To: SUPERSEDED BY EI 10-038 EFFECTIVE 5/5/11		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 10-034

Title: **SECTION 552 – EXTERNALLY STABILIZED CUT STRUCTURES**

Distribution:
- ☐ Manufacturers (18)
- ☒ Local Gov't. (31)
- ☒ Other (32)
- ☐ Surveyors (33)
- ☒ Consultants (34)
- ☒ Contractors (39)
- ☐ _____( )

Approved:

Anthony Torre — 11-12-10

Anthony Torre, P.E., Acting Deputy Chief Engineer (Research) — Date

ADMINISTRATIVE INFORMATION:
- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 5, 2011.
- Superseded issuance(s): This EI modifies EI 03-003.
- These revisions will be incorporated into a future update to the Standard Specifications.

PURPOSE: The purpose of this EI is to issue revised Standard Specification Section 552 *Externally Stabilized Cut Structures.*

TECHNICAL INFORMATION:
- To minimize the quantity of special specifications, as emphasized by SiteManager, the soldier pile and lagging specification has been incorporated into the Standard Specifications.

- To maintain consistency with the wall categories presented in the Highway Design Manual Chapter 9 Table 9-6 *Classification of Retaining Wall Systems*, the title of the Section was changed to the more expansive topic "Externally Stabilized Cut Structures".

- Additions to Standard Specification Section 715 *Castings, Forgings, and Metals* is being issued concurrently via EI 10-033.

IMPLEMENTATION:
- The Main Office Design Quality Assurance Bureau will insert these standard specification revisions into contract proposals beginning with projects submitted for the letting of May 5, 2011.

- The following special specifications are disapproved:

Item 551.0460NN17	Holes in Earth for Soldier Pile and Lagging Wall
Item 551.0461NN17	Rock Sockets for Soldier Pile and Lagging Wall
Item 551.0462NN17	Installing Soldier Piles for Soldier Pile and Lagging Wall
Item 551.0463NN17	Installing Lagging for Soldier Pile and Lagging Wall
Item 551.04500110	Soldier Pile Wall
Item 551.0460NN08	Holes in Earth for Soldier Pile and Lagging Wall
Item 551.0461NN08	Rock Sockets for Soldier Pile and Lagging Wall
Item 551.0462NN08	Installing Soldier Piles for Soldier Pile and Lagging Wall
Item 551.0463NN08	Installing Lagging for Soldier Pile and Lagging Wall
Item 551.0463NN11	Installing Lagging for Soldier Pile and Lagging Wall

- The following standard specifications are approved:

Item 552.20nn	Holes in Earth for Soldier Pile and Lagging Wall
Item 552.21nn	Rock Sockets for Soldier Pile and Lagging Wall
Item 552.22nn	Soldier Piles for Soldier Pile and Lagging Wall
Item 552.2301nn	Treated Wood Lagging for Soldier Pile and Lagging Wall
Item 552.2302nn	Untreated Wood Lagging for Soldier Pile and Lagging Wall
Item 552.2303nn	Precast Concrete Panel Lagging for Soldier Pile and Lagging Wall
Item 552.2304nn	Steel Sheeting Lagging for Soldier Pile and Lagging Wall

TRANSMITTED MATERIALS:

- Revisions to the Standard Specification *Section 552 Externally Stabilized Cut Structures.* Both metric and U.S. Customary revisions are attached.

BACKGROUND: The NYS Department of Transportation is implementing Trns·port SiteManager, including both Construction and Materials functionality. Implementation of standard AASHTO software enables SiteManager to allow revising this agency's practices to be more consistent with industry-accepted best practices. The revisions to the Standard Specifications are to minimize the overall quantity of special specifications.

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us. Questions or comments regarding the technical aspects of the Standard Specification Section should be directed to Chris Nebral, P.E., of the Geotechnical Engineering Bureau at (518) 457-4717, cnebral@dot.state.ny.us.

Make the following changes to the Standard Specifications dated May 4, 2006:

Delete Section 552- Support and Protection Systems entirely and **Add** the following:

SECTION 552 – EXTERNALLY STABILIZED CUT STRUCTURES

552-1 DESCRIPTION

552-1.01 Permanent Sheeting. Under this work, the Contractor shall furnish and install permanent sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed by the Engineer.

All the sheeting and supports will be left in place as a finished structure unless removal of waling and bracing is called for in the contract documents.

552-1.02 Temporary Sheeting. Under this work, the Contractor shall furnish, install, maintain and remove temporary sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed by the Engineer. It may be left in place only with the written permission of the Engineer.

552.1.03 Interim Sheeting. Under this work, the Contractor shall furnish, install, maintain, cut off and remove sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed, in writing, by the Engineer.

The interim sheeting shall be cut off and removed only to the elevation shown in the contract documents. The remaining material shall be left in place.

552-1.04 Excavation Protection System. Under this work, the Contractor shall design, furnish, place, maintain and remove an excavation protection system (EPS) at locations shown in the contract documents or as directed, in writing, by the Engineer. Details of the EPS must conform to the requirements of 29 CFR 1926 and installation shall be in accordance with the State and Federal Safety Codes. A sloping (layback) option will not be allowed.

Sheeting, shoring, a shield system, i.e. trench box or trench shield or other pre-engineered protective system may be used to prevent cave-ins. The requirements of any protective system shall be as contained in 29 CFR 1926. It may be left in place only with the written permission of the Engineer.

552-1.05 Soldier Pile and Lagging Wall. Under this work, the Contractor shall furnish and place a soldier pile and lagging wall in accordance with the contract documents; cut off walls located within the roadway limits to the elevation shown in the contract documents and leave the remainder in place unless removal is granted, in writing, by the Engineer; completely remove walls outside the roadway limits if noted on the plans; and dispose of removed material.

552-1.06 Alternate Design. The Contractor may submit to the Department a construction alternate other than that presented in the contract documents as a Value Engineering Change Proposal. Slope lay back will not be allowed. A simple material substitution involving a sheeting section modulus or soldier pile designation greater than that shown in the contract documents will be considered for acceptance. However, all proposed changes to details shown in the contract documents must be approved, in writing, by the Deputy Chief Engineer for Technical Services.

Any geotechnical analysis for a flexible support system shall be done in accordance with the procedures contained in the geotechnical design procedure "*Geotechnical Design Procedure for Flexible Wall Systems*".

552-2 MATERIALS

552-2.01 Permanent Sheeting

A. Permanent Timber Sheeting. Permanent timber sheeting shall be new and unused and consist of any acceptable species which can be placed satisfactorily in accordance with the requirements of §712-14 *Stress Graded Timber and Lumber.* Timber sheeting shall be treated in accordance with §708-31 *Wood Preservative - Waterborne* and applied in conformance with American Wood Preservers Association (AWPA) Use Category Designation UC4B. The timbers shall meet or exceed the actual cross section or stress grade shown in the contract documents. The timbers shall be sound and free from any defects which might impair its strength or tightness. The materials shall include all necessary waling and bracing required.

B. Permanent Steel Sheeting. Steel sheeting shall be new and unused conforming to the provisions of §715-17 *Steel Sheeting*. Waling and bracing shall be new and unused conforming to the provisions of §715-01 *Structural Steel*. Stock steel may be used.

552-2.02 Temporary Sheeting

A. Temporary Timber Sheeting. Temporary timber sheeting shall consist of any acceptable species which can be placed satisfactorily in accordance with the requirements of §712-14 *Stress Graded Timber and Lumber.*

Temporary timber sheeting may consist of new or used, treated or untreated material but must be in satisfactory condition and suitable for the intended use. The Engineer will reject unsatisfactory used materials.

B. Temporary Steel Sheeting. The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The materials shall include all necessary waling and bracing required. The Engineer will reject unsatisfactory used materials.

552-2.03 Interim Sheeting

A. Interim Timber Sheeting. Interim timber sheeting may consist of new of used, treated or untreated material but shall be in satisfactory condition and suitable for the intended use. The Engineer will reject unsatisfactory used materials.

B. Interim Steel Sheeting. The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The materials shall include all necessary waling and bracing required. The Engineer will reject unsatisfactory used materials.

552-2.04 Excavation Protection System. The selection of EPS materials shall be the Contractor's option. The Engineer will reject unsatisfactory materials.

552-2.05 Soldier Pile and Lagging Wall.

A. Soldier Pile. Soldier piles shall be as shown on the contract documents and conform to the requirements of §715-18 *Soldier Piles.* Waling and bracing shall be as shown in the contract documents and conform to the requirements of §715-01 *Structural Steel.* Each pile shall consist of

one continuous steel section. No pile splices will be allowed unless approved, in writing, by the Deputy Chief Engineer for Technical Services.

Used material is permitted for temporary walls unless otherwise noted on the plans, provided the material is in conformance with the specification and is acceptable to the Engineer.

B. Lagging. Lagging type(s) shall be as shown in the contract documents:

1. Treated Wood. Treated wood shall meet or exceed the full dimension thickness shown in the contract documents and graded for an extreme fiber stress of at least 6900 kPa conforming to the material requirements of §712-14 *Stress Graded Timber and Lumber.* Timbers shall be treated in accordance with §708-31 *Wood Preservative - Waterborne.* The treatment shall be applied in conformance with American Wood Preservers Association (AWPA) Use Category Designation UC4B.

2. Untreated Wood. Untreated wood shall be graded for an extreme fiber stress of at least 6900 kPa conforming to the provisions of §712-14 *Stress Graded Timber and Lumber* and shall meet or exceed the full dimension thickness shown in the contract documents.

3. Precast Concrete Panels. Precast concrete panels shall conform to the provisions of §704-03 *Precast Concrete-General.*

4. Steel Sheeting. Steel sheeting shall conform to the provisions of §552-2.01 B. *Permanent Steel Sheeting.*

C. Backfill for Holes. Backfill material shall be as shown in the contract documents:

1. Concrete Backfill. Concrete backfill shall be Class G concrete conforming to the provisions of Section 555 *Structural Concrete.*

2. Grout Backfill. Grout backfill shall be a workable mixture capable of stabilizing the hole being excavated. The Contractor shall use either controlled low strength material meeting the requirements of Section 204 *Controlled Low Strength Material (CLSM)* or cement, concrete sand and water conforming to Table 552-1 *Grout Backfill Requirements.*

TABLE 552-1 GROUT BACKFILL REQUIREMENTS

Material	Subsection
Portland Cement Type 2	§701-01
Concrete Sand	§703-07
Water	§712-01

552-3 CONSTRUCTION DETAILS

552-3.01 General. The Contractor shall install sheeting having a section modulus not less than that shown in the contract documents. The Contractor shall install soldier piles meeting the size designation shown in the contract documents.

Any material which stops the driving of sheeting or soldier piles within a depth of 3 m from the ground surface at the time of driving shall be removed by the Contractor. Payment for removal of such material and any backfill required to fill the resulting void will be made under the appropriate pay items. If very compact material or boulders prevent the progression of the sheeting or soldier piles to the design tip elevation at a greater depth, the Contractor shall notify the Engineer.

The Contractor shall perform work in a manner that causes no subsidence of the surrounding ground surface. If subsidence should occur, the Contractor shall cease work and provide a written plan to prevent subsidence for approval by the Engineer. The Contractor shall repair all damage that resulted from the subsidence at no additional cost to the State.

552-3.02 Temporary Sheeting. The Contractor shall install temporary sheeting having a section modulus which meets or exceed that shown in the contract documents.

After its function is no longer required, the Contractor shall remove the sheeting placed under this work, or with the written permission of the Engineer, leave it in place after cutting off the tops at an agreed elevation.

552-3.03 Interim Sheeting. The Contractor shall install interim sheeting having a section modulus which meets or exceed that shown in the contract documents.

The Contractor shall cut off the interim sheeting and remove it to the elevation shown in the contract documents. The remaining material shall be left in place.

552-3.04 Excavation Protection System. The Contractor shall install an Excavation Protection System in accordance with the contract documents.

The EPS installed under this work shall be of sufficient size and strength to meet the requirements of 29 CFR 1926 and the Live Load requirement as contained in the AASHTO Standard Specifications for Highway Bridges. A sloping (layback) option will not be allowed. Prior to use, the Contractor shall supply the Engineer with documentation of compliance. The EPS may be left in place only with the written permission of the Engineer.

All damage to the adjacent pavement or ground caused by the use of the chosen EPS (e.g. voids beneath the pavement or shoulder, pavement or shoulder cracking or subsidence, ground settlement) shall be repaired at no additional cost to the State. Severe damage which directly affects the safety of the public shall be immediately repaired. The operation shall be halted until a satisfactory prevention method is instituted.

552-3.05 Soldier Pile and Lagging Wall. The Contractor shall install Soldier Piles meeting the size designation shown in the contract documents either by driving or by placing them in holes as indicated on the plans in accordance with Table 552-2 *Soldier Pile and Lagging Wall Pile Tolerances*. For each pile out of tolerance, provide a satisfactory replacement or provide a modification approved by the Engineer prior to proceeding. No pile splices will be allowed unless approved, in writing, by the Deputy Chief Engineer of the Office of Technical Services.

TABLE 552-2 SOLDIER PILE AND LAGGING WALL PILE TOLERANCES

Survey Location	Tolerance
Plan	75 mm at the top of pile.
Vertical	Vertical tolerance of one (1) mm per 100 mm on each axis of the soldier pile shown on the plans. Verify the axes on the top 1.5 m of the soldier pile with a straight edge (1.5 m minimum length) and a level (1.2 m minimum length).

A. Driving Piles. Soldier piles shall be equipped with shoes in conformance with provisions of §551-3.01 C.1.a. *Preparation of Piles, Shoes, Steel Bearing Piles*, and driven in conformance with provisions of §551-3.01 D. *Equipment for Driving Piles*, except that submission of Form BD 138 is not required.

B. Creating Holes for Pile Installation. The Contractor shall provide equipment capable of establishing and maintaining holes of the minimum diameter and to the depth or elevation shown in the contract documents. Temporary sleeves or casings are permitted and may be required as per the plans. Jetting is not permitted.

If the top of socket elevation shown in the contract documents varies by more than 0.6 m, the Contractor shall stop work and notify the Engineer. The Engineer will notify the Geotechnical Engineering Bureau and obtain written recommendations prior to allowing the work to proceed.

Upon completion of the hole, the Contractor shall install the soldier pile in accordance with Table 552-2 *Soldier Pile and Lagging Wall Pile Tolerances.*

C. Backfilling. After placing the piles, the Contractor shall backfill holes with the backfill(s) indicated in the contract documents.

1. Concrete Backfill. The Contractor shall place backfill in accordance with the provisions of §555-3.04 *Handling and Placing Concrete* and §555-3.05 *Depositing Structural Concrete Under Water* as shown in the contract documents. The Contractor shall allow a minimum curing time of one day before placing any lagging.

2. Grout Backfill. The Contractor shall place backfill in accordance with the provisions of §555-3.04 *Handling and Placing Concrete* and §555-3.05 *Depositing Structural Concrete Under Water*. The Contractor shall allow a minimum curing time of one day before placing any lagging.

D. Lagging. The Contractor shall install horizontal lagging so that the unsupported soil height does not exceed 1 m at any time. If the method chosen for attaching the lagging to the soldier piles requires reattachment of lagging to the soldier piles due to planned excavation on both sides of the wall, the Contractor shall reattach the lagging at no additional cost to the State.

The Contractor shall fabricate the precast concrete lagging to the shape and size shown in the contract documents.

Precast panels manufactured in strict conformance with the contract documents do not require working drawings. When working drawings are not required, the Contractor shall notify the Engineer, in writing, of the Fabricator's intention to manufacture the panels in accordance with the contract documents. The Director of the Materials Bureau will be notified by the Engineer of the Contractor's/Fabricator's intention and will institute appropriate approval notifications.

If the precast panels are not fabricated in strict conformance with the contract documents, the Contractor shall submit working drawings through the Engineer to the Materials Bureau for written approval a minimum of 45 calendar days before beginning fabrication. Working drawings shall conform to the requirements of §704-03 *Precast Concrete-General.*

Panels manufactured without prior written approval from the Materials Bureau will not be accepted.

E. Wall Removal. The Contractor shall cut off soldier piles placed within the roadway limits at the subgrade surface unless otherwise noted in the contract documents. Soldier piles placed outside the roadway limits may be removed or cut off a minimum of 0.6 m below final ground surface unless otherwise noted in the contract documents.

If lagging is to be removed, the Contractor shall remove the lagging so that the unsupported soil height does not exceed a maximum of 1 m at any time. This maximum height may be reduced by the Engineer, based on specific site conditions, in order to prevent collapse and loss of ground.

552-4 METHOD OF MEASUREMENT

552-4.01 General. When the support system is used in stage construction, the quantity of support system will be the maximum number of square meters satisfactorily installed between the payment lines shown in the Contract Documents measured on either, but not both sides, of adjacent construction stages.

552-4.02 Permanent Sheeting. The quantity of sheeting to measure for payment will be the number of square meters, to the nearest 0.1 square meters, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.03 Temporary Sheeting. The quantity of sheeting to measure for payment will be the number of square meters, to the nearest 0.1 square meters, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.04 Interim Sheeting. The quantity of sheeting to measure for payment will be the number of square meters, to the nearest 0.1 square meters, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.05 Excavation Protection System. The quantity of protection system to measure for payment will be the number of square meters, to the nearest 0.1 square meters, obtained by multiplying the vertical length between the payment lines herein described, by the horizontal length of EPS shown in the contract documents. The upper payment line will be the ground surface existing at the site prior to the beginning of the work. The lower payment line will be the bottom of the excavation shown on the plans immediately adjacent to the protection system. The horizontal length will be the length of protection system installed measured along the payment lines as shown in the contract documents. Both sides of the excavation will be measured and computed for payment.

552-4.06 Soldier Pile and Lagging Wall.

A. Holes in Earth. The quantity to be measured for payment will be in meters of holes in earth installed. The upper payment limit is the intersected grade or ground line whichever is lower. For holes requiring rock sockets, the lower payment limit is the top of rock. For holes without rock sockets, the lower payment limit is the pile tip elevation.

B. Rock Sockets. The quantity to be measured for payment will be in meters of sockets in rock installed. The upper payment limit is the top of rock as shown on the plans. The lower payment limit is the pile tip elevation.

C. Soldier Piles. The quantity to be measured for payment will be in meters of soldier piles installed. The upper payment limit is the pile top elevation. The lower payment limit is the pile tip elevation.

D. Lagging. The quantity of lagging to measure for payment will be the number of square meters, to the nearest 0.1 square meters, between the payment lines shown in the contract documents.

552-5 BASIS OF PAYMENT

552-5.01 General. When the support system is used in stage construction, the unit price bid for the support system shall be the maximum number of square meters satisfactorily installed on either, but not both sides, of adjacent construction stages.

552-5.02 Permanent Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item.

552-5.03 Temporary Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item. Progress payments in the amount of 75% of the bid amount will be made upon installation of the sheeting with the remainder paid upon its satisfactory removal. If the Contractor leaves all or part of the sheeting in place, it will be at no additional cost to the State and the remaining 25% of the bid amount will be paid after its function is no longer required.

552-5.04 Interim Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item. Progress payments in the amount of 75% of the bid amount will be made upon installation of the sheeting with the remainder paid upon satisfactory removal of that portion specified in the contract documents. If the support system is to be left in place in its entirety, the remainder will be paid after its function is no longer required. The cost of any work necessary to cut off and remove the specified portion shall be included in the unit price bid.

552-5.05 Excavation Protection System. The unit price bid for this work shall include the cost of furnishing all labor materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, bracing, and design services when employed.

If the Engineer directs, in writing, that the EPS be left in place, this will be classified as extra work.

552-5.06 Soldier Pile and Lagging Wall.

A. Holes in Earth. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including progressing the hole through obstructions.

B. Rock Sockets. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

C. Soldier Piles. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including pile driving equipment, pile shoes, backfilling the hole and cutting off the soldier pile where required. No additional payment will be made for complete pile removal, where allowed. Splices approved, in writing, by the Deputy Chief Engineer for Technical Services will be paid for under the appropriate pay item.

D. Lagging. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including waling, bracing, connections and lagging removal, where required. No additional payment will be made when a wall is excavated on both sides. No additional payment will be made if wood lagging is placed behind concrete.

Payment will be made under:

Item No.	**Item**	**Pay Unit**
552.10	Permanent Timber Sheeting	Square Meter
552.11	Permanent Steel Sheeting	Square Meter
552.12	Temporary Timber Sheeting	Square Meter
552.13	Temporary Steel Sheeting	Square Meter
552.14	Interim Timber Sheeting	Square Meter
552.15	Interim Steel Sheeting	Square Meter
552.16	Excavation Protection System	Square Meter
552.20nn	Holes in Earth for Soldier Pile and Lagging Wall	Meter
552.21nn	Rock Sockets for Soldier Pile and Lagging Wall	Meter
552.22nn	Soldier Piles for Soldier Pile and Lagging Wall	Meter
552.2301nn	Treated Wood Lagging for Soldier Pile and Lagging Wall	Square Meter
552.2302nn	Untreated Wood Lagging for Soldier Pile and Lagging Wall	Square Meter
552.2303nn	Precast Concrete Panel Lagging for Soldier Pile and Lagging Wall	Square Meter
552.2304nn	Steel Sheeting Lagging for Soldier Pile and Lagging Wall	Square Meter

Note: nn denotes serialized pay item. Each wall and its associated components will be serialized.

Make the following changes to the Standard Specifications dated May 1, 2008:

Delete Section 552- Support and Protection Systems entirely and **Add** the following:

SECTION 552 – EXTERNALLY STABILIZED CUT STRUCTURES

552-1 DESCRIPTION

552-1.01 Permanent Sheeting. Under this work, the Contractor shall furnish and install permanent sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed by the Engineer.

All the sheeting and supports will be left in place as a finished structure unless removal of waling and bracing is called for in the contract documents.

552-1.02 Temporary Sheeting. Under this work, the Contractor shall furnish, install, maintain and remove temporary sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed by the Engineer. It may be left in place only with the written permission of the Engineer.

552.1.03 Interim Sheeting. Under this work, the Contractor shall furnish, install, maintain, cut off and remove sheeting of the type, at the locations and to the elevation(s) shown in the contract documents or as directed by the Engineer.

The interim sheeting shall be cut off and removed only to the elevation shown in the contract documents. The remaining material shall be left in place.

552-1.04 Excavation Protection System. Under this work, the Contractor shall design, furnish, place, maintain and remove an excavation protection system (EPS) at locations shown in the contract documents or as directed, in writing, by the Engineer. Details of the EPS must conform to the requirements of 29 CFR 1926 and installation shall be in accordance with the State and Federal Safety Codes. A sloping (layback) option will not be allowed.

Sheeting, shoring, a shield system, i.e. trench box or trench shield or other pre-engineered protective system may be used to prevent cave-ins. The requirements of any protective system shall be as contained in 29 CFR 1926. It may be left in place only with the written permission of the Engineer.

552-1.05 Soldier Pile and Lagging Wall. Under this work, the Contractor shall furnish and place a soldier pile and lagging wall in accordance with the contract documents; cut off walls located within the roadway limits to the elevation shown in the contract documents and leave the remainder in place unless removal is granted, in writing, by the Engineer; completely remove walls outside the roadway limits if noted on the plans; and dispose of removed material.

552-1.06 Alternate Design. The Contractor may submit to the Department a construction alternate other than that presented in the contract documents as a Value Engineering Change Proposal. Slope lay back will not be allowed. A simple material substitution involving a sheeting section modulus or soldier pile designation greater than that shown in the contract documents will be considered for acceptance. However, all proposed changes to details shown in the contract documents must be approved, in writing, by the Deputy Chief Engineer for Technical Services.

Any geotechnical analysis for a flexible support system shall be done in accordance with the procedures contained in the geotechnical design procedure "*Geotechnical Design Procedure for Flexible Wall Systems*".

552-2 MATERIALS

552-2.01 Permanent Sheeting

A. Permanent Timber Sheeting. Permanent timber sheeting shall be new and unused and consist of any acceptable species which can be placed satisfactorily in accordance with the requirements of §712-14 *Stress Graded Timber and Lumber*. Timber sheeting shall be treated in accordance with §708-31 *Wood Preservative - Waterborne* and applied in conformance with American Wood Preservers Association (AWPA) Use Category Designation UC4B. The timbers shall meet or exceed the actual cross section or stress grade shown in the contract documents. The timbers shall be sound and free from any defects which might impair its strength or tightness. The materials shall include all necessary waling and bracing required.

B. Permanent Steel Sheeting. Steel sheeting shall be new and unused conforming to the provisions of §715-17 *Steel Sheeting*. Waling and bracing shall be new and unused conforming to the provisions of §715-01 *Structural Steel*. Stock steel may be used.

552-2.02 Temporary Sheeting

A. Temporary Timber Sheeting. Temporary timber sheeting shall consist of any acceptable species which can be placed satisfactorily in accordance with the requirements of §712-14 *Stress Graded Timber and Lumber*.

Temporary timber sheeting may consist of new or used, treated or untreated material but must be in satisfactory condition and suitable for the intended use. The Engineer will reject unsatisfactory used materials.

B. Temporary Steel Sheeting. The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The materials shall include all necessary waling and bracing required. The Engineer will reject unsatisfactory used materials.

552-2.03 Interim Sheeting

A. Interim Timber Sheeting. Interim timber sheeting may consist of new of used, treated or untreated material but shall be in satisfactory condition and suitable for the intended use. The Engineer will reject unsatisfactory used materials.

B. Interim Steel Sheeting. The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The materials shall include all necessary waling and bracing required. The Engineer will reject unsatisfactory used materials.

552-2.04 Excavation Protection System. The selection of EPS materials shall be the Contractor's option. The Engineer will reject unsatisfactory materials.

552-2.05 Soldier Pile and Lagging Wall.

A. Soldier Pile. Soldier piles shall be as shown on the contract documents and conform to the requirements of §715-18 *Soldier Piles*. Waling and bracing shall be as shown in the contract documents and conform to the requirements of §715-01 *Structural Steel*. Each pile shall consist of

one continuous steel section. No pile splices will be allowed unless approved, in writing, by the Deputy Chief Engineer for Technical Services.

Used material is permitted for temporary walls unless otherwise noted on the plans, provided the material is in conformance with the specification and is acceptable to the Engineer.

B. Lagging. Lagging type(s) shall be as shown in the contract documents:

1. Treated Wood. Treated wood shall meet or exceed the full dimension thickness shown in the contract documents and graded for an extreme fiber stress of at least 1000 psi conforming to the material requirements of §712-14 *Stress Graded Timber and Lumber*. Timbers shall be treated in accordance with §708-31 *Wood Preservative - Waterborne.* The treatment shall be applied in conformance with American Wood Preservers Association (AWPA) Use Category Designation UC4B.

2. Untreated Wood. Untreated wood shall be graded for an extreme fiber stress of at least 1000 psi conforming to the provisions of §712-14 *Stress Graded Timber and Lumber* and shall meet or exceed the full dimension thickness shown in the contract documents.

3. Precast Concrete Panels. Precast concrete panels shall conform to the provisions of §704-03 *Precast Concrete-General.*

4. Steel Sheeting. Steel sheeting shall conform to the provisions of §552-2.01 B. *Permanent Steel Sheeting.*

C. Backfill for Holes. Backfill material shall be as shown in the contract documents:

1. Concrete Backfill. Concrete backfill shall be Class G concrete conforming to the provisions of Section 555 *Structural Concrete.*

2. Grout Backfill. Grout backfill shall be a workable mixture capable of stabilizing the hole being excavated. The Contractor shall use either controlled low strength material meeting the requirements of Section 204 *Controlled Low Strength Material (CLSM)* or cement, concrete sand and water conforming to Table 552-1 *Grout Backfill Requirements.*

TABLE 552-1 GROUT BACKFILL REQUIREMENTS

Material	Subsection
Portland Cement Type 2	§701-01
Concrete Sand	§703-07
Water	§712-01

552-3 CONSTRUCTION DETAILS

552-3.01 General. The Contractor shall install sheeting having a section modulus not less than that shown in the contract documents. The Contractor shall install soldier piles meeting the size designation shown in the contract documents.

Any material which stops the driving of sheeting or soldier piles within a depth of 10 feet from the ground surface at the time of driving shall be removed by the Contractor. Payment for removal of such material and any backfill required to fill the resulting void will be made under the appropriate pay items. If very compact material or boulders prevent the progression of the sheeting or soldier piles to the design tip elevation at a greater depth, the Contractor shall notify the Engineer.

The Contractor shall perform work in a manner that causes no subsidence of the surrounding ground surface. If subsidence should occur, the Contractor shall cease work and provide a written plan to prevent subsidence for approval by the Engineer. The Contractor shall repair all damage that resulted from the subsidence at no additional cost to the State.

552-3.02 Temporary Sheeting. The Contractor shall install temporary sheeting having a section modulus which meets or exceed that shown in the contract documents.

After its function is no longer required, the Contractor shall remove the sheeting placed under this work, or with the written permission of the Engineer, leave it in place after cutting off the tops at an agreed elevation.

552-3.03 Interim Sheeting. The Contractor shall install interim sheeting having a section modulus which meets or exceed that shown in the contract documents.

The Contractor shall cut off the interim sheeting and remove it to the elevation shown in the contract documents. The remaining material shall be left in place.

552-3.04 Excavation Protection System. The Contractor shall install an Excavation Protection System in accordance with the contract documents.

The EPS installed under this work shall be of sufficient size and strength to meet the requirements of 29 CFR 1926 and the Live Load requirement as contained in the AASHTO Standard Specifications for Highway Bridges. A sloping (layback) option will not be allowed. Prior to use, the Contractor shall supply the Engineer with documentation of compliance. The EPS may be left in place only with the written permission of the Engineer.

All damage to the adjacent pavement or ground caused by the use of the chosen EPS (e.g. voids beneath the pavement or shoulder, pavement or shoulder cracking or subsidence, ground settlement) shall be repaired at no additional cost to the State. Severe damage which directly affects the safety of the public shall be immediately repaired. The operation shall be halted until a satisfactory prevention method is instituted.

552-3.05 Soldier Pile and Lagging Wall. The Contractor shall install Soldier Piles meeting the size designation shown in the contract documents either by driving or by placing them in holes as indicated on the plans in accordance with Table 552-2 *Soldier Pile and Lagging Wall Pile Tolerances*. For each pile out of tolerance, provide a satisfactory replacement or provide a modification approved by the Engineer prior to proceeding. No pile splices will be allowed unless approved, in writing, by the Deputy Chief Engineer of the Office of Technical Services.

TABLE 552-2 SOLDIER PILE AND LAGGING WALL PILE TOLERANCES

Survey Location	Tolerance
Plan	3 inches at the top of pile.
Vertical	Vertical tolerance of one (1) inch per 5 feet on each axis of the soldier pile shown on the plans. Verify the axes on the top 5 feet of the soldier pile with a straight edge (5 feet minimum length) and a level (4 feet minimum length).

A. Driving Piles. Soldier piles shall be equipped with shoes in conformance with provisions of §551-3.01 C.1.a. *Preparation of Piles, Shoes, Steel Bearing Piles*, and driven in conformance with provisions of §551-3.01 D. *Equipment for Driving Piles*, except that submission of Form BD 138 is not required.

B. Creating Holes for Pile Installation. The Contractor shall provide equipment capable of establishing and maintaining holes of the minimum diameter and to the depth or elevation shown in the contract documents. Temporary sleeves or casings are permitted and may be required as per the plans. Jetting is not permitted.

If the top of socket elevation shown in the contract documents varies by more than 2 feet, the Contractor shall stop work and notify the Engineer. The Engineer will notify the Geotechnical Engineering Bureau and obtain written recommendations prior to allowing the work to proceed.

Upon completion of the hole, the Contractor shall install the soldier pile in accordance with Table 552-2 *Soldier Pile and Lagging Wall Pile Tolerances.*

C. Backfilling. After placing the piles, the Contractor shall backfill holes with the backfill(s) indicated in the contract documents.

1. Concrete Backfill. The Contractor shall place backfill in accordance with the provisions of §555-3.04 *Handling and Placing Concrete* and §555-3.05 *Depositing Structural Concrete Under Water* as shown in the contract documents. The Contractor shall allow a minimum curing time of one day before placing any lagging.

2. Grout Backfill. The Contractor shall place backfill in accordance with the provisions of §555-3.04 *Handling and Placing Concrete* and §555-3.05 *Depositing Structural Concrete Under Water*. The Contractor shall allow a minimum curing time of one day before placing any lagging.

D. Lagging. The Contractor shall install horizontal lagging so that the unsupported soil height does not exceed 3 feet at any time. If the method chosen for attaching the lagging to the soldier piles requires reattachment of lagging to the soldier piles due to planned excavation on both sides of the wall, the Contractor shall reattach the lagging at no additional cost to the State.

The Contractor shall fabricate the precast concrete lagging to the shape and size shown in the contract documents.

Precast panels manufactured in strict conformance with the contract documents do not require working drawings. When working drawings are not required, the Contractor shall notify the Engineer, in writing, of the Fabricator's intention to manufacture the panels in accordance with the contract documents. The Director of the Materials Bureau will be notified by the Engineer of the Contractor's/Fabricator's intention and will institute appropriate approval notifications.

If the precast panels are not fabricated in strict conformance with the contract documents, the Contractor shall submit working drawings through the Engineer to the Materials Bureau for written approval a minimum of 45 calendar days before beginning fabrication. Working drawings shall conform to the requirements of §704-03 *Precast Concrete-General.*

Panels manufactured without prior written approval from the Materials Bureau will not be accepted.

E. Wall Removal. The Contractor shall cut off soldier piles placed within the roadway limits at the subgrade surface unless otherwise noted in the contract documents. Soldier piles placed outside the roadway limits may be removed or cut off a minimum of 2 feet below final ground surface unless otherwise noted in the contract documents.

If lagging is to be removed, the Contractor shall remove the lagging so that the unsupported soil height does not exceed a maximum of 3 feet at any time. This maximum height may be reduced by the Engineer, based on specific site conditions, in order to prevent collapse and loss of ground.

552-4 METHOD OF MEASUREMENT

552-4.01 General. When the support system is used in stage construction, the quantity of support system will be the maximum number of square feet satisfactorily installed between the payment lines shown in the Contract Documents measured on either, but not both sides, of adjacent construction stages.

552-4.02 Permanent Sheeting. The quantity of sheeting to measure for payment will be the number of square feet, to the nearest square foot, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.03 Temporary Sheeting. The quantity of sheeting to measure for payment will be the number of square feet, to the nearest square foot, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.04 Interim Sheeting. The quantity of sheeting to measure for payment will be the number of square feet, to the nearest square foot, obtained by multiplying the vertical length of sheeting between the payment lines herein described, by the horizontal length of sheeting shown in the contract documents. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line will be the original ground at the time of commencing work. The lower payment line will be the elevation shown in the contract documents as the minimum embedment depth.

The horizontal length will be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.05 Excavation Protection System. The quantity of protection system to measure for payment will be the number of square feet, to the nearest square foot, obtained by multiplying the vertical length between the payment lines herein described, by the horizontal length of EPS shown in the contract documents. The upper payment line will be the ground surface existing at the site prior to the beginning of the work. The lower payment line will be the bottom of the excavation shown on the plans immediately adjacent to the protection system. The horizontal length will be the length of protection system installed measured along the payment lines as shown in the contract documents. Both sides of the excavation will be measured and computed for payment.

552-4.06 Soldier Pile and Lagging Wall.

A. Holes in Earth. The quantity to be measured for payment will be in feet of holes in earth installed. The upper payment limit is the intersected grade or ground line whichever is lower. For holes requiring rock sockets, the lower payment limit is the top of rock. For holes without rock sockets, the lower payment limit is the pile tip elevation.

B. Rock Sockets. The quantity to be measured for payment will be in feet of sockets in rock installed. The upper payment limit is the top of rock as shown on the plans. The lower payment limit is the pile tip elevation.

C. Soldier Piles. The quantity to be measured for payment will be in feet of soldier piles installed. The upper payment limit is the pile top elevation. The lower payment limit is the pile tip elevation.

D. Lagging. The quantity of lagging to measure for payment will be the number of square feet, to the nearest square foot, between the payment lines shown in the contract documents.

552-5 BASIS OF PAYMENT

552-5.01 General. When the support system is used in stage construction, the unit price bid for the support system shall be the maximum number of square feet satisfactorily installed on either, but not both sides, of adjacent construction stages.

552-5.02 Permanent Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item.

552-5.03 Temporary Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item. Progress payments in the amount of 75% of the bid amount will be made upon installation of the sheeting with the remainder paid upon its satisfactory removal. If the Contractor leaves all or part of the sheeting in place, it will be at no additional cost to the State and the remaining 25% of the bid amount will be paid after its function is no longer required.

552-5.04 Interim Sheeting. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, and bracing. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item. Progress payments in the amount of 75% of the bid amount will be made upon installation of the sheeting with the remainder paid upon satisfactory removal of that portion specified in the contract documents. If the support system is to be left in place in its entirety, the remainder will be paid after its function is no longer required. The cost of any work necessary to cut off and remove the specified portion shall be included in the unit price bid.

552-5.05 Excavation Protection System. The unit price bid for this work shall include the cost of furnishing all labor materials and equipment necessary to satisfactorily complete the work, including driving equipment, waling, bracing, and design services when employed.

If the Engineer directs, in writing, that the EPS be left in place, this will be classified as extra work.

552-5.06 Soldier Pile and Lagging Wall.

A. Holes in Earth. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including progressing the hole through obstructions.

B. Rock Sockets. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

C. Soldier Piles. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including pile driving equipment, pile shoes, backfilling the hole and cutting off the soldier pile where required. No additional payment will be made for complete pile removal, where allowed. Splices approved, in writing, by the Deputy Chief Engineer for Technical Services will be paid for under the appropriate pay item.

D. Lagging. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including waling, bracing, connections and lagging removal, where required. No additional payment will be made when a wall is excavated on both sides. No additional payment will be made if wood lagging is placed behind concrete.

Payment will be made under:

Item No.	Item	Pay Unit
552.10	Permanent Timber Sheeting	Square Foot
552.11	Permanent Steel Sheeting	Square Foot
552.12	Temporary Timber Sheeting	Square Foot
552.13	Temporary Steel Sheeting	Square Foot
552.14	Interim Timber Sheeting	Square Foot
552.15	Interim Steel Sheeting	Square Foot
552.16	Excavation Protection System	Square Foot
552.20nn	Holes in Earth for Soldier Pile and Lagging Wall	Foot
552.21nn	Rock Sockets for Soldier Pile and Lagging Wall	Foot
552.22nn	Soldier Piles for Soldier Pile and Lagging Wall	Foot
552.2301nn	Treated Wood Lagging for Soldier Pile and Lagging Wall	Square Foot
552.2302nn	Untreated Wood Lagging for Soldier Pile and Lagging Wall	Square Foot
552.2303nn	Precast Concrete Panel Lagging for Soldier Pile and Lagging Wall	Square Foot
552.2304nn	Steel Sheeting Lagging for Soldier Pile and Lagging Wall	Square Foot

Note: nn denotes serialized pay item. Each wall and its associated components will be serialized.