

**Project Special Provisions
Culvert**

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Quang H. Nguyen 12-8-04

PROJECT SPECIAL PROVISIONS
CULVERT

PROJECT R-2813C

BUNCOMBE COUNTY

FALSEWORK AND FORMWORK

(10-12-01)

1.0 DESCRIPTION

Use this Special Provision as a guide to develop temporary works submittals required by the Standard Specifications or other provisions; no additional submittals are required herein. Such temporary works include, but are not limited to, falsework and formwork.

Falsework is any temporary construction used to support the permanent structure until it becomes self-supporting. Formwork is the temporary structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Access scaffolding is a temporary structure that functions as a work platform that supports construction personnel, materials, and tools, but is not intended to support the structure. Scaffolding systems that are used to temporarily support permanent structures (as opposed to functioning as work platforms) are considered to be falsework under the definitions given. Shoring is a component of falsework such as horizontal, vertical, or inclined support members. Where the term "temporary works" is used, it includes all of the temporary facilities used in bridge construction that do not become part of the permanent structure.

Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to achieve the lines and grades shown on the plans in the final structure.

2.0 MATERIALS

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

3.0 DESIGN REQUIREMENTS

A. Working Drawings

Provide working drawings for items as specified in the contract, or as required by the Engineer, with design calculations and supporting data in sufficient detail to permit a structural and safety review of the proposed design of the temporary work.

When concrete placement is involved, include data such as the drawings of proposed sequence, rate of placement, direction of placement, and location of all construction joints. Submit the number of copies as called for by the contract.

When required, have the drawings and calculations prepared under the guidance of, and sealed by, a North Carolina Registered Professional Engineer who is knowledgeable in temporary works design.

Design falsework and formwork requiring submittals in accordance with the 1995 AASHTO *Guide Design Specifications for Bridge Temporary Works* except as noted herein.

1. Wind Loads

Table 2.2 of Article 2.2.5.1 is modified to include wind velocities up to 110 mph (177 km/hr). In addition, Table 2.2A is included to provide the maximum wind speeds by county in North Carolina.

Table 2.2 - Wind Pressure Values

Height Zone feet (m) above ground	Pressure, lb/ft ² (kPa) for Indicated Wind Velocity, mph (km/hr)				
	70 (112.7)	80 (128.7)	90 (144.8)	100 (160.9)	110 (177.0)
0 to 30 (0 to 9.1)	15 (0.72)	20 (0.96)	25 (1.20)	30 (1.44)	35 (1.68)
30 to 50 (9.1 to 15.2)	20 (0.96)	25 (1.20)	30 (1.44)	35 (1.68)	40 (1.92)
50 to 100 (15.2 to 30.5)	25 (1.20)	30 (1.44)	35 (1.68)	40 (1.92)	45 (2.15)
over 100 (30.5)	30 (1.44)	35 (1.68)	40 (1.92)	45 (2.15)	50 (2.39)

2. Time of Removal

The following requirements replace those of Article 3.4.8.2.

Do not remove forms until the concrete has attained strengths required in Article 420-17 of the Standard Specifications and these Special Provisions.

Do not remove forms until the concrete has sufficient strength to prevent damage to the surface.

Table 2.2A - Steady State Maximum Wind Speeds by Counties in North Carolina

COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)
Alamance	70 (112.7)	Franklin	70 (112.7)	Pamlico	100 (160.9)
Alexander	70 (112.7)	Gaston	70 (112.7)	Pasquotank	100 (160.9)
Alleghany	70 (112.7)	Gates	90 (144.8)	Pender	100 (160.9)
Anson	70 (112.7)	Graham	80 (128.7)	Perquimans	100 (160.9)
Ashe	70 (112.7)	Granville	70 (112.7)	Person	70 (112.7)
Avery	70 (112.7)	Greene	80 (128.7)	Pitt	90 (144.8)
Beaufort	100 (160.9)	Guilford	70 (112.7)	Polk	80 (128.7)
Bertie	90 (144.8)	Halifax	80 (128.7)	Randolph	70 (112.7)
Bladen	90 (144.8)	Harnett	70 (112.7)	Richmond	70 (112.7)
Brunswick	100 (160.9)	Haywood	80 (128.7)	Robeson	80 (128.7)
Buncombe	80 (128.7)	Henderson	80 (128.7)	Rockingham	70 (112.7)
Burke	70 (112.7)	Hertford	90 (144.8)	Rowan	70 (112.7)
Cabarrus	70 (112.7)	Hoke	70 (112.7)	Rutherford	70 (112.7)
Caldwell	70 (112.7)	Hyde	110 (177.0)	Sampson	90 (144.8)
Camden	100 (160.9)	Iredell	70 (112.7)	Scotland	70 (112.7)
Carteret	110 (177.0)	Jackson	80 (128.7)	Stanley	70 (112.7)
Caswell	70 (112.7)	Johnston	80 (128.7)	Stokes	70 (112.7)
Catawba	70 (112.7)	Jones	100 (160.9)	Surry	70 (112.7)
Cherokee	80 (128.7)	Lee	70 (112.7)	Swain	80 (128.7)
Chatham	70 (112.7)	Lenoir	90 (144.8)	Transylvania	80 (128.7)
Chowan	90 (144.8)	Lincoln	70 (112.7)	Tyrell	100 (160.9)
Clay	80 (128.7)	Macon	80 (128.7)	Union	70 (112.7)
Cleveland	70 (112.7)	Madison	80 (128.7)	Vance	70 (112.7)
Columbus	90 (144.8)	Martin	90 (144.8)	Wake	70 (112.7)
Craven	100 (160.9)	McDowell	70 (112.7)	Warren	70 (112.7)
Cumberland	80 (128.7)	Mecklenburg	70 (112.7)	Washington	100 (160.9)
Currituck	100 (160.9)	Mitchell	70 (112.7)	Watauga	70 (112.7)
Dare	110 (177.0)	Montgomery	70(112.7)	Wayne	80 (128.7)
Davidson	70 (112.7)	Moore	70 (112.7)	Wilkes	70 (112.7)
Davie	70 (112.7)	Nash	80 (128.7)	Wilson	80 (128.7)
Duplin	90 (144.8)	New Hanover	100 (160.9)	Yadkin	70 (112.7)
Durham	70 (112.7)	Northampton	80 (128.7)	Yancey	70 (112.7)
Edgecombe	80 (128.7)	Onslow	100 (160.9)		
Forsyth	70 (112.7)	Orange	70 (112.7)		

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize, metallize or otherwise protect these devices as directed by the Engineer. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

B. Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings.

Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

Do not start construction of any temporary work for which working drawings are required until the drawings have been approved. Such approval does not relieve the Contractor of the responsibility for the accuracy and adequacy of the working drawings.

The time period for review of the working drawings does not begin until complete drawings and design calculations, when required, are received by the Engineer.

On the drawings, show all information necessary to allow the design of any component to be checked independently as determined by the Engineer.

If requested by the Engineer, submit with the working drawings manufacturer's catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

4.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

Construct temporary works in conformance with the approved working drawings. Ensure that the quality of materials and workmanship employed is consistent with that assumed in the design of the temporary works. Do not weld falsework members to any portion of the permanent structure unless approved. Show any welding to the permanent structure on the approved construction drawings.

Provide tell-tales attached to the forms and extending to the ground, or other means, for accurate measurement of falsework settlement. Make sure that the anticipated compressive settlement and/or deflection of falsework does not exceed 1 inch (25 mm). For cast-in-place concrete structures, make sure that the calculated deflection of falsework

flexural members does not exceed $1/240$ of their span regardless of whether or not the deflection is compensated by camber strips.

A. Maintenance and Inspection

Inspect and maintain the temporary work in an acceptable condition throughout the period of its use. Certify that the manufactured devices have been maintained in a condition to allow them to safely carry their rated loads. Clearly mark each piece so that its capacity can be readily determined at the job site.

Perform an in-depth inspection of an applicable portion(s) of the temporary works, in the presence of the Engineer, not more than 24 hours prior to the beginning of each concrete placement. Inspect other temporary works at least once a month to ensure that they are functioning properly. Have a North Carolina Registered Professional Engineer inspect the cofferdams, shoring, sheathing, support of excavation structures, and support systems for load tests prior to loading.

B. Foundations

Determine the safe bearing capacity of the foundation material on which the supports for temporary works rest. If required by the Engineer, conduct load tests to verify proposed bearing capacity values that are marginal or in other high-risk situations.

The use of the foundation support values shown on the contract plans of the permanent structure is permitted if the foundations are on the same level and on the same soil as those of the permanent structure.

Allow for adequate site drainage or soil protection to prevent soil saturation and washout of the soil supporting the temporary works supports.

If piles are used, the estimation of capacities and later confirmation during construction using standard procedures based on the driving characteristics of the pile is permitted. If preferred, use load tests to confirm the estimated capacities; or, if required by the Engineer conduct load tests to verify bearing capacity values that are marginal or in other high risk situations.

The Engineer reviews and approves the proposed pile and soil bearing capacities.

5.0 REMOVAL

Unless otherwise permitted, remove and keep all temporary works upon completion of the work. Do not disturb or otherwise damage the finished work.

Remove temporary works in conformance with the contract documents. Remove them in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight.

6.0 METHOD OF MEASUREMENT

Unless otherwise specified, temporary works will not be directly measured.

7.0 BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items requiring temporary works will be full compensation for the above falsework and formwork.

SUBMITTAL OF WORKING DRAWINGS

(8-13-04)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the Standard Specifications and the requirements of this Special Provision. The list of submittals contained herein does not represent a list of required submittals for this project. Submittals are only necessary for those items as required by the Standard Specifications, other Special Provisions, or contract plans. Make submittals that are not specifically noted in this Special Provision directly to the Resident Engineer.

If submittals contain variations from plan details or specifications, significantly affect project cost, or significantly affect field construction or operations, discuss them with, and submit them through, the Resident Engineer. State the reason for the proposed variation in the submittals. To minimize overall review time, make sure all working drawing submittals are complete when first submitted. Provide a contact name and phone number with each submittal. Direct any questions regarding working drawing submittal requirements to the Resident Engineer, Structure Design Unit contacts or the Geotechnical Engineering Unit contacts noted below.

2.0 WORKING DRAWINGS SUBMITTAL CONTACTS

All submittals noted herein are reviewed by the Structure Design Unit and/or the Geotechnical Engineering Unit.

For submittals to the Structure Design Unit, use the following addresses:

Via US mail:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1581 Mail Service Center
Raleigh, NC 27699-1581
Attention: Mr. P. D. Lambert, P. E.

Via other delivery service:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1000 Birch Ridge Drive
Raleigh, NC 27610
Attention: Mr. P. D. Lambert, P. E.

For submittals to the Geotechnical Engineering Unit, use the following addresses:

For projects in Divisions 1-7, use the following Eastern Regional Office address:

Via US mail:

Mr. K. J. Kim, Ph. D., P. E.
 Eastern Regional Geotechnical
 Manager
 North Carolina Department
 of Transportation
 Geotechnical Engineering Unit
 Eastern Regional Office
 1570 Mail Service Center
 Raleigh, NC 27699-1570

Via other delivery service:

Mr. K. J. Kim, Ph. D., P. E.
 Eastern Regional Geotechnical
 Manager
 North Carolina Department
 of Transportation
 Geotechnical Engineering Unit
 Eastern Regional Office
 3301 Jones Sausage Road, Suite 100
 Garner, NC 27529

For projects in Divisions 8-14, use the following Western Regional Office address:

Via US mail:

Mr. John Pilipchuk, L. G., P. E.
 Western Regional Geotechnical
 Manager
 North Carolina Department
 of Transportation
 Geotechnical Engineering Unit
 Western Regional Office
 5253 Z Max Boulevard
 Harrisburg, NC 28075

Via other delivery service:

Mr. John Pilipchuk, L. G., P. E.
 Western Region Geotechnical
 Manager
 North Carolina Department
 of Transportation
 Geotechnical Engineering Unit
 Western Regional Office
 5253 Z Max Boulevard
 Harrisburg, NC 28075

Direct any questions concerning submittal review status, review comments, or drawing markups to the following contacts:

Primary Structures Contact:

Paul Lambert
 (919) 250 – 4041
 (919) 250 – 4082 facsimile
plambert@dot.state.nc.us

Secondary Structures Contacts:

James Gaither (919) 250 – 4042
 Man-Pan Hui (919) 250 – 4044

Eastern Regional Geotechnical Contact (Divisions 1-7):

K. J. Kim
 (919) 662 – 4710
 (919) 662 – 3095 facsimile
kkim@dot.state.nc.us

Western Regional Geotechnical Contact (Divisions 8-14):

John Pilipchuk
(704) 455 – 8902
(704) 455 – 8912 facsimile
jpilipchuk@dot.state.nc.us

3.0 SUBMITTAL COPIES

The quantities provided in this Special Provision act as a guide in the submittal process.

Unless otherwise required by the contract, submit two sets of supporting calculations to the Structure Design Unit.

Furnish one complete copy of the submittal, including all attachments, to the Resident Engineer. If requested, provide additional copies of any submittal. At the same time, submit the following number of copies directly to the Structure Design Unit and/or the Geotechnical Engineering Unit:

Working Drawing Submittal	Copies Required by Structure Design Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal¹
Arch Culvert Falsework	5	0	Plan Note & SN Sheet
Box Culvert Falsework ²	5	0	Plan Note & SN Sheet
Cofferdams ⁴	6	1	Articles 410-5 and 420-8
Expansion Joint Seals (hold down plate type with base angle)	9	0	“Expansion Joint Seals”
Expansion Joint Seals (modular)	2, then 9	0	“Modular Expansion Joint Seals”
Expansion Joint Seals (strip seals)	9	0	“Strip Seals”
Falsework & Forms (superstructure)	8	0	Article 420-3
Falsework & Forms ² (substructure)	8	0	Article 420-3
Mechanically Stabilized Earth Retaining Walls ⁴	7	1	“MSE Retaining Walls”
Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings ^{5,6}	7	0	Article 1072-10
Miscellaneous Metalwork ^{5,6}	7	0	Article 1072-10
Overhead Sign Assemblies	13	0	Article 903-3(C)
Pile Points	7	1	Article 450-8(D) & “Steel Pile Points”
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20

Precast Concrete Box Culverts	2, then 1 reproducible	0	“(Optional) Precast Reinforced Concrete Box Culvert at Station ____”
Precast Retaining Wall Panels	10	0	Article 1077-2
Pot bearings ⁵	8	0	“Pot Bearings”
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Proprietary retaining walls ⁴	9	1	Applicable Project Special Provision
Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078-11
Prestressed Concrete Cored Slab (detensioning sequences) ³	6	0	Article 1078-11
Revised Bridge Deck Plans (adaptation to metal stay-in-place forms)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	“Modular Expansion Joint Seals”
Soil Nail Retaining Walls ⁴	4	1	Applicable Project Special Provision
Sound Barrier Wall Steel Fabrication Plans ⁶	7	0	Article 1072-10 & “Sound Barrier Wall”
Sound Barrier Wall Casting Plans	10	0	Article 1077-2 & “Sound Barrier Wall”
Structural Steel ⁵	2, then 7	0	Article 1072-10
TFE Expansion Bearings ⁵	8	0	Article 1072-10
Temporary Detour Structures ⁴	10	1	Article 400-3 & “Construction, Maintenance and Removal of Temporary Structure at Station ____”
Temporary Shoring ⁴	6	1	Article 410-4 & “Temporary Shoring for Maintenance of Traffic”

Temporary Fabric or Wire Walls ⁸	0	2	Applicable Project Special Provision
Permanent Anchored Tieback Retaining Walls ⁴	4	1	Applicable Project Special Provision
Evazote Joint Seals ⁷	9	0	Applicable Project Special Provision
Optional Disc Bearings ⁵	8	0	“Optional Disc Bearings”
Removal of Existing Structure over Railroad	5	0	Railroad Special Provisions
Drilled Pier Construction Sequence Plans ⁸	0	2	“Drilled Piers”
Pile Hammers ⁸	0	2	Article 450-6

FOOTNOTES

1. References are provided to help locate the part of the contract where the working drawing submittals are required. References in quotes refer to the Project Special Provision by that name. Articles refer to the Standard Specifications.
2. Submittals for these items are necessary only when plan notes require them.
3. Submittals for these items may not be required. A list of pre-approved sequences is available from the producer or the Materials and Tests Unit.
4. These submittals are reviewed by the Structure Design Unit and the Geotechnical Engineering Unit. If NCDOT Shoring Standards are used, working drawings need not be submitted, but the Shoring Selection Form should be forwarded to the Geotechnical Engineering Unit.
5. The fabricator may submit these items directly to the Structure Design Unit.
6. The two sets of preliminary submittals required by Article 1072-10 of the Standard Specifications are not required for these items.
7. Submittals for Fabrication Drawings are not required. Submission of Catalogue Cuts of Proposed Material is required. See Section 5.A of the Project Special Provision.
8. Submittals for these items are reviewed by the Geotechnical Engineering Unit only and correspondence regarding these items should be directed to and will come from the Geotechnical Engineering Unit.

CRANE SAFETY

11-09-04

Submit all items listed below to the Engineer prior to beginning crane operations. . Changes in personnel or equipment must be reported to the Engineer and all applicable items listed below must be updated and submitted prior to continuing with crane operations.

Comply with the manufacturer specifications and limitations applicable to the operation of any and all cranes and derricks. Prime contractors, sub-contractors, and fully operated rental companies shall comply with the current Occupational Safety and Health Administration regulations (OSHA).

CRANE SAFETY SUBMITTAL LIST

- A. **Competent Person:** Provide the name and qualifications of the “Competent Person” responsible for crane safety and lifting operations. The named competent person will have the responsibility and authority to stop any work activity due to safety concerns.
- B. **Riggers:** Provide the qualifications, experience and training of the persons responsible for rigging operations. Training should include, but not be limited to, weight calculations, center of gravity determinations, sling selection and capacities, sling and rigging equipment inspection, safe rigging practices, and determining load weights.
- C. **Crane Inspections:** Inspection records for all cranes shall be current and readily accessible for review upon request.
- D. **Crane Operators:** **By January 1, 2006**, all crane operators shall be certified by NC CCO (National Commission for the Certification of Crane Operators), or satisfactorily complete the Carolinas AGC’s Professional Crane Operator's Proficiency Program. Other approved nationally accredited programs will be considered upon request. Submit current certification for the type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations, for each operator.

Medical evaluations shall meet or exceed the CCO medical evaluation requirements and must remain current within a 3-year expiration date. Utilize either the CCO Physical Examination Form or a current DOT Medical Examiner’s Certificate.

SOLDIER PILE RETAINING WALL

R-2813C
April 7, 2004

1. GENERAL

The work under this section consists of design and construct the soldier pile retaining wall at the locations indicated in the plans and in accordance with the details in the plans, the following provisions, and as directed by the Engineer. The Contractor may choose either the precast panel or cast-in-place face option as shown in the plan details.

Value engineering proposals for other wall types will not be considered.

Submit 5 copies of plans and calculations to the Engineer for review and approval in accordance with Section 105-2 of the Standard Specifications. The plans and calculations must be prepared and sealed by a North Carolina Registered Professional Engineer. The Contractor will be notified of the acceptance or rejection of the design within 40 calendar days of the Engineer's receipt of the design submittal.

Schedule a soldier pile retaining wall preconstruction conference with the Contractor including the drilling superintendent, the Resident Engineer including the inspector, the Area Bridge Construction Engineer and the representative from the Geotechnical Engineering Unit to discuss construction and inspection of the soldier pile retaining wall.

2. DESIGN CRITERIA

Review all available subsurface information and conduct additional investigations, as needed prior to beginning design. Use the soil parameters as shown on the plans for design of the walls.

Design all wall components for a 75 -Year design life.

Design the soldier pile retaining wall in accordance with the criteria set forth in the latest version of AASHTO Allowable Strength Design Standard Specifications for Highway Bridges (including interims), the special provisions and the plans.

Include calculations and details of the timber lagging, cast-in-place concrete facing or precast concrete panels in the design package.

The cast-in-place facing must be a minimum 205 mm in thickness and must be constructed on a 150 mm thick by 460 mm wide unreinforced concrete leveling pad. For precast concrete panel, the unreinforced concrete leveling pads supporting only a brick veneer must be 150 mm thick by 205 mm wide.

Use a minimum size of HP 310x79 or larger H-pile.

All cast-in-place concrete face, brick veneers and precast concrete panels must be embedded a minimum of 460 mm below the proposed finished grade. Filter fabric drainage mats and drain pipes at minimum 3 meter centers are required.

Top of the wall elevations at near both ends are estimated values. These elevations may be adjusted in the field, upon approval by the Engineer, to ensure that both ends of the wall are tied-in/zero out with the driveways.

Plans must contain sufficient information to layout and construct the walls and must include but not be limited to the following:

- Elevation views showing all proposed and existing ground lines and stations, soldier piles, leveling pad elevations, construction joint locations.
- Plan views showing all horizontal layout information.
- Section views showing in detail all wall components, the proximity of other structures, proposed and existing ground lines.
- Connection, drainage, interface of drilled pier concrete and lean sand grout, any other details needed to construct the wall.
- Construction sequence and installation procedure for installing soldier piles, panels, temporary support, brick veneer, as well as shaft excavation procedure including casing lengths, diameter, and thickness, and details on pouring of concrete.

3. MATERIALS AND CONSTRUCTION

All materials must be as specified or better and as approved by the Engineer.

Steel Piles

HP steel piles must conform to the applicable parts of the Standard Specifications and these provisions. Steel piles must be ASTM Grade A36 with the addition of 0.2% minimum copper.

The piles must be installed to grade using the lengths and cut off elevations shown in the plans by pre-augering or drilling a 610 mm minimum diameter hole. The hole must be backfilled with concrete up to the bottom of the cushioning material or leveling pads, whichever is lower.

Piles must be installed to within 50 mm of their plan location and the center to center distance between piles must not differ from the plans by more than 75 mm after installation. The plumbness of the piles must not vary from the vertical by more than 3 mm per 0.3 m. In general, installed piles will be acceptable if the brick veneer, when installed, will have an acceptable appearance to the Engineer.

Splicing of piles is subject to the Engineer's approval and must be in accordance with the plans. Welding must conform to the requirements of Article 1072-20 of the Standard Specifications.

Steel Casing

Steel for temporary casing must conform to ASTM A252, Grade 2. The minimum wall thickness for temporary casing with diameter less than 1.066 meters is 9.5 millimeters. The minimum wall thickness for temporary casing with diameter of 1.066 meters to 1.982 meters and is 12.7 millimeters.

Concrete and Reinforcing Steel

Concrete for the precast panels, cast-in-place face and leveling pad must be Class A and must conform to the applicable requirements in section 420 and 1000 of the Standard Specifications and these provisions

Reinforcing steel in facing must conform to the applicable requirements in sections 425 and 1070 of the Standard Specifications.

Panels must not be removed from the forms until the concrete has attained sufficient strength to prevent damage. Cracked, spalled or damaged panels will be rejected. The leveling pad must cure a minimum of twenty-four hours before setting any forms for the facing or brick veneer.

The side of the panel must be plumb and have a minimum bearing distance 50 mm on the pile flanges. A 12.5 mm thick expansion joint material must be placed between the panels and pile flanges for the width of the bearing surface. The panel must be seated firmly on the cushioning material and must be held securely against the pile flange until the backfill is placed sufficiently to hold it in place.

Concrete for shaft excavation below the bottom of the wall must be designated as Drilled Pier concrete and must have a minimum compressive strength of 31.0 MPa at 28 days. The cementitious material content must comply with one of the following options:

- (1) The mix must have a minimum cement content of 380 Kg per cubic meter and a maximum cement content of 475 Kg per cubic meter, however, if the alkali content of the cement exceeds 0.4%, the cement content must be reduced by 20% and replaced with fly ash at the rate of 1.2 Kg of fly ash per Kg of cement removed.
- (2) If Type IP blended cement is used, the mix must have a minimum of 395 Kg per cubic meter Type IP blended cement and a maximum of 494 Kg per cubic meter Type IP blended cement in the mix.

The maximum water-cementitious material ratio is 0.45. The concrete must be non air-entrained. Workability must be such that vibrating or prodding will not be required to consolidate the concrete. At the time of concrete placement, the slump must be within the range of 175 mm to 225 mm.

Use Type I or Type II cement or Type IP blended cement in the mix. Use either No. 67 or No. 78M coarse aggregate. An approved water-reducer, water-reducing retarder, high-range water-reducer, or high-range water-reducing retarder may be used to facilitate placement of the concrete. All admixtures must meet AASHTO M 194 and must be added at the concrete plant when the mixing water is introduced into the concrete. Redosing of admixtures is not permitted.

Place concrete within two hours after introduction of the mixing water, and the concrete temperature at the time of placement must not exceed 32° C.

Brick Masonry Coping

Expansion joints are not permitted, but construction joints may be used where the coping changes slopes and at 27.4 meter centers.

Brick Veneer

Construct the front face of the soldier pile retaining wall with a brick veneer facing. A sample of the brick must be provided to the Engineer for approval prior to ordering the materials. The final appearance of the brick veneer must match the masonry brick retaining walls to be constructed at other locations along the project and be approved by the Engineer.

The brick veneer must be attached with approved metal ties according to the Manufacturer's Specifications with a minimum 405 mm spacing vertically and 810 mm spacing horizontally with each row staggered 405 mm from the row above. The Contractor should be aware that if the precast panel option is chosen, the metal ties should be placed into the panels before casting.

Shaft Excavation

Shaft excavation must conform to the applicable provisions of Section 410 of the Standard Specifications.

Regardless of the material encountered, the shaft must be excavated by drilling, augering or coring to a depth sufficient to set the full length of steel pile to grade, and must be constructed in accordance with Section 825 of the Standard Specifications. Shaft concrete must be cast against undisturbed ground unless otherwise permitted by the Engineer. If over-excavation occurs vertically, the Contractor must backfill with No. 57 stone before setting the pile. All loose and soft material must be removed and the excavation must be dewatered immediately before and during the concrete casting operation. The top of the concrete shafts must be generally level.

If necessary, special measures must be taken to insure the stability of the shaft such as installing temporary casings prior to drilling, installing the pile and placing concrete immediately after a shaft is excavated before caving occurs, installing well points or other measures. If caving occurs, the shaft excavation operation must be halted until special measures are implemented as approved by the Engineer.

Precast panels or cast-in-place face must not be installed before the shaft concrete has cured for a minimum of 3 days.

Excavation and Backfill

The Prime Contractor and the Wall Subcontractor must coordinate scheduling such that earthwork and wall construction can be accomplished at a minimum of delay to each.

Excavation close to the wall location must not be done until the soldier piles have been placed and shaft concrete poured and set up.

The Contractor must take care to minimize the excavation necessary to place the cushioning material, panels and timber lagging. Excavation to install panels and timber lagging must be limited 150 mm behind the piles. All excavation behind the panels and timber lagging and any over excavation must be backfilled with No. 57 stone. The No. 57 stone must conform to the applicable requirements of Section 1005 of the Standard Specifications and these provisions.

Compaction of the No. 57 stone backfill must be to the satisfaction of the Engineer. The stone must be rodded and spread in order to fill all voids and insure maximum density. Larger areas must be compacted with hand operated equipment. Flushing the stone with water will not be allowed. Heavy compaction equipment will not be allowed behind the wall. The No. 57 stone cushioning material must be compacted with at least two (2) passes of lightweight compaction equipment.

Temporary Earth Support

Timber lagging between soldier piles must be constructed such as to be safe and provide adequate resistance to earth loads. The materials used must be sound and free of defects.

Filter Fabric and Drain Pipes

Filter fabric drainage mats on the backside of the wall, used in conjunction with a granular material or with a molded, polymeric core must conform to Section 1056-1 of the Standard Specifications.

Drain pipes installed along the lower portions of the wall near the leveling pad or footing must conform to Section 815 of the Standard Specifications.

Timber Lagging and Shear Studs

Timber lagging must conform to the requirements of Section 1082-1 of the Standard Specifications.

Headed shear studs and their installation must meet the requirements of Sections 1072-8 and 1072-20 of the Standard Specifications.

4. MEASUREMENT AND PAYMENT

No separate measurement for payment purposes will be made for this work. The lump sum payment must be for the soldier pile retaining wall and either precast panels or cast-in-place concrete facing including the brick. Payment will include all costs for concrete, reinforcing steel, excavation, backfill, timber lagging, piles, brick, fence, labor, design and all other materials and equipment including all tools and any other miscellaneous items necessary to complete the work.

Payment will be made under:

Soldier Pile Retaining Wall.....Lump Sum