

SECTION 00596D - SOLDIER PILE RETAINING WALLS

(Follow all instructions and make all edits with “Track Changes” turned on. This template provides a basic special provision layout for use with a soldier pile retaining wall (cut wall construction) in predrilled hole. It may be necessary to delete, add, or revise content for Project specific design. In general, do not re-number or re-letter subsections when item(s) are deleted. Delete all purple text before preparing the final document. All other modifications to this Section will require ODOT Technical Resource and State Specifications Engineer approval.)

(Note to spec writer: SP00510 should be included for temporary shoring, structure excavation for soldier pile wall construction, including quantity breakdown as needed. SP00530, SP00540, and SP00543 should be included for cast-in-place permanent facing reinforcement, concrete, and architectural treatment including quantity breakdown as needed.)

Section 00596D is not a Standard Specification and is included in this Project by Special Provision.

Description

00596D.00 Scope - This Work consists of furnishing and constructing permanent soldier pile retaining walls composed of steel soldier piles placed and backfilled in predrilled holes, top-down wall excavation, and installation of lagging, wall drainage system and permanent facing.

Select the drilling method and Equipment, and construction procedures to meet the requirements of these Special Provisions, subject to the review and approval of the Engineer.

(Use the following sentence when tie back retaining walls are required.)

See Section 00596E for requirements of permanent ground anchors in tie back retaining walls.

00596D.01 Abbreviations and Definitions:

CGC - Commercial Grade Concrete

CLSM - Controlled Low Strength Material

Soldier Pile - Steel H-pile, wide flange beam, or built-up section, including shear connector studs and connection plates. Soldier piles are placed in predrilled holes spaced at regular intervals and backfilled before top-down excavation begins for retaining wall construction.

00596D.02 Submittals - Submit Working Drawings, Equipment lists and other submittals according to 00150.35 and 00150.37.

(a) Unstamped Submittals:

(1) Soldier Pile Retaining Wall Work Plan including:

- Construction schedule and sequence.
- Descriptive data and operating procedure for Equipment to be used.
- Method of drilling, cleanout, and disposal of drilling spoils, including water or contaminated CLSM or CGC expelled from the top of the hole or casing.
- Method for ensuring predrilled hole stability. If temporary casing is proposed, provide material, size, installation and removal information. If drilling slurry is proposed, provide mix design, and procedure for use, removal and disposal.
- Details of soldier pile installation and bracing, including centralizers.
- Details of CLSM and CGC placement including operational procedures for pumping and tremie methods.
- Wall excavation Lifts and lagging placement.
- Connection of geocomposite drains to lagging or facing and to subsurface drain.
- Reinforced concrete facing construction.

(Use the following bullet when tie back retaining walls are required.)

- Ground anchor construction, installation, and testing procedures according to Section 00596E if used.

(2) Personnel qualifications according to 00596D.30.

(3) Materials certificates of compliance and quality compliance documents size, grade and strength of Materials to be used.

(4) Shop assembly and erection details, including:

- Plan and profile views with soldier pile locations shown and numbered.
- Members and connections for any portion of the system not shown are to be detailed by the Contractor and indicated on the Working Drawings.
- Indicate all welds by standard welding symbols of the AWS A2.4.
- Reinforced concrete shop drawing for cast-in-place facing according to Section 00540
- Precast concrete panel lagging.

(b) Stamped Working Drawings:

- Contractor designed temporary ground support.

- Mix designs for structural concrete in cast-in-place facing and precast concrete panel lagging.
- Design, layout and details of forms and falsework support for cast-in-place facing according to Section 00540.

Clearly indicate by flagging and clouding any changes, additions or alterations to submittals that are deviations from the Contract documents or changes to previously approved or accepted submittals. Provide a written explanation of changes accompanying each submittal.

Materials

00596D.10 Steel Soldier Pile - Furnish structural steel soldier piles of the shape, material and grade shown. Furnish Materials meeting the following requirements:

Drilling Slurry	00512.14
Steel Piles	02520.10
Structural Steel Plates, Shapes, Bars and Miscellaneous Metals	02530
Shear connector studs	AASHTO M169, AWS D1.1

00596D.11 Steel Casing - Furnish temporary casing meeting the requirements of ASTM A 252 or ASTM A 36. Use casing of sufficient strength to resist handling, transportation and installation stresses and the external stresses of the subsurface Materials. Ensure that the casing is clean and watertight prior to placement.

00596D.12 Drilling Slurry - Furnish drilling slurry meeting the requirements of 00512.14.

00596D.13 Backfill in Pre drilled Holes for Soldier Piles - Furnish CGC as shown and meeting the requirements of Section 00440 except furnish the mixture with a slump of 8 inches \pm 1 1/2 inches. Furnish CLSM as shown and meeting the requirements of Section 00442.

00596D.14 Subsurface Drains - Furnish subsurface drainage pipe, drain backfill material and drainage geotextile as shown and according to Section 00430.

(In subsection .15, modify the list of products as advised by the wall designer.)

00596D.15 Prefabricated Geocomposite Wall Drains - Furnish one of the following products, or other approved equal:

- SiteDrain™ Sheet-184 by American Wick Drain, Inc., Monroe, NC
- Delta® Drain 6000 HI-X by Cosella-Dorken Products, Inc., Beamsville, ON
- TenCate Mirafi® G100N by TenCate Geosynthetics Americas, Pendergrass, GA

Furnish geocomposite drains in rolls wrapped with a protective covering and stored in a manner that protects the drains from mud, dirt, dust, sunlight and damage.

(Use one of the three options for subsection .16 shown below, as appropriate to the type of lagging to be used. Delete the other options.)

[Option 1 - Use the following bullet when timber lagging is used]

00596D.16 Timber Lagging - Furnish construction-grade, rough-cut douglas fir timber meeting the requirements of Section 02130. When treated timber lagging is shown, furnish preservative treatment according to Section 02190.

[Option 2 - Use the following bullet when precast concrete lagging panels are used]

00596D.16 Precast Concrete Lagging Panel Facing - Furnish structural concrete of the class shown, according to Sections 00540 and 02001. Furnish steel reinforcement meeting the requirements of Sections 00530 and 02510.

[Option 3 - Use the following bullet when steel plate lagging is used]

00596D.16 Steel Plate Lagging - Furnish ASTM A 572, Grade 50 structural steel plate meeting the requirements of Section 02530.

00596D.17 Cast-in-Place Reinforced Concrete Facing - Furnish structural concrete of the class shown, according to Sections 00540 and 02001. Furnish reinforcement according to Sections 00530 and 02510.

00596D.18 Architectural Treatment - Furnish architectural treatment according to Section 00543.

Equipment

00596D.20 Approval of Predrilling Equipment for Soldier Pile Holes - 10 Calendar Days before the preconstruction meeting, submit the following (unstamped) according to 00596D.02:

- Drilling Equipment data including suitability, based on the Contractor's understanding of the site and subsurface conditions.
- Project history of the drilling Equipment that demonstrates the successful use of the Equipment in drilling boreholes of equal or greater diameter and depth and through subsurface conditions similar to those expected to be encountered on this Project.

Procedural approvals given by the Engineer are subject to trial in the field and will not relieve the Contractor of the responsibility to satisfactorily complete the Work.

Labor

00596D.30 Personnel Qualifications - 10 Calendar Days before the preconstruction meeting, submit the following:

- A list identifying the personnel performing and supervising the soldier pile work. Include a list of the locations and dates of previous projects and reference contacts for verification to support the experience requirements listed below.
- Proof of successfully completing at least three temporary or permanent soldier pile retaining wall projects in the last 5 years.

- Proof that drill operator has successfully performed three projects with similar drilled holes in the last 5 years.
- Welder qualifications and welding procedures in accordance with American Welding Society Standard AWS D 1.1, *Structural Welding Code*.

Do not start Work on any soldier pile wall, or order Materials, until the personnel qualifications have been approved by the Engineer.

00596D.31 Quality Control Personnel - Provide technicians with CAgT and CDT certifications.

Construction

00596D.40 Predrilled Holes for Soldier Piles - Predrill holes at the locations and to the depths and diameters shown. Maintain a stable hole meeting the minimum required diameter for the full depth shown. Ensure that the sidewalls of holes do not collapse during drilling. Frequently check the plumbness, alignment, and dimensions of the hole during construction.

Dispose of materials removed from the predrilled hole according to 00290.20. Divert all surface water away from holes and prevent all surface water from entering holes by approved means.

Notify the Engineer of completion of each hole to permit inspection. No more than 2 inches of loose or disturbed Material is allowed at the bottom of the predrilled hole. Hole cleanliness is determined by the Engineer. Measure and record final bottom of the hole elevation after final cleaning to verify that the bottom elevation meets Contract requirements. Do not proceed with soldier pile installation until the hole bottom cleanliness requirements have been met and the bottom elevation is approved.

Install temporary casing according to the approved installation plan. Ensure that temporary casing is clean and watertight before installation. Remove all temporary casing during or after completion of backfill placement.

00596D.41 Steel Soldier Piles - Furnish and place steel soldier piles as shown and according to the following:

- (a) **General** - Shop fabricate soldier pile with attachments such that no field welding is necessary.
- (b) **Storage and Handling** - Store and handle steel soldier piles in ways that protect them from damage. Bent or kinked piles are rejected.
- (c) **End Treatment** - Cut pile ends square.
- (d) **Splices** - Do not splice piles unless approved by the Engineer.
- (e) **Welding** - Perform structural steel welding according to 00560.26(a) and steel piling welding according to 00520.43(g). Do not begin welding until all of the following have been approved by the Engineer:

- Welding Procedure Specification (WPS)
- Procedure Qualification Records (PQR)
- Welder Qualification Test Records (WQTR)
- Material Test Report (MTR)
- AWS Certified Welding Inspector (CWI)

Following completion of all welding, submit the following:

- An inspection report stating that the welding under the Contract was performed according to AWS D1.1 that includes a review of the WPS, a review of welder qualifications, and a report on visual inspection of the welds on the job site. Have a certified welding inspector (CWI) holding QC1 certification as defined in AWS D1.1 sign the inspection report.

(f) Cutoff Lengths - Cut off the tops of all permanent piles square and smooth at the elevations shown or as directed. All cut-off pile becomes the property of the Contractor. Dispose of according to 00290.20.

(g) Placement - Do not place steel soldier piles in predrilled holes prior to receipt of the Engineer's approval of the hole. Fit piles with approved centralizers to keep the pile in the center of the hole. Obtain the Engineer's approval of the centralizer Material type, attachment method, and placement before use.

(Edit the tolerance values as needed for Project specific design requirements. The dimensional tolerances given are estimated to be adequate for most cases, however, less stringent location tolerances may be acceptable based on the Project.)

Position each pile meeting the following tolerances:

- Within 2 inches of the plan location shown, perpendicular to wall face, measured from top of wall face elevation.
- Within 2 inches of the plan location shown, parallel to wall face, measured from top of wall face elevation.
- Within 2 inches of the plan elevation.
- Vertical plumbness tolerance of 1 inch per 10 feet for each axis of the soldier pile.
- Provide minimum required bearing contact between lagging and soldier pile flange as shown.
- Provide minimum required edge distance between pile edges and the predrilled hole as shown.

00596D.42 Backfilling Predrilled Holes for Soldier Piles - Place concrete in predrilled holes immediately after completion of soldier pile installation, and with approval of the Engineer. Concrete may be placed without mechanical vibration in those areas of predrilled holes that are not formed or are below the ground line.

Restrain the soldier pile from vertical and horizontal movement during concrete placement. Place concrete with a tremie pipe, beginning near the bottom of the hole. Place concrete continuously until concrete at the top of the predrilled hole is free of water, Soil, and debris, and uncontaminated concrete extends to the elevation shown. If a temporary casing is used, fill the space between the casing and the soldier pile with pile concrete as the casing is withdrawn, maintaining a minimum 5-foot head of backfill above the bottom of the casing. A slight downward movement of the casing while exerting downward pressure, or hammering or vibrating the casing is permitted to facilitate extraction. Dispose of all contaminated concrete and CLSM pile backfill expelled from the top of the predrilled hole in an approved manner. Remove waste pile backfill from the site. If a delay in pile backfill placement occurs because of a delay in pile backfill delivery or other factors, reduce the placement rate to maintain a flow of fresh pile backfill into the predrilled hole.

Do not wait longer than 60 minutes between pile concrete placements or use concrete older than 90 minutes from batch time, unless allowed by the approved mix design. Use procedures for concrete placement that ensure the concrete in the predrilled hole forms a monolithic, homogeneous unit.

Place pile concrete using hoses or pipes having watertight joints. For concrete placement by gravity tremie, use a hose or pipe having an inside diameter of at least 8 inches. For placement by concrete pump, use a hose with an inside diameter of at least 4 inches. Provide a backup delivery system that can be used in case of failure of the primary delivery system. Place concrete only against the bottom of the predrilled hole or into fresh concrete.

If caving occurs during concrete placement, the prebored pile may be rejected at the discretion of the Engineer.

Following the concrete placement, backfill the remainder of the predrilled hole with CLSM.

00596D.43 Excavation and Lagging Installation - Do not begin general excavation in the area in front of the wall until after the soldier piles are constructed. Maintain a stable excavation site and safe working conditions. Place lagging as shown. Place lagging from the top down as wall excavation proceeds. Minimize excavation required to install the lagging and fill resulting voids behind the lagging with granular wall backfill.

Prior to the start of excavation perform survey to establish baseline location of the tops of soldier piles. Perform survey and frequent visual inspection during excavation and lagging installation to monitor wall movement and maintain tolerance according to 00596D.41(g).

Where lagging is installed above original ground, carefully place granular wall backfill against the lagging as required to minimize the formation of voids. Place backfill at a rate that prevents movement of the wall and loss of ground.

(Use the following sentence when tie back retaining walls are required.)

See Section 00596E for installation, stressing and testing of permanent ground anchors in tie back retaining walls.

00596D.44 Wall Drainage Systems - Place geocomposite drains according to manufacturer's installation guidelines. Construct seams, top, bottom and end caps to prevent concrete or backfill from entering the geocomposite. Install the geocomposite drains between

the piles with the geotextile fabric facing toward the lagging and the impervious backing away from the lagging. Secure the drains in position so as to prevent concrete from contaminating the geotextile facing. Install continuous drains from the top of the lagging to the bottom of the concrete facing.

Construct wall subsurface drain according to Section 00430.

00596D.45 Reinforced Concrete Facing - Construct reinforced concrete facing to the limits shown, according to Sections 00530 and 00540 and the approved Working Drawings.

Measurement

00596D.80 Measurement - The quantities of Work performed under this Section will be measured according to the following:

(Delete Work that is not required on the Project.)

(a) Predrilling and Encasing Soldier Piles - Predrilling and backfilling holes for soldier piles will be measured on the length basis by the vertical excavated length from the bottom of the predrilled hole to the top of predrilled hole elevation.

(b) Steel Soldier Piles - Steel soldier piles will be measured on the length basis by the length of each pile from the pile tip to the top of the pile elevation. No measurement will be made for welded attachments to the piles.

(c) Lagging - Lagging will be measured on the area basis by the square foot area of lagging installed. The quantity will be computed based on the vertical dimension from the highest lagging elevation to the lowest lagging elevation between each pair of adjacent soldier piles as the height dimension and the center-to-center spacing of the soldier piles as the length dimension.

(d) Wall Drainage and Filter System - No measurement of quantities will be made for Structure drainage system.

The estimated quantities of Materials for Structure drainage system are:

(List by structure number then item and quantity. Revise item list as appropriate. Obtain information from the Retaining Wall Designer.)

Structure Number	Material	Quantities
#	6-inch Drain Pipe	____ foot
#	Drainage Geotextile, Type 1	____ sq. ft.
#	Geocomposite Drains	____ sq. ft.
#	Granular Drain Backfill	____ cu. Yd.

Delineators at subsurface drain outlets will be measured according to 00840.80.

Structure excavation will be measured according to 00510.80.

The quantities of reinforcement used in cast in place concrete facing will be measured according to 00530.80.

The quantities of structural concrete in cast in place facing will be measured according to 00540.80.

Payment

00596D.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
<i>(Delete Pay Items not included in the Schedule of Items. Do not change the alpha characters next to the Pay Items.)</i>	
(a) Predrilling and Encasing Soldier Piles	Foot
(b) _____ Steel Soldiers Piles	Foot
(c) Lagging	Square Foot
(d) Wall Drainage and Filter System.....	Lump Sum

In Item (b), the type and size of pile is inserted in the blank.

Item (a) includes providing, moving, setting up, and removing the drilling Equipment to the Project at the various locations on the Project. It also includes predrilling holes for soldier piles and disposing of the excavated Material while furnishing, placing, removing temporary casings, and backfilling the predrilled hole with specified concrete after steel soldier pile installation.

Item (b) includes furnishing complete fabricated soldier piles with welded assemblies, installing, supporting, and trimming the piles.

Item (c) includes furnishing and installing lagging and filling voids behind lagging with granular wall backfill.

Item (d) includes furnishing and installing geocomposite drain and subsurface drain pipe, Aggregate and geotextile.

Structure excavation will be paid for according to 00510.90.

Reinforcement in cast in place concrete facing will be paid for according to 00530.90.

Concrete in cast in place concrete facing will be paid for according to 00540.90.

Delineators at subsurface drain outlets will be paid for according to 00840.90.

Payment will be payment in full for furnishing and placing all Materials, and for providing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for welding inspection performed according to 00596D.41(e).