

**Supplemental Technical Specification for  
Cofferdams**

**SCDOT Designation: SC-M-204-1 (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 cofferdams for construction of bridge substructure or other elements of work are required. All materials used for the cofferdam shall conform to the requirements of the appropriate Sections of the Standard Specifications.

**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 cofferdams of similar sizes to those indicated on the Plans. Provide a list of those projects. List for each referenced project, the project start and completion dates, total volume of cofferdam installed, and a detailed description of the project, site conditions, and subsurface conditions. The project description shall include details of the cofferdam, 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 projects prior to commencing cofferdam design.

The Contractor is responsible for all structural and geotechnical design of the cofferdam. Design all cofferdams 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).

The geotechnical load ( $\gamma$ ) and resistance ( $\phi$ ) 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 cofferdam. Do not use Extreme Event I (EE I) in the design of the cofferdam, unless the cofferdam will be in use for 5 years or more. Prior to designing any cofferdams to be in service for 5 years or more, coordinate and discuss with the RCE, why the cofferdam system must be in service 5 years or more. If the  $S_L$  of the cofferdam if approved to be 5 years or more, contact the RCE to determine is EE II loadings will be required to be considered in the design of the cofferdam.

Design all cofferdams or 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 cofferdam or shoring system may experience during the life of the structure (include on working drawings).

The Contractor is solely responsible for the external and internal stability of the cofferdam system. Use the soils information provided in the plans for these designs. If additional cofferdams are 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). All cofferdams or shoring systems are considered to be Earth Retaining Structures (ERSs).

Submit the results of any additionally required geotechnical investigation; 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.

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 cofferdams 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).

#### **5.0 Construction**

##### **5.1 Installation**

Install the cofferdam prior to excavation for foundation construction unless some excavation is required to remove identified obstructions. Extend the cofferdam as shown on the accepted working drawings. Ensure the cofferdam is braced in accordance with the working drawings and constructed to permit the free pumping of water and to keep the cofferdam free of water until all foundation concrete below water has reached its initial set. Confirm the interior dimensions of the cofferdam is sufficient to give clearance for the construction of forms, inspection of the exterior of forms, and pumping and handling of leakage from outside of the forms, both when seal concrete is and is not required. Construct the forms and cofferdam to protect green concrete against damage from a sudden rising of water and to prevent damage to the foundation by erosion. Leave no bracing in the cofferdam that extends into the substructure without written permission from the Engineer-of-Record with concurrence from the BCE.

Right or enlarge cofferdams that become tilted or moved laterally to provide ample clearance. No extra compensation is made for this work.

##### **5.2 Foundation Seal**

When the working plans indicate that seal concrete is required, excavate the interior of the cofferdam to within 6 inches of the elevation indicated on the Plans. Remove all objectionable (soft or loose subgrade soil, organics, etc.) material from the cofferdam to the satisfaction of the RCE.

When foundation piles are to be driven, over excavate the cofferdam sufficiently below the anticipated finished grade to account for any "heave" that may occur during the installation of the piles. If considered necessary by the RCE, excavate to sufficient depth and backfill with bridge lift material to avoid contamination by mud. Completely remove earth material in the arched web of steel and/or concrete sheet piling so that the seal concrete is in full contact with the cofferdam sheeting in all areas. Maintain a water level inside of the cofferdam at the same level as exterior to prevent blow in or heave of the bottom of the cofferdam during the excavation of the cofferdam. After achieving the subgrade elevation beneath the seal concrete and cleaning the exposed surface, install deep foundations as indicated on the plans.

Where drilled shafts are required, install drilled shaft casings and seal concrete to the elevations indicated on the plans.

Where seal concrete is required, level the exposed subgrade of the cofferdam prior to placing seal concrete to within a 5 percent grade in any direction from one edge to the opposite edge. Remove earth material, loose rock and small boulders.

Obtain written concurrence of the BCE before performing excavation by blasting. Comply with the requirements in the SCDOT Construction Manual, including notifying the SCDOT Director of Communications before performing any blasting operations. Before blasting in any stream, river or lake coordinate plans and operations with the local South Carolina Department of Natural Resources (SCDNR) District Fisheries Biologist and District Law Enforcement Captain.

When the seal concrete is placed underwater, maintain the same water level both inside as well as outside the cofferdam to prevent hydrostatic pressure on fresh concrete due to head differential.

Construct the seal concrete as prescribed in **Subsection 702.4.2.6** of the Standard Specifications for Highway Construction.

### **5.3 Dewatering**

Perform dewatering under the supervision of a registered engineer, pursuant to the laws of South Carolina, and his/her field supervisor. Provide a list of at least 3 projects of similar size that both the engineer and field supervisor, each, have been in charge of during the past 5 years. Provide the project name, address, and contact name and phone number for references that are familiar with the work. Allow 15 calendar days for review of these projects prior to commencing dewatering. Perform dewatering of a cofferdam enclosure using a method that prevents any portion of the seal concrete materials from being carried away. Do not dewater the cofferdam during the placement of seal concrete nor until the seal concrete has achieved the required compressive strength as indicated in the plans or as directed by the RCE. After the seal concrete has achieved the required strength, dewater the cofferdam, and thoroughly clean the seal concrete of all laitance and other objectionable (soft or loose subgrade soil, organics, etc.) materials prior to the placement of foundation concrete. Place the foundation concrete in the dry.

### **5.4 Backfill**

Ensure that the backfill for structures conforms to the requirements of **Subsection 205.4.2** of the Standard Specifications for Highway Construction (latest edition).

### **5.5 Removal of Cofferdams**

Materials used to construct the cofferdam remain the property of the Contractor.

If the Contractor elects to leave the cofferdam in-place, contact the RCE for evaluation of the effect on the structure by leaving the cofferdam in-place. Additionally, if the Contractor elects to leave the cofferdam in-place, the Contractor is required to obtain all permit modifications at no additional cost to the Department.

Prior to removal of the cofferdam, Contractor to obtain concurrence from RCE. RCE will determine that removal of cofferdam will not affect completed structural components prior to completion of project.

Remove the cofferdam with all falsework, sheeting, and bracing. Remove the cofferdam without disturbing or marring the finished structure.

## **6.0 Measurement**

All materials to be excavated to permit bridge foundation construction shall be measured as required in **Section 204** of the Standard Specifications for Highway Construction (latest edition).

In the case of a permanent structural member such as a strut, diaphragm, beam, or other structural element where it is necessary to excavate in order to place forms, such excavation is included in the volume of structure excavation. However, the limit of structural excavation measurement does not extend more than 12 inches horizontally beyond the sides of the members, nor more than 12 inches below the bottom of the members.

Where a foundation seal is indicated in the Contract, the quantity for the pay item Wet Excavation for Bridges is the volume of the excavation of material other than water between the bottom of the watercourse and the actual bottom of seal concrete as poured and within the vertical planes of the neat lines of the seal shown on the Plans and is measured by the cubic yard (CY) of excavated material, complete, and accepted.

If material for backfill is required because of the removal of unstable material below grade is obtained from the roadway or material pits, it is included in the measurement for Unclassified Excavation. Material necessary for backfill obtained from sources other than the roadway and material pits is considered as being equal to the volume of the unstable material removed and is measured as provided in **Subsection 203.5** of the Standard Specifications for Highway Construction (latest edition). No direct allowance is made for overhaul or shrinkage for material to backfill undercut areas.

The quantity for the pay item Cofferdam or Cofferdam – Type (1, 2, 3, 4, 5, or 6) is measured by each (EA) cofferdam designed, including any required design changes; constructed; dewatered; maintained and removed in accordance with the Plans, complete, and accepted. The type is based on a theoretical range of the volume contained in the cofferdam. No adjustment is made for differences between theoretical and actual volume of the cofferdam constructed unless approved by the RCE.

## **7.0 Payment**

Payment for the accepted quantity of each pay item, measured or determined as provided in **Section 6.0 Measurement**, is determined using the contract unit bid price for the applicable pay item. The payment is full compensation for all direct and indirect costs and expenses necessary for the successful completion of excavation to the depth indicated on the Plans, in the Specifications, or directed by the RCE.

All materials excavated to permit bridge foundation construction will be paid for as required in **Section 204** of the Standard Specifications for Highway Construction (latest edition).

If it is necessary and approved by the RCE to carry a foundation more than 5 feet, but not more than 10 feet below the Plan elevation for any individual footing, payment for the additional excavation work performed below the Plan elevation is determined using an adjusted unit price equal to 150% of the contract unit bid price for the applicable classification of excavation.

If it is necessary and approved by the RCE to carry a foundation more than 10 feet below Plan elevation for any individual footing, payment for the additional excavation work performed below the Plan elevation is determined using an adjusted unit price equal to 200% of the contract unit bid price for the applicable excavation. The payment includes the cost of removing the cofferdam, cribs, sheeting, backfill, and disposing of surplus material. Excavation is paid under one classification only once and no allowance is made for necessary re-excavation.

Payment for Cofferdam or Cofferdam – Type (1, 2, 3, 4, 5, or 6) is full compensation for the design (includes necessary calculations, drawings, and any required revisions), construction, dewatering, maintenance and removal of the cofferdam as specified or directed. Payment includes installation of the cofferdam; placement of seal concrete if required or used; dewatering; underwater inspection; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract. The cofferdam is paid at 75 percent of the contract unit bid price after the cofferdam is dewatered and the remaining 25 percent upon removal of the cofferdam. If the cofferdam is not to be removed, then the remaining 25 percent will be paid upon substantial completion and acceptance of the substructure.

Pay items under this section include the following:

| <b>Item No.</b> | <b>Pay Item</b>                         | <b>Unit</b> |
|-----------------|-----------------------------------------|-------------|
| 2045000         | Cofferdam                               | EA          |
| 2045010         | Cofferdam - Type 1 (0 – 10,000 CF)      | EA          |
| 2045020         | Cofferdam - Type 2 (10,001 – 20,000 CF) | EA          |
| 2045030         | Cofferdam - Type 3 (20,001 – 30,000 CF) | EA          |
| 2045040         | Cofferdam - Type 4 (30,001 – 40,000 CF) | EA          |
| 2045050         | Cofferdam - Type 5 (40,001 – 50,000 CF) | EA          |
| 2045060         | Cofferdam - Type 6 (>50,000 CF)         | EA          |