

Supplemental Technical Specification for Temporary Shoring

SCDOT Designation: SC-M-204-2 (01/23)

APPROVED:
Division Administrator

By: _____
FEDERAL HIGHWAY ADMINISTRATION

1.0 DESCRIPTION

Furnish all necessary design and material submittals required when the project Plans indicate the use of temporary shoring is required for construction of bridge substructure or other elements of work. All materials used for the temporary shoring shall conform to the requirements of the appropriate Sections of the Standard Specifications. Temporary shoring systems may consist of the following:

- A. Sheet pile (unanchored or anchored) (cut)
- B. Soldier pile and lagging (unanchored or anchored) (cut)
- C. Soil Nail with temporary facing (cut)
- D. Gabion (fill)
- E. Mechanically Stabilized Earth (MSE) Wall (welded wire or geosynthetic face) (fill)
- F. Reinforced soil slope (RSS) (fill)

“Cut” and “fill” are indicated after each temporary shoring system in the list above; this is typical usage. The Contractor may select to use any system; however, the Contractor should also be aware of the limitations and potential concerns of using a “cut” shoring system in place of a “fill” shoring system and vice versa. “Cut” indicates top-down construction and “fill” indicates bottom-up construction. “Cut” and “fill” are used in the selection of performance criteria, (i.e., performance limits during the service life of the system). Shoring systems A, B, and C are cantilevered shoring systems, while shoring systems D, E, and F are flexible gravity shoring systems. The type of shoring system affects the selection of the appropriate resistance factors.

Furnish, install, maintain, and remove (if practical, consult with the RCE on the practicality of removal) temporary shoring systems at the locations shown on the plans.

2.0 Design Requirements

Retain the services of an engineer(s) licensed pursuant to the laws of South Carolina who has (have) designed a minimum of 3 temporary shoring system of similar size (i.e., length and exposed wall height) to those indicated on the Plans. Provide a list of those projects. List for each referenced project, the project start and completion dates, total linear length of temporary shoring installed, and a detailed description of the project, site conditions, and subsurface conditions. Include in the project description details of the temporary shoring, the client name and address, the name and telephone number of the representative of the consultant and owner for whom the work was performed and who can attest to the successful completion of the work, and any other information relevant to demonstrating the engineer’s qualifications. Allow 15 calendar days for review of these resumes and qualifications.

The Contractor is responsible for all structural and geotechnical design of the temporary shoring system. Design all temporary shoring systems using LRFD methods and in accordance with the following documents:

- A. AASHTO Guide Design Specifications for Bridge Temporary Works, latest version with all interims
- B. AASHTO Construction Handbook for Bridge Temporary Works, latest version with all interims
- C. AASHTO LRFD Bridge Construction Specifications, latest version with all interims
- D. AASHTO LRFD Bridge Design Specifications, latest allowed version with interims
- E. SCDOT Geotechnical Design Manual (GDM), latest version including all Geotechnical Design Bulletin (GDBs).

All temporary shoring systems are considered to be Earth Retaining Structures (ERSs). Design any shoring system that is anticipated to have a service life (S_L) of less than 5 years as a temporary Earth Retaining Structure (ERS) (i.e., shoring system). Follow the requirements presented in the latest edition of the SCDOT GDM when designing temporary shoring. Temporary shoring is used during construction to allow for the staged construction of a permanent structure (i.e., embankment, bridge abutment, etc.). Even though the shoring system is temporary, the shoring system may remain in place at the end of construction due to the impracticability of removing the shoring components (i.e., tie backs, soil reinforcement, etc.) or the potential of damage to the permanent structure that may occur during extraction of the shoring system components. Identify all components of the temporary shoring to be left in place and include all details, impacts, and design ramifications of any such components in the Working Drawings and design calculation submittals.

Design any temporary shoring system that is anticipated to have a service life of 5 years or more as a permanent ERS and follow the requirements presented in the latest edition of the SCDOT GDM. Temporary shoring systems with an anticipated service life of 5 years or more do not have to have a permanent face, unless required by the plans or the RCE. Design all permanently exposed shoring systems as an ERS and follow the requirements of the latest edition of the SCDOT GDM.

The load (γ) and resistance (ϕ) factors for temporary structures [service life (S_L) less than 5 years ($S_L < 5$ years)] contained in the SCDOT GDM shall be used in the design of the temporary shoring system. Do not use Extreme Event I (EE I) in the design of temporary shoring systems, unless the temporary shoring system will be in use for 5 years or more. Prior to designing any temporary shoring system to be in service for 5 years or more, coordinate and discuss with the RCE, why the temporary shoring system must be in service 5 years or more. If the S_L of the temporary shoring is approved to be 5 years or more, contact the RCE to determine if EE II loadings will be required to be considered in the design of the temporary shoring.

Design all temporary shoring systems to resist all dead and live loadings including earth pressures, hydrostatic pressures, traffic loads, point loads, line loads, and surcharge loads that the temporary shoring system may experience during the life of the structure (include on working drawings). Include a drainage system to prevent intrusion of water into the temporary shoring as well as to reduce the hydrostatic pressure buildup behind the temporary shoring.

The Contractor is solely responsible for the external and internal stability of the temporary shoring system. Use the soils information provided in the contract documents for these designs. If additional temporary shoring is required by the Contractor's means and methods, the Contractor is solely responsible for obtaining any required geotechnical information. The Contractor's geotechnical exploration shall meet the requirements of the SCDOT GDM (latest version).

Submit the results of any additionally required geotechnical investigations; all design calculations, including soil design parameters used; methods of construction; details of components that will not be removed; and detailed drawings for design cases to RCE.

Design the temporary shoring system to limit vertical and lateral displacements that would affect the stability or performance of any adjacent structures (MSE walls, Bridge foundations, Pavement Structure, Approach Slabs, Embankment (stage construction), etc.). Determine deformations for vertical settlement, sliding, bulging, bowing, bending, and buckling. Please note that this is not an all-inclusive list and that the determination of additional deformations may be required. Include in the design a method or system to prevent reflective cracking above the interface between the temporary shoring and the permanent structure.

Allowable deformations are dependent on the type of structure affected by the deformation of the temporary shoring system. Regardless of the type of structure affected by the deformations, limit deformations to less than 3 inches in either the vertical or horizontal direction unless otherwise shown in the plans.

Provide an instrumentation plan, meeting the requirements contained in the latest version of the SCDOT GDM, for monitoring the deformations of the temporary shoring and any adjacent structure. Submit the instrumentation plan with all shop and working drawing submittals. The instrumentation plan shall indicate a maximum allowable deformation of no more than 3 inches (vertically or horizontally), for the temporary shoring system and adjacent structures.

Typical instrumentation used for monitoring deformations includes survey targets, settlement monuments, crack gages, inclinometers, and/or tilt monitors. Establish monitoring locations that permits consistent and repeatable measurements for the entire construction period.

Establish a monitoring schedule for the duration of construction and include the schedule in the instrumentation plan. Submit periodic monitoring reports to the RCE in accordance with the accepted instrumentation plan. Any changes in frequency of monitoring or report submittal must be sent to the RCE for acceptance. If the initial instrumentation plan is found by the RCE to not adequately document the movements of the temporary shoring system or the adjacent structures, revise the instrumentation plan and resubmit the revised plan to the RCE for review and acceptance.

If the measured deformations exceed the maximum allowable deformations shown in the instrumentation plan, the Contractor will be required to stop work immediately, and at Contractor's expense, provide additional analysis demonstrating the wall is satisfactory and/or mitigate the situation prior to resumption of construction activities. The Department will determine whether the additional analysis and/or mitigation proposed by the Contractor is satisfactory. Extended monitoring after construction may be required if adjacent structures have been affected by the construction. The extended monitoring of the adjacent structures shall continue until the structures

have stabilized and the Department concurs with the results and conclusions of the monitoring report.

3.0 Materials

Materials used to construct temporary shoring systems shall meet the requirements of the appropriate Sections of the Standard Specifications for Highway Construction (latest edition).

4.0 Submittals

Submit all working drawings, design calculations, and material certifications as required by the appropriate Sections of the Standard Specifications for Highway Construction (latest edition). If a material specification is not provided by the Standard Specifications for Highway Construction (latest edition), the Contractor may either apply the AASHTO LRFD Bridge Construction Specifications, latest version including all interims or contact the Office of Materials and Research for guidance.

5.0 Construction

Construct the temporary shoring system in a manner that protects adjacent structures; roadways; railways; and existing traffic, while allowing construction access for new bridge or other structure and embankment construction. Perform backfilling operations around existing piles so that only minimal lateral loads (i.e., approximately 10 kips) are exerted on existing piles. The Contractor is responsible for any damages or retrofit to adjacent structures that result from the construction of the shoring system.

When timber lagging is used, use timber meeting the requirements of **Section 706** Standard Specifications for Highway Construction (latest edition) for lagging.

Use bracing, tiebacks, or other wall components that provide access for new bridge substructure and superstructure or other structure construction, while maintaining traffic flow that meets project and/or RCE requirements.

Backfill material for shoring systems that will be permanently incorporated into embankments shall meet or exceed the requirements for borrow excavation. Ensure that the backfill for structures conforms to the requirements of **Subsection 205.4.2** of the Standard Specifications for Highway Construction (latest edition).

6.0 Removal of Temporary Shoring

Contractor to consult with the RCE on the practicality of removing temporary shoring. The RCE will determine that removal of the temporary shoring will not affect completed structural components. Any temporary shoring materials removed remain the property of the Contractor.

7.0 Measurement

The quantity for the pay item Temporary Shoring System is the length of the shoring system and is measured by the linear foot (LF) along the actual horizontal length of the shoring system, complete, and accepted.

Identify the number and type of instruments required by the instrumentation plan. Include installation, maintenance, monitoring and reporting of all instrumentation.

If borrow excavation is anticipated to be used to backfill the shoring system, the quantities of borrow excavation have been included in the quantity of borrow excavation for the project.

8.0 Payment

Payment for the accepted quantity for Temporary Shoring System is full compensation for design (includes necessary calculations and drawings), construction, maintenance and removal of the Temporary Shoring System as specified or directed. Payment includes providing and installation of all materials necessary to construct either Temporary Shoring Systems and all other materials (excluding backfill materials which have been included in the borrow excavation quantities), labor equipment, tools, supplies, transportation, and other items or incidental work necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract. Borrow excavation required to construct shoring systems will be paid at the unit rate of borrow excavation for the project. The cost of any excess backfill material to be removed from the project following removal of the shoring systems is incidental to the cost of temporary and permanent shoring systems.

All costs associated with developing the instrumentation plan, purchasing instrumentation, installing instrumentation, and monitoring of the instrumentation shall be included in the unit cost of the temporary shoring system.

If part or all of the Temporary Shoring System must be left in place, include the cost of leaving the system in place in the unit cost of the Temporary Shoring System. If the Contractor elects to leave any Temporary Shoring System in place permanently (with approval from the RCE) for the Contractor's convenience, the Contractor is not entitled to additional compensation. If the RCE directs the Contractor to leave any Temporary Shoring System in place permanently, that the Contractor intended to remove, payment for such modification will be addressed separately with a supplemental agreement.

When more than one Temporary Shoring System is used, label each system a designative number and use the corresponding Item Number. Pay items under this section include the following:

Item No.	Pay Item	Unit
2047000	Temporary Shoring System	LF
2047001	Temporary Shoring System No. 1	LF
2047002	Temporary Shoring System No. 2	LF
2047003	Temporary Shoring System No. 3	LF
2047004	Temporary Shoring System No.4	LF
2047005	Temporary Shoring System No. 5	LF
2047006	Temporary Shoring System No. 6	LF
2047007	Temporary Shoring System No. 7	LF
2047008	Temporary Shoring System No. 8	LF