF 711-1 Vibratory Pile Hammer Data
Supplemental Technical Specification Template
Special Provision Template

GeoScoping Form

PROJECT INFORMATION	
Project ID:	Date of Trip:
County:	Location:
Rd/Route:	Local Name:
Attendees:	

EXISTING BRIDGE INFORMATION	
Bridge Length:	Bridge Width:
Superstructure Type:	Substructure Type:
Begin Bridge Sta.:	End Bridge Sta.:
Begin Bridge Embankment Sta.[1]:	End Bridge Embankment Sta.[1]:
Structure Number:	Posted Weight Limit:
Crossing:	Skew:
Latitude:	Longitude:
Existing Fill Height:	Approximate Existing Slope Angle:

[1]Begin and End Bridge Embankment 100 feet down station or up station from bridge, respectively

EXISTING ROADWAY EMBANKMENT INFORMATION		
Begin Project Sta.:	Begin Bridge Embankment Sta.[1]:	
Accessibility Issues:		
Ground Cover:		
Existing Fill Height:	Approximate Existing Slope Angle:	
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.):		
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.):		
Traffic Control Necessary (Y/N):		
Surface Soil:	Muck (Y/N):	
Exposed Rock (Y/N):	In Stream Bed (Y/N):	In Banks (Y/N):
Wetlands On-Site (Y/N):	Wetlands Adjacent (Y/N):	
Depth FG to Water:	Water Depth:	
Depth to Existing Ground:		
Scour Condition at EB:	Scour Condition at IB:	
End Bridge Embankment Sta.[1]:	End Project Sta.:	
Accessibility Issues:		
Ground Cover:		
Existing Fill Height:	Approximate Existing Slope Angle:	
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.):		
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.):		
Traffic Control Necessary (Y/N):		
Surface Soil:	Muck (Y/N):	
Exposed Rock (Y/N):	In Stream Bed (Y/N):	In Banks (Y/N):
Wetlands On-Site (Y/N):	Wetlands Adjacent (Y/N):	
Depth FG to Water:	Water Depth:	
Depth to Existing Ground:		
Scour Condition at EB:	Scour Condition at IB:	

GeoScoping Form

UTILITIES INFORMATION
Attached:
Above Ground/ Overhead:
Underground:

COMMENTS

Instructions:

1. Attach boring location plan for bridge and roadway.
2. Attach all photographs taken, photographs to be labeled as to direction looking in and what is being depicted.
3. Fill out GeoScoping Form as completely as possible, using additional sheets as necessary to describe site conditions.
4. If representative of GEC on site during GeoScoping, include GEC representative's name and contact number in Attendees block.

Bridge Load Data Sheet

PROJECT INFORMATION					
Project ID:		**County:**		**Route:**	
Description:					
Loads Provided By:			**Date Loads Provided:**		
Bridge Type:					
No. Spans /Lengths:			**Width / No. Lanes:**		
Edition of AASHTO LRFD Bridge Design Specifications:					
Edition of SCDOT Seismic Design Specifications for Highway Bridges:					
Bridge Operational Classification (OC):			**Scour Report Attached:**		
Seismic Design Category (SDC):					
Proposed Foundations (foundation type, size, and number per bent)	**End Bent**				
	Interior Bent				
Location/Elev. of Applied Loads:[1]		**End Bent:**		**Int. Bent:**	
Location/Elev. Est. Point of Fixity:		**End Bent:**		**Int. Bent:**	

[1]Perferred location of loads is the either the existing ground line for interior bents or the proposed ground line for end bents.

Bridge Load Data Sheet

Compression Loads

	Limit State	Strength			Service		
	Load Cases:	Case 1FL ($P=P_{max}$)	Case 2FL ($V=V_{max}$)	Case 3FL ($M=M_{max}$)	Case 1SL ($P=P_{max}$)	Case 2SL ($V=V_{max}$)	Case 3SL ($M=M_{max}$)
End Bent - Longitudinal	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
End Bent - Transverse	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
Interior Bent - Longitudinal	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
Interior Bent - Transverse	P (kips) =						
	V (kips) =						
	M (ft-kip) =						

	Limit State	Extreme Event I[c]			Extreme Event II[a,c]			Extreme Event II[b,c]		
	Load Cases:	Case 1EL ($P=P_{max}$)	Case 2EL ($V=V_{max}$)	Case 3EL ($M=M_{max}$)	Case 1EEL ($P=P_{max}$)	Case 2EEL ($V=V_{max}$)	Case 3EEL ($M=M_{max}$)	Case 1EEL ($P=P_{max}$)	Case 2EEL ($V=V_{max}$)	Case 3EEL ($M=M_{max}$)
End Bent - Longitudinal	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
End Bent - Transverse	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
Interior Bent - Longitudinal	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
Interior Bent - Transverse	P (kips) =									
	V (kips) =									
	M (ft-kip) =									

Notes: P – Axial; V – Shear; M – Moment; [a] – Check Flood w/o collision loads; [b] – Collision loads w/o check flood; [c] – If no EE Limit State loads are to be provided, the SEOR shall either put 0 or N/A. Please note that N/A will be interpreted as 0.

Bridge Load Data Sheet

Tension Loads

	Limit State	Strength			Service		
	Load Cases:	Case 1FL ($P=P_{max}$)	Case 2FL ($V=V_{max}$)	Case 3FL ($M=M_{max}$)	Case 1SL ($P=P_{max}$)	Case 2SL ($V=V_{max}$)	Case 3SL ($M=M_{max}$)
End Bent - Longitudinal	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
End Bent - Transverse	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
Interior Bent - Longitudinal	P (kips) =						
	V (kips) =						
	M (ft-kip) =						
Interior Bent - Transverse	P (kips) =						
	V (kips) =						
	M (ft-kip) =						

	Limit State	Extreme Event I[c]			Extreme Event II[a,c]			Extreme Event II[b,c]		
	Load Cases:	Case 1EL ($P=P_{max}$)	Case 2EL ($V=V_{max}$)	Case 3EL ($M=M_{max}$)	Case 1EEL ($P=P_{max}$)	Case 2EEL ($V=V_{max}$)	Case 3EEL ($M=M_{max}$)	Case 1EEL ($P=P_{max}$)	Case 2EEL ($V=V_{max}$)	Case 3EEL ($M=M_{max}$)
End Bent - Longitudinal	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
End Bent - Transverse	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
Interior Bent - Longitudinal	P (kips) =									
	V (kips) =									
	M (ft-kip) =									
Interior Bent - Transverse	P (kips) =									
	V (kips) =									
	M (ft-kip) =									

Notes: P – Axial; V – Shear; M – Moment; [a] – Check Flood w/o collision loads; [b] – Collision loads w/o check flood; [c] – If no EE Limit State loads are to be provided, the SEOR shall either put 0 or N/A. Please note that N/A will be interpreted as 0.

Seismic Information Request

PROJECT INFORMATION				
Project ID:				
County:		**RPG[1]:**		**Route:**
Description:				
Latitude (4 decimals):	.		**Longitude (4 decimals):**	.

SEISMIC REQUEST

The SCDOT Geotechnical Design Manual (GDM) and Seismic Design Specifications for Highway Bridges (Seismic Specs), latest editions, provide detailed seismic design requirements for transportation structures. The Office of Engineering Support Geotechnical Design Section (OES/GDS) will be generating seismic design information from, SCENARIO_PC, the seismic analysis software. The OES/GDS will provide the completed 3-Point curve based on the information provided on this form in general accordance with the procedures contained in the GDM. The 3-Point curve will be for 5% critical damping and will be based on either the **B-C Boundary** (Geologically Realistic) or **Hard Rock** Outcrop for specific project locations within South Carolina. The Site Geologic Condition shall be determined using the guidance contained in the GDM, which is summarized in the following statements. The Geologically Realistic option is for sites in the Coastal Plain with a sediment thickness greater than 330 feet to sediment having a $V_s \geq$ 2,500 feet per second (ft/s) (NEHRP B-C Boundary). Geologically Realistic conditions can also be encountered outside of the Coastal Plain where the sediment thickness is 330 feet or less above the basement rock and the $V_s \geq$ 8,200 ft/s. The Hard Rock Outcrop option is for an outcrop of hard rock ($V_s \geq$ 11,500 ft/s). The GDM contains a map to assist in determining the Site Geologic Condition. South Carolina is divided in 2 zones, Zone I – Physiographic Units Outside of the Coastal Plain and Zone II – Physiographic Units of the Coastal Plain. The provided 3-Point curve shall include both the FEE and the SEE events since all bridge embankments are required to be designed for both the FEE and SEE. For ERSs located within the roadway embankment only the SEE will be used; however, if in the opinion of the design team a 2-level design should be performed. The OC and Bridge Seismic Level of Design shall be determined as defined in the Seismic Specs and shall be provided by the design team. The Consultant shall use Geologically Realistic Site Conditions and provide the V_s profile to the B-C Boundary (Coastal Plain) or to the depth where V_s is less than 11,500 ft/s (Piedmont), provided the depth criteria previously indicated are met. However, if V_s greater than or equal to 11,500 ft/s ($V_s \geq$ 11,500 ft/s) is encountered at the ground surface or within 100 feet of the existing ground surface then the Hard Rock Outcrop geologic condition shall be used. All Vs profiles are to be provided digitally in an Excel® format to SCDOT and shall at a minimum provide the depth, V_s and unit weight at each depth. In addition, the spreadsheet shall also indicate the test location designator. M_w and R shall be determined by the OES/GDS using the procedures outlined in the GDM since this data is now obtained from SCENARIO_PC. To facilitate developing V_s Profiles to the appropriate depths, SCDOT has placed on the Geotechnical Webpage of the SCDOT Website a map indicating the location of representative V_s profiles along with the information for each location. If additional information is needed, contact the appropriate OES/GDS. This is the condition that is anticipated being encountered on most project sites.

SITE GEOLOGIC CONDITION

Geologically Realistic	**Hard Rock Basement Outcrop**
V_s Profile to the B-C Boundary Provided ☐ V_s Profile to $V_s \leq$ 8,200 ft/s Provided ☐	V_s Profile to $V_s \geq$ 11,500 ft/s Provided ☐

REQUESTOR INFORMATION

Requestor Name:	
Company Name:	
Phone Number:	( ) -
Email Address	
Request Date:	

[1]RPG – Regional Production Group

1 – Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper
2 – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg
3 – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York
4 – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg
Design-Build – D/B

South Carolina
Department of Transportation

INTEROFFICE MEMORANDUM

To: Director of Rights-of-Way

From: RPG

Date:

Subject: Access Permission Request

The following project is being prepared for Geotechnical Subsurface Investigation:
County:
Road:
Project ID:
PIN No.:
Location:
Project Name:
Charge Code:
Project Manager:

Project Management has provided us with plans, and we will visit the above referenced site in the coming weeks. Based upon the information provided, we understand the following design concepts are under consideration at this time:

- The proposed bridge will be constructed on the existing horizontal alignment.
- The grade will be raised approximately XX ft above the existing finish grade elevation
- This project will encompass approximately XX.

Roadway and Bridge borings will need to be performed between Stations XX+XX to XX+XX on Anywhere Road, some of which are on SCDOT Right-of-Way and others that are not. Installation of an accessway will be required for this project. This may entail removal of some trees using heavy equipment to permit access. It may also be necessary for us to bring in fill soil to bridge soft, wet areas. Every effort will be made by the Contractor to minimize damage to property and as few trees as possible will be disturbed in the process. Below is a table of anticipated boring locations for the project site. It must be pointed out that the boring locations are planned and may change if site conditions warrant or utilities such as overhead power lines necessitate relocation of the proposed borings.

Table 1 (Road)

Boring No.	Road Cut (C)/ Road Fill (F)	Proposed Stationing	Offset Distance (ft)*	Boring Depth (ft.)	Tract No.

***Offset from construction centerline, both left and right**

Table 2 (Bridge)

Boring No.	Proposed Stationing	Offset Distance (ft)*	Tract No.

***Offset from construction centerline, both left and right**

South Carolina
Department of Transportation

Attached are the Geotechnical Design Section's Scoping forms (Form GDF 000), one (1) full-sized set and one (1) half-sized set of plans depicting the proposed soil test boring locations for the project. Bridge and roadway soil borings will be required as indicated on the plans.

We anticipate the access permission to be available by Month day, Year so we can begin mobilizing the drillings. Once signed permission has been obtained, please provide a copy of the signed document to us. We will provide a copy of this document to the drillers, who will be required to maintain copies physically in their possession at all times during drilling operations.

If you have any questions or comments, feel free to contact Sara Stone at (803) 737-1608. Or you can email me at **StoneSM@scdot.org**.

Sara M. Stone
Midlands RPG/GDS

JCS/SMS: xxx
cc: BDF, Project Management, Geotech file

South Carolina
Department of Transportation

Date: March 10, 2005

To: Consultant

From: RPG

Re: Soil Exploration Testing and Compressive Strength Testing of Rock Cores

Soil Exploration and Testing of soil samples and Compressive strength testing of rock core samples is requested for the following project

County:
Road:
Route Local Name:
Project ID:
Location:
Project Name:
Charge Code:
Priority: ***Lab test information needed April 22, 2005.***
Final Boring Logs needed April 29, 2005.

Index Testing:

Boring Number	Sample Depth (ft)	Sample Number	Grain Size with wash #200	Atterberg Limit	Natural Moisture Content
B-1	0 - 2				
	2 – 4				
	4 – 6				
	8 - 10				
	13.5 – 15.0				
	18.5 – 20.0				
	23.5 – 25.0				
	28.5 – 30.0				
	33.5 – 35.0				
	43.5 – 45.0				
B-2	0 – 2				
	2 – 4				
	4 – 6				
	6 – 8				
	8 - 10				
	18.5 – 20.0				
	23.5 – 25.0				
B-3	22.0 – 24.0				
	24.0 – 26.0				
	26.0 – 28.0				
	28.0 – 30.0				
	30.0 – 32.0				
	48.5 – 50.0				

Note: ** Conduct hydrometer analysis also.

Electro-Chemical Tests:

Boring Number	Sample Depth (ft)	Sample Number	pH	Resistivity Testing	Chloride Testing	Sulfate Testing
B-1	**Water:**					
	Groundwater					
	Surface Water					
	Soil:					
	0 - 2					
	2 – 4					
	13.5 – 15.0					
	33.5 – 35.0					
	43.5 – 45.0					
B-2	**Water:**					
	Groundwater					
	Surface Water					
	Soil:					
	0 – 2					
	6 – 8					
	8 - 10					
	18.5 – 20.0					
	23.5 – 25.0					
B-3	**Water:**					
	Groundwater					
	Surface Water					
	Soil:					
	22.0 – 24.0					
	28.0 – 30.0					
	30.0 – 32.0					
	48.5 – 50.0					

Shear Strength Testing:

Boring Number	Sample Depth (ft)	Sample Number	Unconfined	Direct Shear	UU	CUw/pp	σ_3 or N		
B-1	0 - 2								
	2 – 4								
	13.5 – 15.0								
B-2	6 – 8								
	43.5 – 45.0								

Note: σ_3 – Confining pressure for UU and CUw/pp.
N – Normal force applied in Direct Shear.

Consolidation Testing:

Boring Number	Sample Depth (ft)	Sample Number	Beginning Load	Load Increment	Ending Load	Begin and End of Reload Cycle
B-1	0 - 2					
	2 – 4					
	13.5 – 15.0					
B-2	6 – 8					
	43.5 – 45.0					

Note: There should be 14 to 16 load increments and load increments should be even. Ending load should exceed the first-order estimate of σ'_p by a factor of 8.

Rock Testing:

Boring Number	Recovery (%)	RQD(%)	Core Number	Number of Breaks Requested
B-2				
B-3				
B-4				
B-5				
B-6				

Please e-mail an electronic copy and forward a hard copy of the results to Sara Stone so that the information can be included in the contract document. If you require any additional information, please contact Sara Stone at 737-1608.

Requested by:

Sara Stone
Geotechnical Professional

cc: BDF, Geotech

South Carolina Department of Transportation

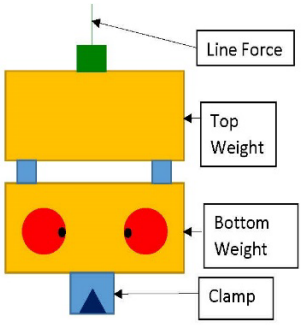
VIBRATORY PILE HAMMER DATA

Date: _____ Contract #: _____ Project #: _____ County: _____

Road Info: _____

Contractor: _____

HAMMER



NOTE:
Attach any hammer modification specifications. Manufacturer's Specifications may be required if hammer is not found in Wave Equation database.

[1]Multiply Horsepower (HP) by 0.7457 to get Kilowatts (kW)

Manufacturer: Model:

Type: Serial #:

Eccentric Mass

Moment (in-lbs): OR Weight (lbs):
Radius =1 if moment provided Radius (ft):

Efficiency:

Rating

Max Power (kW)[1]: Vibratory Frequency (Hz): Vibratory Delay (s):

Weights

Top Weight (kips): Bottom Weight (kips):
(Bias Mass) (Oscillator Mass)

Clamp Weight (kips): No. of Segments:
(Minimum 2)

Connector Spring

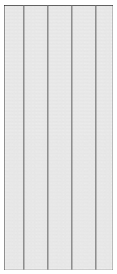
C.O.R.: Stiffness (kips/in): Round Out (ft):

Line Force (kips):

Modifications

Last Maintenance Date: Performed By:

Maintenance Type:



PILE

Pile Type/Size: Pile Point:

Total Pile & Point Length (ft): Splice Description:

Exposed Pile Point Length (ft): Splice Location from Pile Top (ft):

Cross-Sectional Area (sq ft): Concrete Pile Strength, f'_c (psi):

Pipe Pile Wall Thickness (in): Steel Pile Yield Strength, F_y (ksi):

Pile Tip Description:

NOTE: *No later than 30 days before driving the first pile, submit this form & Pile Installation Plan to the RCE. RCE to submit form to Regional Production Group Geotechnical Engineer and Bridge Construction Engineer.*

Submitted By: Name: _____

E-mail: _____ Title: _____ Phone #: _____ Date: _____

Date

Title

1.0 DESCRIPTION

This Section of the Special Provision provides a general description of the material and/or construction activity. It is not intended to provide details.

2.0 TESTING STANDARDS

This Section is used to indicate which edition of the testing standards within the body of this Special Provision is to be used. In addition, this Section also provides the process for getting substitutions for testing standards approved. Below is an example of a paragraph that may be used:

> Use the latest edition of the testing standards indicated in this specification. Substitution of standards will require the prior written approval of the Materials and Research Engineer (MRE) with concurrence of the GEOR. The Contractor or XX Installer is to provide copies of all substituted standards to the RCE. The RCE will provide the copies to the MRE and GEOR for acceptance.

3.0 MATERIALS

This Section provides material requirements including specific testing standards that must be met to achieve the required performance. In addition, this Section also provides the required testing standard method. If 2 or more materials are required to be combined to produce a system, this Section should indicate how these materials are to be combined; any required combined performance requirements and any combined testing requirements necessary to verify the required performance.

4.0 SUBMITTALS

This Section indicates what submittals are required from the Contractor including, material certifications, qualification certifications, etc. In addition, this Section will also contain a subsection indication the review and acceptance procedure, including, who the certifications are sent to, who reviews and approves the certifications. An example of the submittal review process is provided below:

> Acceptance of the proposed materials will be by the MRE. The equipment, construction sequence, and installation method will be accepted by the GEOR. Acceptance of the XX materials, equipment, construction sequence, or installation method does not relieve the Contractor and XX Installer of its responsibility to install the XXs in accordance with the plans and specifications. Acceptance by the GEOR of the method and equipment to be used to install the XXs is contingent upon satisfactory demonstration of XX installation at the project site. If, at any time, the RCE or the GEOR considers that the method of installation does not produce satisfactory XXs, alter the method and/or equipment as necessary to comply with this Supplemental Technical Specification. The RCE and the GEOR will determine the adequacy of the Contractor's methods and equipment.

5.0 CONSTRUCTION REQUIREMENTS

This Section of the Special Provision provides required submittals, construction requirements and acceptance criteria if required. The required submittals Subsections should include, who gets the submittal, typically the Resident Construction Engineer (RCE), who reviews and accepts the submittal and how long the review should take if different from the requirements of the Standard Specifications. The construction requirements should not dictate means and methods, but should provide general guidance to the Contractor on how the construction should be performed and what the end-result should be achieved. The exception to this is if the Special Provision is written as a method specification, where the Contractor is instructed to use certain methods, equipment and materials. In addition, the Construction Requirements Section may also include a discussion of any equipment requirements. Finally, this Section should provide a means of establishing how acceptance is determined. The acceptance criteria should be something that is achievable during construction and is relatively easy to measure.

6.0 METHOD OF MEASURMENT

This Section includes, what is being measured, when it should be measured (if required) and how to measure the item. This Section should also state what is incidental, i.e., what is included in the item, to the measurement of the items

7.0 BASIS OF PAYMENT

This Section provides for when payment can be requested, e.g., completion of installation of an item; a percentage of completed construction, etc. The following statement and table, please note that the table provided is for example only, are required for all Special Provisions:

Payments shall be made under:

Item No.	Pay Item	Pay Unit
8012300	Prefabricated Vertical Drain with Fabric	LF

The Item No. is the provided by the Letting Preparation Engineer and should have requested prior to writing the Special Provision, the Pay Item should be the long description and the Pay Unit is the unit of measurement used for the item.

Supplemental Technical Specification for

XX

SCDOT Designation: SC-M-XXX-X (XX/XX)

Instructions for the Title Block above
XX – New Product Title
SCDOT Designation: SC-M-XXX-X (XX/XX)
The first 3 X's above are the first 3 numerals of the Pay Item Number. *The next X is a sequential number for multiple STSs that have the same 3 numerals* *(XX/XX) is the letting date the STS will become effective, typically STSs will only become effective in January and July of each year.*

1.0 DESCRIPTION

This Section of the STS provides a general description of the material and/or construction activity. It is not intended to provide details.

2.0 TESTING STANDARDS

This Section is used to indicate which edition of the testing standards within the body of this STS are to be used. In addition, this Section also provides the process for getting substitutions for testing standards approved. Below is an example of a paragraph that may be used:

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method does not relieve the Contractor and XX Installer of its responsibility to install the XXs in accordance with the plans and specifications. Acceptance by the GEOR of the method and equipment to be used to install the XXs is contingent upon satisfactory demonstration of XX installation at the project site. If, at any time, the RCE or the GEOR considers that the method of installation does not produce satisfactory XXs, alter the method and/or equipment as necessary to comply with this Supplemental Technical Specification. The RCE and the GEOR will determine the adequacy of the Contractor's methods and equipment.

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