STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

June 10, 2011

Addendum No. 1
RE: Contract ID C202028
WBS # 34817.3.12
F. A. # NHF-0100(21)
Cumberland County (U-2519DA)
I-295 (Fayetteville Outer Loop) From East of SR-1415 (Yadkin Road)
To West of NC-24 (Bragg Boulevard)

June 21, 2011 Letting

To Whom It May Concern:

Reference is made to the plans and proposal furnished to you on this project.

The following revisions have been made to the Roadway plans:

Sheet No. 1-A has been revised to show the addition of Detail Sheet No. 2-AT "Standard Temporary Shoring". Please void Sheet No. 1-A in your plans and staple the revised Sheet No. 1-A thereto.

New Sheet No. 2-AT was added to include the detail for "Standard Temporary Shoring". Please staple New Sheet No. 2-AT after Sheet No. 2-AS in your plans.

Sheet Nos. 3-B and 3-F have been revised to remove the reference to "Method B" pipe installation. Please void Sheet Nos. 3-B and 3-F in your plans and staple the revised Sheet Nos. 3-B and 3-F thereto.

Sheet No. 3-K has been revised to correct some errors in the Earthwork summary. Please void Sheet No. 3-K in your plans and staple the revised Sheet No. 3-K thereto.

Sheet No. TCP-1 has been revised to correct the index of sheets to show the addition of "Sheet No. TCP-3A Temporary Shoring Notes". Please void Sheet No. TCP-1 in your plans and staple the revised Sheet No. TCP-1 thereto.

Sheet No. TCP-3 has been revised to add lane closure restrictions for All American Freeway and Bragg Boulevard and to remove the "Local Notes". Please void Sheet No. TCP-3 in your plans and staple the revised Sheet No. TCP-3 thereto.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
CONTRACT STANDARDS AND DEVELOPMENT UNIT
1591 MAIL SERVICE CENTER
RALEIGH NC 27699-1591

TELEPHONE: 919-707-6900
FAX: 919-250-4119
WEBSITE: WWW.NCDOT.ORG

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

New Sheet No. TCP-3A has been added to include "Temporary Shoring Notes". Please staple New Sheet No. TCP-3A after Sheet No. TCP-3 in your plans.

Sheet No. TCP-5 has been revised to remove the temporary median crossover at Sta. –Y1-28+00 and to revise "Phase I Step 2 and Step 4" of the phasing sequence. Please void Sheet No. TCP-5 in your plans and staple the revised Sheet No. TCP-5 thereto.

Sheet No. TCP-6 has been revised to make changes to "Step 8" of the phasing. Please void Sheet No. TCP-6 in your plans and staple the revised Sheet No. TCP-6 thereto.

Sheet No. TCP-12 has been revised to remove the temporary crossover. Please void Sheet No. TCP-12 in your plans and staple the revised Sheet No. TCP-12 thereto.

Sheet No. TCP-23 has been revised to make a change to "Step 4" of the phasing. Please void Sheet No. TCP-23 in your plans and staple the revised Sheet No. TCP-23 thereto.

The following revisions have been made to the Roadway Sub-Surface plans:

Sheet Nos. 3-C and 3-D have been revised to reflect the corrections made to the Earthwork summary. Please void Sheet Nos. 3-C and 3-D in your plans and staple the revised Sheet Nos. 3-C and 3-D thereto.

The following revision has been made to the Structure plans:

Sheet No. S-18 has been revised to show temporary shoring for Bent 3 and to show a temporary bent for setting girders in Span D. Please void Sheet No. S-18 in your plans and staple the revised Sheet No. S-18 thereto.

On Sheet No. S-21 two notes were added concerning temporary shoring. Please void Sheet No. S-21 in your plans and staple the revised Sheet No. S-21 thereto.

On Sheet No. S-35 notes were added concerning the temporary bent and setting structural steel in Span D. Please void Sheet No. S-35 in your plans and staple the revised Sheet No. S-35 thereto.

On Sheet No. S-171 the quantity of "Structural Steel" has been revised in the "Total Bill of Material". Please void Sheet No. S-171 in your plans and staple the revised Sheet No. S-171 thereto.

On Sheet No. S-226 notes were added concerning temporary shoring for construction of Bent 4. Please void Sheet No. S-226 in your plans and staple the revised Sheet No. S-226 thereto.

Sheet No. S-227 was revised to show temporary shoring locations for Bents 4, 5 and 6. Please void Sheet No. S-227 in your plans and staple the revised Sheet No. S-227 thereto.

On Sheet No. S-234 two notes were added concerning temporary shoring. Please void Sheet No S-234 in your plans and staple the revised Sheet No. S-234 thereto.

The following revisions have been made to the Proposal:

The first page of the Table of Contents has been revised to reflect the below noted changes. Please void the first page of the Table of Contents in your proposal and staple the revised Table of Contents thereto.

Contract C202028 Cumberland County
U-2519DA

Page No. 2 has been revised and new Page No. 2-A and 2-B have been added to include the project special provisions entitled "Intermediate Contract Time Number 3 and Liquidated Damages" and "Intermediate Contract Time Number 4 and Liquidated Damages". Please void Page No. 2 in your proposal and staple revised Page No. 2 and new Page No. 2-A and 2-B thereto.

On Page No. 44 the project special provision entitled "Geogrid Reinforced Slopes" has been revised to delete the second paragraph of Sub-section "2.1.1 Ultimate Tensile Strength". Please void Page No. 44 in your proposal and staple the revised Page No. 44 thereto.

On Page No. 48 a revision has been made to the second sentence of the first paragraph of the "Materials" section of the project special provision entitled "Chipped Waste Tires In Embankments". Please void Page No. 48 in your proposal and staple the revised Page No. 48 thereto.

New Page Nos. 111A thru 111N have been added to include the project special provisions entitled "Temporary Shoring" and "Anchored Temporary Shoring". Please staple New Page Nos. 111A thru 111N after Page No. 111 in your proposal.

On Page Numbers 1, 17 and 21 of the new item sheets the following pay item quantities have been revised or added.

Item	Description	Old Quantity	New Quantity
7-0022000000-M-225	Unclassified Excavation	313,800 M3	341,500 M3
15-0106000000-M-230	Borrow Excavation	1,649,100 M3	1,627,000 M3
325-8280000000-M-440	Approx.___KG Structural Steel	2,891,200 LS	3,071,200 LS
349-0199000000-M-SP	Temporary Shoring	**New Item**	265.5 M2

The Contractor's bid must be based on these revised pay item quantities. The contract will be prepared accordingly.

The Expedite File has been updated to reflect these revisions. Please download the Expedite Addendum File and follow the instructions for applying the addendum. Bid Express will not accept your bid unless the addendum has been applied.

Sincerely,

R. A. Garris, PE
Contract Officer

RAG/jag
Attachments
cc: Mr. Jon Nance, PE
Mr. Ron Hancock, PE
Mr. G. W. Burns, PE
Ms. D. M. Barbour, PE
Mr. Art McMillan, PE
Mr. J. V. Barbour, PE
Ms. Lori Strickland
Mr. R.E. Davenport, PE
Ms. Natalie Roskam, PE
Mr. Njoroge Wainaina, PE
Mr. G. R. Perfetti, PE
Mr. Larry Strickland
Mr. Ronnie Higgins
Project File (2)
Mr. John Sullivan (FHWA) Attn: Mr. Jake Riggsbee, PE

TABLE OF CONTENTS

COVER SHEET
PROPOSAL SHEETS

PROJECT SPECIAL PROVISIONS (GREEN SHEETS) *PAGE No.*

The completion date for this intermediate contract time will be the date which is **three hundred sixty-five (365)** consecutive calendar days after and including the date the Contractor begins this work, **or by May 15, 2015,** whichever is earlier.

The liquidated damages are **Ten Thousand Dollars ($10,000.00)** per calendar day.

INTERMEDIATE CONTRACT TIME NUMBER 2 AND LIQUIDATED DAMAGES
(2-20-07) M1 G14 E

The Contractor shall complete the required work of installing, maintaining and removing the traffic control devices for road closures **for the purpose of overhead structure work** and restoring traffic to **their existing patterns on -Y2- (Bragg Boulevard).** The Contractor shall not close **-Y2- (Bragg Boulevard)** during the following time restrictions:

DAY AND TIME RESTRICTIONS

Monday through Sunday from 5:00 A.M. to 12:00 A.M. (Midnight)

The time of availability for this intermediate contract time will be the time the Contractor begins to install traffic control devices required for the road closures according to the time restrictions stated herein.

The completion time for this intermediate contract time will be the time the Contractor is required to complete the removal of traffic control devices required for the road closures according to the time restrictions stated herein and restore traffic to **their existing traffic patterns along -Y2- (Bragg Boulevard).**

The liquidated damages are **Two Thousand Five Hundred Dollars ($2,500.00)** per **fifteen (15) minutes.**

INTERMEDIATE CONTRACT TIME NUMBER 3 AND LIQUIDATED DAMAGES
(2-20-07) SP1 G14 A

The Contractor shall complete the required work of installing, maintaining, and removing the traffic control devices for lane closures and restoring traffic to a **four-lane, two-way** traffic pattern. The Contractor shall not close or narrow a lane of traffic on **All American Freeway (SR 1007)** during the following time restrictions:

DAY AND TIME RESTRICTIONS

Monday through Friday
5:30 A.M. to 8:30 A.M.
and
4:30 P.M. to 6:00 P.M.

The time of availability for this intermediate contract work shall be the time the Contractor begins to install all traffic control devices for lane closures according to the time restrictions listed herein.

New 6-10-11

The completion time for this intermediate contract work shall be the time the Contractor is required to complete the removal of all traffic control devices for lane closures according to the time restrictions stated above and place traffic in a **four-lane, two-way** pattern.

This intermediate contract time does not apply during the time period in which traffic on All-American Freeway (SR 1007) is in a two-lane, two-way traffic pattern as detailed on sheets TCP-15 through TCP-20 and TCP-24 through TCP-31. No lane closures will be permitted during that time period except full closure for overhead girder installation.

The liquidated damages are **One Thousand Dollars ($1000.00)** per hour.

INTERMEDIATE CONTRACT TIME NUMBER 4 AND LIQUIDATED DAMAGES
(2-20-07) SP1 G14 D

The Contractor shall complete the required work of installing, maintaining and removing the traffic control devices for road closures for **installation of overhead girders over All American Freeway (-Y1-) (see Phase I, Step 2 on TCP-3) and installation of 750mm pipe at -Y1- Sta. 26+89+/- (see Phase I, Step 4 on TCP-3)** and restoring traffic to the existing traffic pattern. The Contractor shall not close **All American Freeway (-Y1-)** during the following time restrictions:

DAY AND TIME RESTRICTIONS

Monday through Sunday from 4:00 A.M. to 10:00 P.M.

The time of availability for this intermediate contract time will be the time the Contractor begins to install traffic control devices required for road closures according to the time restrictions stated herein.

The completion time for this intermediate contract time will be the time the Contractor is required to complete the removal of traffic control devices required for the road closures according to the time restrictions stated herein and restore traffic to the **existing** traffic pattern.

The liquidated damages are **Two Thousand Five Hundred Dollars ($ 2,500.00)** per **15 minutes**.

ACCESS TO FORT BRAGG:

The Contractor's access to the portions of the project are within the Fort Bragg Military Base boundary. Fort Bragg currently has an identification and access management program in affect. Those who desire streamlined access into Fort Bragg may enroll in the current program, RAPIDGate. An overview of the program may be viewed at http://www.eidpassport.com/government/overview.html. The user terms, agreements, and conditions current at the time the Contractor desires entry will apply. These enrollment conditions may be obtained by calling 1-877-727-4342, or by accessing the website address http://www.eidpassport.com/government/forms.html. Any other forms and entry requirements by Fort Bragg officials shall also be obtained by the Contractor.

Enrollment is this program is not mandatory but is highly suggested. Access may be granted by entering the Base through an existing full search Access Control Point (ACP). Valid proof of identification and proof of business is required of each individual attempting to enter the Installation. This process is required with every entry.

2.1.1 Ultimate Tensile Strength (T_{ULT})

Ultimate tensile strength shall be determined in accordance with ASTM D 6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

The geogrid shall provide a minimum cross machine (i.e., cross roll direction) tensile strength of 19 kN/m at five (5) percent strain and a minimum ultimate tensile strength of 28 kN/m determined in accordance with ASTM D 6637.

2.2 Permanent Turf Reinforcement Matting

The product shall be a permanent erosion control reinforcement mat and shall be constructed of synthetic fibers evenly distributed throughout the mat between a bottom UV stabilized netting and a heavy duty UV stabilized top net. The matting shall be stitched together with UV stabilized polypropylene thread to form a permanent three dimensional structure. The mat shall have the following minimum physical properties:

Property	**Test Method**	**Value**	**Unit**
Light Penetration	ASTM D6567	15	%
Thickness	ASTM D6525	12.7	mm
Mass Per Unit Area	ASTM D6566	0.339	kg/sq.m
Tensile Strength	ASTM D6818	5.6	kN/m
Elongation (Maximum)	ASTM D6818	49	%
Resiliency	ASTM D6524	>70	%
UV Stability *	ASTM D4355	>80	%
Porosity (Permanent Net)	Calculated	>85	%
Minimum Filament	Measured	0.76	mm
Maximum Permissible Shear Stress (Vegetated)	Performance Test	>380.0	Pa
Maximum Allowable Velocity	Performance Test	>4.8	m/s

*ASTM D1682 Tensile Strength and % strength retention of material after 1000 hours of exposure.

Submit a certification from the manufacturer showing:

(A) the chemical and physical properties of the mat used, and
(B) conformance of the mat with this specification.

payment, as payment for the work requiring the excavation will be considered adequate compensation for depositing and grading the material on the shoulders or slopes.

When undercut excavation is performed at the direction of the Engineer and the material excavated is found to be suitable for use as shoulder and fill slope material, and there is no area on the project currently prepared to receive the material generated by the undercut operation, the Contractor may construct a stockpile for use as borrow at a later date. Payment for the material used from the stockpile will be made at the contract unit price for *Borrow Excavation* or *Shoulder Borrow*.

When shoulder material is obtained from borrow sources or from stockpiled material, payment for the work of shoulder construction will be made at the contract unit price per cubic yard for *Borrow Excavation* or *Shoulder Borrow* in accordance with the applicable provisions of Section 230 or Section 560 of the *2006 Metric Standard Specifications*.

CHIPPED WASTE TIRES IN EMBANKMENTS:

(4-19-05) (Rev 4-15-08) SPI (Metric)

Description

Place chipped waste tires within the embankment to be constructed in accordance with the details on the plans and this special provision.

Material

The material shall be chipped waste tires. Ninety percent by volume of the chipped waste tires shall be 75 mm or less in size, measured in any direction, and 90% of the chipped waste tires, by volume, shall not have exposed wire extending more than 25 mm beyond any surface of the chip. The presence of loose wires shall be minimized by the Contractor to the extent deemed practical by the Engineer. The tire chips shall be free of any contaminates such as oil, grease, etc. that could leach into the ground water. The material that accumulates around shredding machinery and associated conveyor belts (fine steel cord wire, soil, etc.) should not be mixed with the shreds. All tire material shall be processed from scrap tires taken from within North Carolina.

The Contractor shall be responsible for securing all necessary permits, which may be required for the transport and storage of chipped tire material, from the North Carolina Department of Environment and Natural Resources, Division of Waste Management.

Construction Methods

Place chipped tires in the core of the embankment section. Chipped tires shall not be placed within 1.2 m of the outside limits of embankments, or subgrade, or below the elevation noted on the cross sections. See cross sections for the areas designated for chipped tire placement and typical sections for the "Chipped Tire Material Detail."

Embankments shall be constructed by placing alternate layers of mixed and blended chipped tires and embankment soil with layers of pure embankment soil. The mixing and blending shall

TEMPORARY SHORING:
(2-20-07) (Rev 9-25-07) M11 R02

Description

Design and construct temporary shoring in accordance with the contract. Temporary shoring includes standard shoring, temporary mechanically stabilized earth (MSE) walls and non-anchored temporary shoring. Trench boxes are not considered temporary shoring. "Standard shoring" refers to *standard temporary shoring* and *standard temporary MSE walls*. Notes on plans may restrict the use of one or both types of standard shoring. Notes on plans may also require or prohibit temporary MSE walls.

Unless noted otherwise on the plans, temporary shoring is required as shown on the plans and to maintain traffic. Temporary shoring to maintain traffic is defined as shoring necessary to provide lateral support to the side of an excavation or embankment parallel to an open travelway when a theoretical 2:1 (H:V) slope from the bottom of the excavation or embankment intersects the existing ground line closer than 1.5 m from the edge of pavement of the open travelway.

This provision is not applicable to anchored temporary shoring or the installation of pipes, drop inlets and utilities unless noted otherwise on the plans. Provide all shoring submittals before beginning work.

Materials

(A) Certifications, Storage and Handling

Provide Type 7 Contractor's Certifications in accordance with Article 106-3 of the *2006 Metric Standard Specifications* for all shoring materials used with the exception of reinforcing fabrics and geogrids. Furnish Type 2 Typical Certified Mill Test Reports in accordance with Article 106-3 of the *2006 Metric Standard Specifications* for all seam strengths and reinforcing fabric and geogrid properties. Provide minimum average roll values (MARV) in accordance with ASTM D4759 for test reports. For testing reinforcing fabric and geogrids, a lot is defined as a single day's production.

Load, transport, unload and store shoring materials such that they are kept clean and free of damage. Identify, store and handle all geogrids and geotextile fabrics in accordance with ASTM D4873. Geogrids and fabrics with defects, flaws, deterioration or damage will be rejected. Do not leave fabrics or geogrids uncovered for more than 7 days.

(B) Shoring Backfill

Use shoring backfill for the construction of all temporary shoring including backfilling behind non-anchored temporary shoring and in the reinforced zone for temporary MSE walls. Unless backfilling around culverts, use shoring backfill that meets the requirements of Class II Type I, Class III, Class V or Class VI select material in accordance with Section 1016 of the *2006 Metric Standard Specifications* or AASHTO

M145 for soil classification A-2-4 with a maximum plasticity index (PI) of 6. For backfilling around culverts, use shoring backfill as defined herein except for A-2-4 soil.

(C) Non-anchored Temporary Shoring

Use steel shapes, plates and piles that meet the requirements of ASTM A36 and steel sheet piles that meet the requirements of Article 1084-2 of the *2006 Metric Standard Specifications*. Use timber lagging with a minimum allowable bending stress of 6.9 MPa that meets the requirements of Article 1082-1 of the *2006 Metric Standard Specifications*. For standard temporary shoring, use pile sections and lengths and lagging sizes as shown on the plans.

(D) Temporary MSE Walls

Use welded wire reinforcement forms, facings, mesh and mats that meet the requirements of AASHTO M55 or M221. Use connector bars and wires for welded wire wall components and support struts that meet the requirements of AASHTO M32. For standard temporary MSE walls, use wire gauges, strut sizes and welded wire components as shown on the plans.

(1) Geotextile Fabrics

Use geotextile fabrics that meet the requirements of Article 1056-1 of the *2006 Metric Standard Specifications*.

(a) Reinforcing Fabric

The reinforcement direction (RD) is defined as the direction perpendicular to the wall face and the cross-reinforcement direction (CRD) is defined as the direction parallel to the wall face.

Use woven polyester or polypropylene fabric that meets the following properties:

Property	Test Method	Requirement (MARV)
Wide Width Tensile Strength @ Ultimate (RD)	ASTM D4595	Varies – 35 kN/m min
Wide Width Tensile Strength @ Ultimate (CRD)	ASTM D4595	18 kN/m min
Trapezoidal Tear Strength	ASTM D4533	0.44 kN min
CBR Puncture Strength	ASTM D6241	2.67 kN min
UV Resistance after 500 hrs	ASTM D4355	70 %
Apparent Opening Size (AOS), US Sieve	ASTM D4751	0.212 mm min – 0.850 mm max
Permittivity	ASTM D4491	0.20 sec^{-1}

For standard temporary MSE walls (temporary fabric wall) use reinforcing fabric wide width tensile strengths and lengths in the RD as shown on the plans.

(b) Retention Fabric

Retain shoring backfill at the face of temporary MSE walls with retention fabric. Use fabric that meets the requirements of Class 3 and the UV resistance, AOS and permittivity for separation geotextile in accordance with AASHTO M288.

(2) SierraScape Temporary Wall

Use uniaxial (UX) geogrids composed of high-density polyethylene (HDPE) manufactured by Tensar Earth Technologies. Test geogrids in accordance with ASTM D6637. Use connection rods manufactured by Tensar Earth Technologies to transfer the load between the facings and geogrids.

For standard temporary MSE walls (SierraScape temporary wall) use geogrid types and lengths as shown on the plans.

(3) Terratrel Temporary Wall

Use ribbed reinforcing steel strips manufactured by The Reinforced Earth Company that meet the requirements of ASTM A572, Grade 450. Use connector rods that meet the requirements of AASHTO M31, Grade 415 and hair pin connectors that meet the requirements of ASTM A1011, Grade 345. Use bolts, nuts and washers that meet the requirements of AASHTO M164.

For standard temporary MSE walls (Terratrel temporary wall) use ribbed steel strip size and lengths, rod lengths and diameters, hairpin connectors, bolts, nuts and washers as shown on the plans.

Embedment

"Embedment" is defined as the depth of shoring below the bottom of the excavation or the grade in front of the shoring. For cantilever shoring, embedment is the depth of the piling below the grade in front of the shoring. For temporary MSE walls, embedment is the difference between the grade elevation in front of the wall and the elevation of the bottom of the reinforced zone.

Portable Concrete Barriers

Provide portable concrete barriers in accordance with the plans and if shoring is located within the clear zone as defined in the *AASHTO Roadside Design Guide*. Use NCDOT portable concrete barriers (PCBs) in accordance with Roadway Metric Standard Drawing No. 1170.01

and Section 1170 of the *2006 Metric Standard Specifications*. Use Oregon Tall F-Shape Concrete Barriers in accordance with detail drawing and special provision obtained from:

http://www.ncdot.org/doh/preconstruct/wztc/DesRes/English/DesResEng.html

The clear distance is defined as the horizontal distance from the back face of the barrier to the edge of pavement and the minimum required clear distance is shown on the traffic control plans. At the Contractor's option or if the minimum required clear distance is not available, set an unanchored PCB against the traffic side of the shoring and design shoring for traffic impact or use the "surcharge case with traffic impact" for the standard temporary shoring. An anchored PCB or Oregon barrier is required for barriers above and behind temporary MSE walls.

Contractor Designed Shoring

"Contractor designed shoring" is defined as non-anchored temporary shoring or temporary MSE walls designed by the Contractor. Unless prohibited or required, Contractor designed shoring is optional. Contractor designed shoring is required when notes on plans prohibit the use of standard shoring. Non-anchored Contractor designed shoring is prohibited when notes on plans require the use of temporary MSE walls and Contractor designed temporary MSE walls are prohibited when notes on plans prohibit the use of temporary MSE walls.

Before beginning design, survey the shoring location to determine existing elevations and actual design heights. Submit design calculations and drawings including typical sections for review and acceptance showing details of the proposed design and construction sequence in accordance with Article 105-2 of the *2006 Metric Standard Specifications*. Have shoring designed, detailed and sealed by a Professional Engineer registered in the State of North Carolina. Submit 3 hard copies of design calculations and 10 hard copies of drawings and an electronic copy (pdf or jpeg format on CD or DVD) of both the calculations and drawings.

Design non-anchored temporary shoring in accordance with the *AASHTO Guide Design Specifications for Bridge Temporary Works* and temporary MSE walls in accordance with the *AASHTO Allowable Stress Design Standard Specifications for Highway Bridges*. Use the following soil parameters for shoring backfill in the reinforced zone.

Total Unit Weight = 18.8 kN/m^3
Friction Angle = 30 degrees
Cohesion = 0 kPa

Design temporary shoring in accordance with the in-situ assumed soil parameters shown on the plans. Design shoring for a 3-year design service life and a traffic surcharge equal to 11.5 kPa. This surcharge is not applicable for construction traffic. If a construction surcharge will be present within a horizontal distance equal to the height of the shoring, design the shoring for the required construction surcharge. If the edge of pavement or a structure to be protected is within a horizontal distance equal to the height of the shoring, design shoring for a maximum deflection of 75 mm. Otherwise, design shoring for a maximum deflection of 150 mm.

For non-anchored temporary shoring, the top of shoring elevation is defined as the elevation where the grade intersects the back face of the shoring. For traffic impact, apply 29.2 kN/m to the shoring 450 mm above the top of shoring elevation. When designing for traffic impact, extend shoring at least 800 mm above the top of shoring elevation. Otherwise, extend shoring at least 150 mm above the top of shoring elevation.

Standard Shoring

Unless notes on plans prohibit the use of one or both types of standard shoring, standard shoring is optional. Submit a "Standard Temporary MSE Wall Selection Form" for each standard temporary MSE wall location and a "Standard Temporary Shoring Selection Form" for up to three standard temporary shoring locations. Submit selection forms at least 14 days before beginning shoring construction. Obtain standard shoring selection forms from:

http://www.ncdot.org/doh/preconstruct/highway/geotech/formdet/

(A) Standard Temporary Shoring

Determine the shoring height, traffic impact, groundwater condition and slope or surcharge case for each standard temporary shoring location. Determine the minimum required extension, embedment and sheet pile section modulus or H pile section from the plans for each location.

(B) Standard Temporary MSE Walls

Choose a standard temporary MSE wall from the multiple temporary MSE wall options shown in the plans. Do not use more than one option per wall location.

Step bottom of reinforced zone in increments equal to vertical reinforcement spacing for the wall option chosen. Determine the wall height and slope or surcharge case for each section of standard temporary MSE wall. With the exception of either the first or last section of wall, use horizontal section lengths in increments equal to the following for the wall option chosen.

Standard Temporary MSE Wall Option	Increment
Temporary Fabric Wall	2.7 m min (varies)
Hilfiker Temporary Wall	3.0 m min (varies)
SierraScape Temporary Wall	5.7 m
Retained Earth Temporary Wall	7.3 m
Terratrel Temporary Wall	6.0 m

Determine the appropriate facings and/or forms and reinforcement length, spacing, strength, type, density and/or size from the plans for each wall section.

Construction Methods

When using an anchored PCB, anchor the barrier in accordance with Roadway Metric Standard Drawing 1170.01 and Section 1170 of the *2006 Metric Standard Specifications*. Control drainage during construction in the vicinity of temporary shoring. Collect and direct run off away from temporary MSE walls, shoring and shoring backfill.

(A) Non-anchored Temporary Shoring

Install and interlock sheet piling or install piles as shown on the plans or accepted submittals with a tolerance of 42 mm per meter from vertical. Contact the Engineer if the design embedment is not achieved. If piles are placed in drilled holes, perform pile excavation to the required elevations and backfill excavations with concrete and lean sand grout.

Remove grout as necessary to install timber lagging. Install timber lagging with a minimum bearing distance of 75 mm on each pile flange. Backfill voids behind lagging with shoring backfill.

Perform welding in accordance with the accepted submittals and Article 1072-20 of the *2006 Metric Standard Specifications*.

(1) Pile Excavation

Excavate a hole with a diameter that will result in at least 75 mm of clearance around the entire pile. Use equipment of adequate capacity and capable of drilling through soil and non-soil including rock, boulders, debris, man-made objects and any other materials encountered. Blasting is not permitted to advance excavations. Blasting for core removal is permitted only when approved by the Engineer. Dispose of drilling spoils in accordance with Section 802 of the *2006 Metric Standard Specifications*. Drilling spoils consist of all excavated material including water removed from excavations by either pumping or drilling tools.

If unstable, caving or sloughing soils are encountered, stabilize excavations with clean watertight steel casing. Steel casings may be either sectional type or one continuous corrugated or non-corrugated piece. Provide casings of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill. Use steel casings with an outside diameter equal to the hole size and a minimum wall thickness of 6 mm.

Before placing concrete, check the water inflow rate in the excavation after any pumps have been removed. If the inflow rate is less than 150 mm per half hour, remove any water and free fall the concrete into the excavation. Ensure that concrete flows completely around the pile. If the water inflow rate is greater than 150 mm per half hour, propose and obtain approval of the concrete placement procedure before placing concrete.

Center the pile in the excavation and fill the excavation with Class A concrete in accordance with Section 1000 of the *2006 Metric Standard Specifications* except as modified herein. Provide concrete with a slump of 150 to 200 mm. Use an approved high-range water reducer to achieve this slump. Place concrete in a continuous manner to the bottom of shoring or the elevations shown on the accepted submittals. Fill the remainder of the excavation with a lean sand grout and remove all casings.

(B) Temporary MSE Walls

The Engineer may require a wall preconstruction meeting to discuss the construction and inspection of the temporary MSE walls. If required, conduct the meeting with the Site Superintendent, the Resident or Bridge Maintenance Engineer, the Bridge Construction Engineer and the Geotechnical Operations Engineer before beginning wall construction.

Perform all necessary clearing and grubbing in accordance with Section 200 of the *2006 Metric Standard Specifications*. Excavate as necessary as shown on the plans or accepted submittals. Notify the Engineer when foundation excavation is complete. Do not place shoring backfill or first reinforcement layer until obtaining approval of the excavation depth and foundation material.

If applicable, install foundations located within the reinforced zone in accordance with the plans or accepted submittals.

Erect and maintain facings and forms as shown on the plans or accepted submittals. Stagger vertical joints of facings and forms to create a running bond when possible unless shown otherwise on the plans or accepted submittals.

Place facings and forms as near to vertical as possible with no negative batter. Construct temporary MSE walls with a vertical and horizontal tolerance of 75 mm when measured with a 3 m straight edge and an overall vertical plumbness (batter) and horizontal alignment of less than 150 mm.

Place reinforcement at locations and elevations shown on the plans or accepted submittals and in slight tension free of kinks, folds, wrinkles or creases. Repair or replace any damaged reinforcement. Contact the Engineer when existing or future structures such as foundations, pavements, pipes, inlets or utilities will interfere with reinforcement. To avoid structures, deflect, skew and modify reinforcement.

Do not splice reinforcement in the reinforcement direction (RD), i.e., parallel to the wall face. Seams are allowed in the cross-reinforcement direction (CRD). Bond or sew adjacent reinforcing fabric together or overlap fabric a minimum of 450 mm with seams oriented perpendicular to the wall face.

Place shoring backfill in 200 to 250 mm thick lifts and compact in accordance with Subarticle 235-4(C) of the *2006 Metric Standard Specifications*. Use only hand operated

compaction equipment within 1 m of the wall face. Do not damage reinforcement when placing and compacting shoring backfill. End dumping directly on the reinforcement is not permitted. Do not operate heavy equipment on reinforcement until it is covered with at least 250 mm of shoring backfill. Do not use sheepsfoot, grid rollers or other types of compaction equipment with feet.

Cover reinforcing and retention fabric with at least 75 mm of shoring backfill. Place top reinforcement layer between 100 to 600 mm below top of wall as shown on the plans or accepted submittals.

Bench temporary MSE walls into the sides of excavations where applicable. If the top of wall is within 1.5 m of finished grade, remove top form or facing and incorporate the top reinforcement layer into the fill when placing fill in front of the wall. Temporary MSE walls remain in place permanently unless required otherwise.

Measurement and Payment

Temporary Shoring will be measured and paid for at the contract unit price per square meter of exposed face area at locations shown on the plans or required by the Engineer. For temporary MSE walls, the wall height will be measured as the difference between the top and bottom of wall and does not include the embedded portions of the wall or any pavement thickness above the wall. For all other temporary shoring, the shoring height will be measured as the difference between the top and bottom of shoring elevation. The bottom of shoring elevation is defined as where the grade intersects the front face of the shoring. The top of shoring elevation is defined as where the grade intersects the back face of the shoring. No payment will be made for any extension of shoring above the top of shoring or any embedment below the bottom of shoring. Such price and payment will be full compensation for furnishing all labor, tools, equipment, materials and all incidentals necessary to design and install the temporary shoring and complete the work as described in this provision.

No payment will be made for temporary shoring not shown on the plans or required by the Engineer including shoring for OSHA reasons or the Contractor's convenience. No value engineering proposals will be accepted based solely on revising or eliminating the shoring locations shown on the plans or the estimated quantities shown in the bid item sheets as a result of actual field measurements or site conditions.

No additional payment will be made for anchoring PCBs or providing Oregon barriers in lieu of unanchored PCBs. Additional costs for anchoring PCBs or providing Oregon barriers will be considered incidental to *Temporary Shoring*.

Payment will be made under:

Pay Item	**Pay Unit**
Temporary Shoring	Square Meter

ANCHORED TEMPORARY SHORING: **(SPECIAL)**

Description

Anchored temporary shoring consists of sheet piling or H piles with timber lagging anchored with ground or helical anchors. At the Contractor's option, use anchored temporary shoring in lieu of temporary shoring. Design and construct anchored temporary shoring based on actual elevations and dimensions in accordance with the contract and accepted submittals. For this provision, "anchored shoring" refers to anchored temporary shoring and "Anchored Shoring Contractor" refers to the contractor installing the anchors. Use an Anchored Shoring Contractor prequalified by the NCDOT Contractual Services Unit for anchored retaining walls work (work code 3020).

Materials

Provide Type 7 Contractor's Certifications in accordance with Article 106-3 of the *Standard Specifications* for anchored shoring materials. Store steel materials on blocking a minimum of 12" (300 mm) above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Load, transport, unload and store anchored shoring materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Use steel piles meeting the requirements of Section 1084 of the *Standard Specifications*. For steel shapes and plates not addressed below, use steel materials meeting the requirements of ASTM A36. Use timber lagging with a minimum allowable bending stress of 1000 psi (6.9 MPa) that meets the requirements of Article 1082-1 of the *Standard Specifications*.

(A) Ground Anchors

A ground anchor consists of a grouted steel bar or strands with miscellaneous elements. Use high-strength steel bars meeting the requirements of AASHTO M275 or seven-wire strands meeting the requirements of ASTM A886 or Article 1070-5 of the *Standard Specifications*. Splice bars in accordance with Article 1070-10 of the *Standard Specifications*. Do not splice strands.

Provide bondbreakers, spacers and centralizers meeting the requirements of Section 6.3.5 of the *AASHTO LRFD Bridge Construction Specifications*. Use grout in accordance with the contract.

(B) Helical Anchors

A helical anchor consists of a lead section with a central steel shaft and at least one helix steel plate followed by extensions with only central shafts (no helixes). Use helical anchors with an ICC Evaluation Service, Inc. (ICC-ES) report. Helical anchors without an ICC-ES report may be approved at the discretion of the Engineer. Provide couplers,

thread bar adapters and bolts for connecting helical anchors together and to piling in accordance with the anchor manufacturer's recommendations.

(C) Anchorages

Anchorages consist of steel bearing plates with washers and hex nuts for bars or steel wedge plates and wedges for strands. Provide bearing plates meeting the requirements of Section 6.3.3 of the *AASHTO LRFD Bridge Construction Specifications* and washers, hex nuts, wedge plates and wedges in accordance with the anchor manufacturer's recommendations.

(D) Shoring Backfill

Use shoring backfill meeting the requirements of Class II Type I, Class III, Class V or Class VI Select Material in accordance with Section 1016 of the *Standard Specifications* or AASHTO M145 for soil classification A-2-4 with a maximum plasticity index (PI) of 6.

Design

Before beginning design, survey Contractor designed shoring locations to determine existing elevations and actual design heights. Design anchored shoring in accordance with the plans and the *FHWA Geotechnical Engineering Circular No. 4 "Ground Anchors and Anchored Systems"* (Publication No. FHWA-IF-99-015). Do not embed anchored shoring below bottom of excavation or the grade in front of shoring. Backfill voids and fill sections behind lagging and piling with shoring backfill.

Provide portable concrete barriers in accordance with the contract for barriers for temporary shoring. The top of shoring elevation is defined as the elevation where the grade intersects the back face of the anchored shoring. For traffic impact, apply 2 kips/ft (29.2 kN/m) to the anchored shoring 18" (450 mm) above the top of shoring elevation. When designing for traffic impact, extend anchored shoring at least 32" (800 mm) above the top of shoring elevation. Otherwise, extend anchored shoring at least 6" (150 mm) above the top of shoring elevation.

Design anchored shoring for a 3-year design service life and a traffic surcharge equal to 240 psf (11.5 kPa). This surcharge is not applicable for construction traffic. If a construction surcharge will be present within a horizontal distance equal to the height of the shoring, design the anchored shoring for the required construction surcharge.

Do not extend anchors beyond right-of-way or easement lines. Extend the unbonded length for ground anchors or the shallowest helix for helical anchors at least 5 ft (1.5 m) behind the critical failure surface. If existing or future obstructions such as foundations, guardrail posts, pavements, pipes, inlets or utilities will interfere with anchors, maintain a minimum clearance of 6" (150 mm) between the obstruction and the anchors.

Determine anchor loads for ground and helical anchors in accordance with Geotechnical Engineering Circular No. 4. Size anchors such that design loads do not exceed 60% of bar, strand or central shaft tensile strengths. Also, size anchors such that maximum test loads do not exceed 80% of bar, strand or central shaft tensile strengths and lock-off loads do not exceed 70% of tensile strengths.

Submit anchored shoring designs including unit grout/ground bond strengths and lock-off loads for ground anchors and installation torque requirements for helical anchors for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, shoring profiles with anchor locations and typical sections with anchor, piling and shoring details. If necessary, include details on working drawings for obstructions interfering with anchors or extending through shoring. Also, submit a sequence and step-by-step description of anchored shoring construction including details of piling installation, excavations and temporary support of excavations and anchor installation and testing. Submit design calculations for each anchored shoring section with different surcharge loads, shoring geometry or material parameters. A minimum of one analysis is required for each shoring section with different anchor lengths. Submit 3 hard copies of design calculations and 10 hard copies of drawings and an electronic copy (PDF on CD or DVD) of both the calculations and drawings. Have anchored shoring designed, detailed and sealed by a Professional Engineer registered in North Carolina.

Construction Methods

When using an anchored NCDOT portable concrete barrier (PCB), anchor the barrier in accordance with Roadway Standard Drawing 1170.01 and Section 1170 of the *Standard Specifications*. Control drainage during construction in the vicinity of anchored shoring. Direct run off away from anchored shoring and areas above and behind shoring.

Before starting anchored shoring construction, conduct a preconstruction meeting to discuss the construction, inspection and testing of the anchored shoring. Schedule this meeting after all anchored shoring submittals have been accepted. The Resident or Bridge Maintenance Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and Anchored Shoring Contractor Superintendent and Project Manager will attend this preconstruction meeting.

Notify the Engineer before blasting in the vicinity of anchored shoring. Perform blasting in accordance with the contract. Install foundations located behind anchored shoring and within a horizontal distance equal to the longest anchor length before beginning anchored shoring construction.

Install piling with a tolerance of 1/2 inch per foot (42 mm per meter) from vertical and in accordance with the accepted submittals and this provision. Contact the Engineer if the design pile embedment is not achieved. If piles are placed in drilled holes, perform pile excavation to the required elevations and backfill excavations with concrete and lean sand grout.

Construct anchored shoring from the top down by excavating material in front of shoring in accordance with the accepted submittals. Remove grout as necessary to install timber lagging

and ensure at least 3" (75 mm) of contact in the horizontal direction between the lagging and pile flanges. Do not excavate the next lift until the timber lagging for the preceding lift is installed and the preceding row of anchors are accepted by the Engineer.

Perform any welding in accordance with Article 1072-20 of the *Standard Specifications* and the accepted submittals.

(A) Pile Excavation

Excavate holes with diameters that result in at least 3" (75 mm) of clearance all around piles. Use equipment of adequate capacity and capable of drilling through soil and non-soil including rock, boulders, debris, man-made objects and any other materials encountered. Blasting is not permitted to advance excavations. Blasting for core removal is permitted only when approved by the Engineer. Dispose of drilling spoils in accordance with Section 802 of the *Standard Specifications*. Drilling spoils consist of all excavated material including water removed from excavations by either pumping or drilling tools.

If unstable, caving or sloughing soils are encountered, stabilize excavations with clean watertight steel casing. Steel casings may be either sectional type or one continuous corrugated or non-corrugated piece. Provide casings of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth and backfill. Use steel casings with an outside diameter equal to the hole size and a minimum wall thickness of 1/4 inch (6 mm).

Before placing concrete, check the water inflow rate in the excavation after any pumps have been removed. If the inflow rate is less than 6" (150 mm) per half hour, remove any water and free fall the concrete into the excavation. Ensure that concrete flows completely around the pile. If the water inflow rate is greater than 6" (150 mm) per half hour, propose and obtain approval of the concrete placement procedure before placing concrete.

Center the pile in the excavation and fill the excavation with Class A Concrete in accordance with Section 1000 of the *Standard Specifications* except as modified herein. Provide concrete with a slump of 6 to 8 inches (150 to 200 mm). Use an approved high-range water reducer to achieve this slump. Place concrete in a continuous manner to the bottom of shoring or the elevations shown on the accepted submittals. Fill the remainder of the excavation with a lean sand grout and remove all casings.

(B) Anchor Fabrication and Installation

Fabricate and install ground anchors in accordance with the accepted submittals, Sections 6.4 and 6.5 of the *AASHTO LRFD Bridge Construction Specifications* and the following requirements unless otherwise approved.

- Materials in accordance with this provision are required instead of materials conforming to Sections 6.4 and 6.5.3 of the AASHTO LRFD Specifications

- Encapsulation-protected ground anchors in accordance with Section 6.4.1.2 of the AASHTO LRFD specifications are not required
- Corrosion protection for unbonded lengths of ground anchors and anchorage covers are not required

Install helical anchors in accordance with the accepted submittals and the anchor manufacturer's instructions. Measure the torque during installation and do not exceed the torsion strength rating of the helical anchors. Satisfy the minimum installation torque and length requirements before terminating anchor installation. When replacing helical anchors, embed the last helix of the replacement anchor at least 3 helix plate diameters past where the first helix of the previous anchor was located.

(C) Anchor Testing

Proof test and lock-off all anchors in accordance with the accepted submittals and Section 6.5.5 of the *AASHTO LRFD Bridge Construction Specifications* with the exception of the acceptance criteria in Section 6.5.5.5. For the AASHTO LRFD specifications, "ground anchor" refers to a ground or helical anchor and "tendon" refers to a bar or strand for a ground anchor and a central shaft for a helical anchor.

(D) Anchor Acceptance

Anchor acceptance is based on the following criteria.

(1) For ground and helical anchors, total movement is less than 0.04" (1 mm) between the 1 and 10 minute readings or less than 0.08" (2 mm) between the 6 and 60 minute readings.

(2) For ground anchors, total movement at maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

(E) Anchor Test Results

Submit 2 original hard copies of anchor test records including movement versus load plots for each load increment within 24 hours of completing each row of anchors. The Engineer will review the test records to determine if the anchors are acceptable.

If the Engineer determines an anchor is unacceptable, revise the anchored shoring design and/or installation methods. Submit a revised anchored shoring design for review and acceptance and provide an acceptable anchor with the revised design and/or installation methods at no additional cost to the Department. If required, replace the anchor and/or provide additional anchors with the revised design and/or installation methods at no additional cost to the Department.

After completing anchor testing for each anchored shoring, submit electronic copies (PDF on CD or DVD) of all corresponding test records.

Measurement and Payment

If the Contractor elects to use anchored temporary shoring in lieu of temporary shoring, the anchored shoring will be paid for at the contract unit price for *Temporary Shoring*. Anchored temporary shoring will be measured as the exposed face area with the shoring height equal to the difference between the top and bottom of shoring elevation. The top of shoring elevation is defined as where the grade intersects the back face of the anchored shoring. The bottom of shoring elevation is defined as where the grade intersects the front face of the anchored shoring. No payment will be made for portions of anchored temporary shoring below bottom of shoring elevations or any extension of anchored shoring above top of shoring.

The contract unit price for *Temporary Shoring* will be full compensation for design, submittals, furnishing labor, tools, equipment and shoring materials, excavating, welding, installing piles and anchors, grouting, testing anchors and providing timber lagging, backfill and any incidentals necessary to design and construct anchored shoring in accordance with this provision.