



November 20, 2002

MEMORANDUM TO GROUP LEADERS & CONSULTANTS

SUBJECT: Temporary Sheet Piles

Due to underground utility conflicts, constructibility issues and possible cost savings, Bridge Design has received requests to replace temporary sheet pile walls with Temporary Mechanically Stabilized Earth (MSE) walls with welded wire form facing and geosynthetic wrap ("Geogrid Retaining Wall").

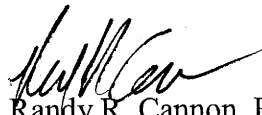
The attached special provision does allow the use of "Geogrid Retaining Wall" as an alternative to Temporary Sheet Piles.

All future projects should use below pay item with attached specification instead of bid item #2047000 – Temporary Sheet Pile-[LF].

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
1072310	Temporary Shoring Wall	Linear Feet (LF)

This is to be incorporated into all future projects. Projects that have already been designed and detailed should be revised as necessary to accommodate this change.

If the designer wants to limit the temporary shoring wall to a particular type in the specification, the plans shall indicate this requirement with a note.


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Bridge Design Engineer

RRC/slb
Attachments
cc: Assistant Bridge Design Engineers
Bridge Construction Engineer
FHWA
CRM East
CRM West
Ed Eargl, Road Design
Rick Werts, Traffic Engineering
File: PC/BA



APPROVED: Oct 3, 2002
Division Administrator
By: David B Law
FEDERAL HIGHWAY ADMINISTRATION

TEMPORARY SHORING WALL

The Standard Specifications for Temporary Sheet Piling are hereby amended as follows:

Delete sub-sections A, B, & C of Section 204.09 and replace them with the following:

A. DESCRIPTION. This work shall consist of the designing, furnishing, installing, maintaining, and removing (if required by the Engineer) the temporary shoring walls at the locations shown on the plans. A temporary shoring wall may be, but is not limited to one of the following types unless specified otherwise in plans:

- a. Steel sheet pile wall – braced or tieback
- b. Steel soldier piles with lagging – braced or tieback
- c. Temporary Mechanically Stabilized Earth (MSE) wall with welded wire form facing and geosynthetic wrap for fill situations.

This item is designated as “temporary” due to its limited service life that is typically until construction of a permanent structure (i.e. embankment, bridge abutment, etc.) is completed. Even though the shoring is “temporary” it may remain in place at the end of construction due to the impracticality of removing the shoring components (i.e. tie backs, soil reinforcement, etc.) or the potential of damage to the permanent structure that may exist during extraction of the shoring components.

B. DESIGN. Temporary shoring walls shall be designed to resist all dead and live loadings (earth pressures, hydrostatic pressures, traffic loads, point loads, line loads, and surcharge loads) that the retaining system may experience during the service life of the structure. The temporary shoring walls shall be designed in accordance with the latest edition of the AASHTO Standard Specifications for Highway Bridges, with interim specifications, and the applicable requirements of section 702.10 entitled “Falsework Design and Inspection”. Temporary shoring walls shall be designed, signed, and sealed by a Registered Professional Engineer, registered to practice in the State of South Carolina.

The Contractor shall be responsible for the external stability of all temporary shoring walls. Any geotechnical investigation necessary to verify the external stability shall be included in the unit price for Temporary Shoring Wall. Differential and absolute settlements of temporary walls shall be limited to ensure minimal detrimental effects.

Temporary shoring walls shall be designed in accordance with the design criteria provided below :

1. **Design Methodology:** Design methodology shall be in accordance with accepted AASHTO design methodology. Temporary MSE walls shall be designed using the Simplified Coherent Gravity approach of determining maximum reinforcement loads, T_{max} . Temporary shoring walls are not required to resist seismic forces from earthquake events.
2. **Design Life:** All temporary shoring walls shall be designed for a minimum of 3 years design life. Temporary shoring walls that will be in use for more than 5 years shall be designed as permanent retaining wall structures.
3. **Soil Design Parameters:** Temporary shoring walls shall be designed using appropriate soil properties relative to the anticipated service life. Temporary shoring that will be in-place for a period where excess pore pressures have not dissipated (typically less than 4 to 6 months) shall be designed using total (undrained) soil shear strength parameters. Effective (drained) soil shear strength (drained) parameters should be used when temporary shoring walls are in service sufficiently long (typically more than 4 to 6 months) for excess pore pressures to dissipate.

4. For Temporary MSE Walls use following External Stability Minimum Safety Factors:
 - Global Stability Factor of Safety, $FS_{Global} = 1.3$
 - Sliding Stability Factor of Safety @ Base, $FS_{Base} = 1.5$
 - Sliding Stability Factor of Safety @ Reinforcement, $SF_{Reinforcement} = 1.5$
 - Overturning Factor of Safety, $FS_{Overturning} = 2.0$
 - Eccentricity, $e < L/6$
(Where L = Reinforcement Length for Temporary MSE Walls)
 - Bearing Capacity Factor of Safety, $FS_{Bearing} = 2.5$

5. For Temporary MSE Walls use following Internal Stability Minimum Safety Factors:
 - Pullout Factor of Safety, $FS_{Pullout} = 1.5$
 - Reinforcement Rupture Factor of Safety, $SF_{Rupture} = 1.2$

6. For Temporary MSE Wall Soil Reinforcement:
 - The soil reinforcement length should be selected based on the longest soil reinforcement length required to meet the following design requirements:
 - a. Resist sliding along the wall base or at each soil reinforcement layer with the appropriate safety factor.
 - b. The length, L, required for internal stability is the distance required to extend beyond the active zone, L_a , plus the length required to resist pullout in the resistant zone, L_e , with the appropriate safety factor. The minimum embedment in the resistant zone shall be 3 feet ($L_e \geq 3$ feet).
 - c. AASHTO minimum soil reinforcement length requirements (8 feet or $0.7H$ where H is the wall design height).
 - Soil reinforcement shall be the same length, L, for each soil reinforcement layer within a design section. A soil reinforcement coverage ratio, R_c , of 1.0 shall be used for all types of geosynthetic sheet reinforcement.
 - AASHTO specifications for soil reinforcement performance (pullout coefficients, degradation, etc.) are based on using AASHTO reinforced backfill specifications. Any deviation in backfill specifications may require additional testing at the contractor's expense or use of previous test results on similar materials.

7. For Temporary MSE Wall Geosynthetic Reinforcement:
 - The default temporary geosynthetic soil reinforcement total reduction factor, $RF_{Default}$, of 3.5 may be used provided that the geosynthetic manufacturer certifies that the geosynthetic reinforcement meets the requirements of AASHTO Table 5.8.6.1.2A. Geosynthetic reinforcements not meeting the requirements of AASHTO Table 5.8.6.1.2A shall use a default total reduction factor, $RF_{Default}$, of 5.
 - Use of total reduction factors, RF, less than default reduction factor, $RF_{Default}$, will require that the geosynthetic manufacturer certify and provide supporting documentation (field and laboratory test results), in accordance with AASHTO specifications, of individual reduction factors for installation damage, RF_{ID} , creep strength reduction, RF_{CR} , and material durability, RF_D for the design life of the temporary wall structure.
 - The geosynthetic soil reinforcement manufacturer shall certify the ultimate tensile strength, T_{Ult} .
 - All strength values certified shall be the minimum average roll value, MARV, for that product.
 - All certifications shall consider the performance of the geosynthetic soil reinforcement in the actual or similar type of reinforced backfill being used.

8. For Temporary MSE Wall Facing
- Temporary facing with as welded wire form and geosynthetic wrap shall be designed in a manner which prevents the occurrence of bulging in excess of 2 inches when backfill behind the facing elements is compressed due to compaction stresses or self weight of the backfill. Bulging shall be measured as the maximum displacement from the theoretical vertical or sloped face of the temporary MSE wall that extends over a section of 1 foot or more along the theoretical wall face.
 - The temporary facing shall be designed to the same structural requirements as the other components of the temporary MSE wall.

The Contractor shall submit design calculations, including soil design parameters used, methods of construction, and detailed drawings for all design cases. If permanent embankments are to be constructed against the temporary shoring walls, the Contractor shall also submit a method to prevent reflective cracking at the top of the embankment that may occur at the interface between the two construction phases. This may be accomplished by constructing a soil-reinforced mat below the pavement structure or approach slab that crosses over the two construction phases for sheet piles and horizontal layers of soil reinforcement that crosses the interface between both construction phases at various elevations along wall for Temporary Mechanically Stabilized Earth (MSE) wall with welded wire form facing and geosynthetic wrap.

All submittals shall have the seal and signature of the design engineer of record, for approval to the Engineer thirty (30) days prior to construction of the wall.

The Contractor shall be responsible for insuring all wall materials (i.e. reinforced MSE backfill) and wall components (i.e soil reinforcements, tie backs, etc.) are in conformance with the design of the temporary shoring wall. Any wall material or wall performance testing (i.e. anchor load testing, etc.) required by the contractor 's design shall be included in the unit price for the Temporary Shoring Wall.

C. CONSTRUCTION. The temporary shoring wall shall be constructed in a manner that protects adjacent buildings, bridges, roadways, or railway, and existing traffic, while allowing construction access for new bridge and roadway embankment construction. The Contractor's backfilling operations around existing piles shall be such that minimum lateral loads are exerted on existing piles. The Contractor shall be responsible for any damages or retrofit to adjacent structures that result from the construction of the temporary shoring wall.

Any wood lagging used shall be in accordance with Section 706 of the South Carolina State Highway Department Standard Specifications for Highway Construction, Edition of 2000.

All bracing, tiebacks, or other wall components used must provide access for new bridge substructure and superstructure construction, while maintaining the existing traffic flow without interruption.

Delete sub-section E of Section 204.10 and replace it with the following:

E. Temporary Shoring Wall. The length of temporary shoring wall to be measured for payment shall be the actual horizontal length of wall in place and accepted by the Engineer.

Section 204.11 is hereby amended to include the following:

All cost for design, materials including geosynthetic reinforcement, wrap and welded wire form if used, installation, maintenance, removing the temporary shoring and other items or incidental work shall be included in the price bid for "Temporary Shoring Wall".

Payment will be made under:

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
1072310	Temporary Shoring Wall	Linear Feet (LF)