

WYOMING DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SHEAR PILES

Project No. P142045
Farson-Lander
Double Nickel Slide
Fremont County

REFERENCE: The 2010 Edition of the Wyoming Department of Transportation's *Standard Specifications for Road and Bridge Construction*.

DESCRIPTION: This work will be considered a specialty item in accordance with Subsection 108.1, Subletting of Contract. The work consists of constructing permanent shear piles. Furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the work specified. The work includes, but is not limited to, drilling, inserting, and grouting the shear piles at the appropriate locations. Other work items include mobilizing equipment and personnel to the site, excavating and constructing suitable drilling pads, and backfilling excavations.

Select the drilling method, drill hole diameter, and grouting method and pressures, subject to the minimum/maximum values in the contract. Contain, haul, and legally dispose of all drilling fluids and excavated material.

SUBMITTALS: Each submittal will be consistent with the provisions of Subsections 105.2, Working Drawings and 501.4.1.3, Shop Drawings. Additional time required due to incomplete or unacceptable submittals will not be cause for time extension or impact or delay claims. All costs associated with incomplete or unacceptable submittals are the responsibility of the contractor.

Qualifications Statement: In addition to the required items discussed in Subsection 108.1.2, Subcontracts and Subcontractors, submit documents demonstrating that the on-site supervision of all drilling, grouting, and shear pile work will be by a resident superintendent with at least five years of experience in similar applications, such as micropile and ground anchor installations. In addition, the contractor's project manager, project engineer(s), and foremen are to have completed at least three similar projects. Ensure drill operators have a minimum of three years experience installing elements of similar diameter and length using the proposed drilling method. The documentation submitted is for personnel that will be on site working on the project. For each project, include:

1. Name of client contact, address, and telephone number;
2. Location of project;
3. Type of structural member installed including length and diameter;

4. Drilling methods; and,
5. Type(s) of subsurface materials encountered.

At a minimum, submit resumes for the following individuals:

Project Manager
Superintendent
Project Engineer(s)
Foreman
Drill Operator(s)

Submit the Qualifications Statement to WYDOT-Geology's Chief Engineering Geologist and the engineer. WYDOT-Geology will approve or reject the contractor's qualifications within 14 calendar days after receipt of a complete submittal. Do not start work or order materials until the engineer gives written approval. If during construction, the contractor proposes to change any of the key personnel, submit the resume of the proposed replacement person and receive approval from the engineer prior to assuming responsibilities on the project. The engineer may suspend the work if the contractor uses non-approved personnel. If work is suspended, the contractor is fully liable for all resulting costs and no adjustment in contract time will result from the suspension.

Shear Pile Installation Work Plan: Submit a detailed installation work plan at least 30 calendar days prior to commencement of the shear pile work including the following (at a minimum):

1. Installation sequence and schedule.
2. Details of proposed drilling methods including number and type of drill rig(s) and tooling.
3. Details of grout mix design including materials to be used. Provide compressive strength test data on trial batches or previous test results of grout placed within one year of the start of grouting as verification of strength.
4. Details of grouting methods including equipment to be used for monitoring and measuring grout volume and pressure during grout placement.
5. Details of reinforcing steel placement including centralizers and couplers.
6. Details of quality control testing.
7. Examples of installation forms including drill logs and grouting records.

The engineer will approve, reject, or comment on the contractor's work plan within 15 calendar days after receipt of a complete submittal. Approval of the work plan does not relieve the contractor of any responsibility under the contract for the successful completion of the work.

Mill Test Reports/Coupon Test Results: Submit certified mill test reports for the reinforcing steel or coupon test results for permanent casing without mill certification. Include the ultimate

strength, yield strength, elongation, and material properties composition. For pipe casing, coupon test results may be submitted in lieu of mill certification. Provide samples, if requested, of any steel material intended for use on the project. The engineer will approve or reject the reinforcing steel or permanent casing within five days after receipt of the test reports. Do not incorporate the reinforcing steel or permanent casing without the engineer's approval of the test reports.

Installation Summary Report: Submit an installation summary report within 30 calendar days after completion of the shear pile work containing:

1. As-built drawings and summary table of the installed shear piles showing the location of each shear pile and total shear pile length.
2. Compilation of all mill test reports and coupon test results for reinforcing steel and permanent casing incorporated in the work.
3. Drill logs of subsurface conditions and materials encountered during drilling.
4. Grouting records indicating the cement type, grout mix design, quantity injected, and grout pressures.

CODES AND STANDARDS: The following publications form a part of this special provision to the extent indicated by the references. The latest publication as of the bidding date of this contract governs, unless indicated otherwise:

American Society for Testing and Materials (ASTM)
American Association of State Highway and Transportation Officials (AASHTO)

ASTM	AASHTO	Specification/Test
A615	M31	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
C109	T106	Compressive Strength of Hydraulic Cement Mortar
C144	M45	Aggregate for Masonry Mortar
C150	M85	Portland Cement
C188	T133	Density of Hydraulic Cement
C494	M194	Chemical Admixtures for Concrete
D1784	--	Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
--	T26	Quality of Water to be Used in Concrete

American Welding Society (AWS)

AWS	Specification/Test
D1.1	Structural Welding Code – Steel
D1.2	Structural Welding Code – Reinforcing Steel

American Petroleum Institute (API)

API	Specification/Test
5CT	Specification for Casing and Tubing
RP 13B-1	Recommended Practice for Field Testing Water Based Drilling Fluids

PRECONSTRUCTION MEETING: A pre pile installation meeting will be scheduled by the engineer in coordination with the contractor to be held at least seven days prior to the anticipated start of any shear pile construction activities. Attendance by the contractor and any subcontractors involved with the shear pile work is **mandatory**. Submit the Shear Pile Installation Work Plan and receive approval prior to the preconstruction meeting. The purpose of the preconstruction meeting is to resolve outstanding submittal comments, clarify the construction requirements, discuss the constructor's submittals for work, coordinate the construction schedule and activities, and identify the contractual relationships and delineation of responsibilities amongst the contractor and any subcontractors involved in the shear pile work.

MATERIALS: Do not deliver materials to the site until the engineer has approved the submittals outlined. Protect the materials from theft, vandalism, traffic, and other potential sources of damage. Protect materials from the elements. Store cement and grout additives under cover and protect from moisture.

Admixtures: Use admixtures that control bleed, improve flowability, reduce water content, and retard set in the grout only if approved by the engineer. Use admixtures that conform to the requirements of ASTM C494 / AASHTO M194. Use only admixtures that are compatible with the grout mix in accordance with the manufacturer's recommendations. Accelerating admixtures are not permitted. Admixtures containing chlorides are not permitted.

Cement: Use Type II Portland cement conforming to ASTM C150 / AASHTO M85 for grout.

Centralizers: Fabricate centralizers from plastic, steel, or material that is nondetrimental to the reinforcing steel. Do not use wood. Securely attach the centralizers to the reinforcing steel. Size the centralizer to center the reinforcing steel within the permanent casing, to allow grout

tremie pipe insertion to the bottom of the drill hole, and to allow grout to freely flow up the casing.

Fine Aggregate: If sand cement grout used, use sand conforming to ASTM C144 / AASHTO M45.

Grout: Provide pumpable mixture of neat cement and water or sand-cement and water that is stable (bleed less than 2 percent), fluid, has a water/cement ratio less than 0.50, and has a minimum 28-day compressive strength of 3,000 psi measured in accordance with ASTM C109 / AASHTO T106.

Grout Tubes: Use grout tubes with adequate length and inside diameter to enable grout to be pumped to the bottom of the drill hole. Provide grout tubes capable of withstanding the anticipated grouting pressures.

Permanent Casing/Pipe: Provide permanent casing/pipe with the outside diameter and minimum wall thickness shown in the contract. Ensure the permanent steel casing/pipe meets the following:

- Requirements of API 5CT, Grade N80; or
- May be new "Structural Grade" (a.k.a. "Mill Secondary") steel pipe but without mill certification, free from defects (dents, cracks, tears), with two coupon tests per truckload delivered to the fabricator, and a minimum yield strength of 80 ksi.

It is anticipated that casing joints will be threaded. If the contractor elects to weld the casing sections together, submit the proposed welding procedures for review as part of the Shear Pile Installation Work Plan.

Reinforcing Steel: Use deformed bars in accordance with ASTM A615 / AASHTO M31, Grade 60.

Use couplers for reinforcing steel that develop the ultimate tensile strength of the bars without evidence of failure.

Water: Use water in the grout mix conforming to AASHTO T26 that is potable, clean, and free of substances that may be injurious to cement and steel.

CONSTRUCTION:

Schedule and Sequence of Shear Pile Work: Schedule installation of shear piles to begin after the spring snowmelt. The earliest anticipated start date for shear pile work is June 1, 2012 and may be subject to change pending actual weather conditions. Provide a written request to the engineer to start work prior to this date. Other work activities include installation of a v-ditch and reconstruction of a portion of the roadway section. Shear pile work and v-ditch

installation may occur concurrently. Install all shear piles prior to roadway reconstruction and final paving unless otherwise approved by the engineer.

Install Row 4 of the shear piles first. Sequencing of the remaining rows is at the discretion of the contractor.

Site Drainage Control: Control and properly dispose of drill flush and construction related waste, groundwater, excess grout and equipment washout water in accordance with all applicable local codes and regulations. Provide positive control and discharge of all surface water that will affect shear pile installation. Onsite disposal is permitted with control of solids content to prevent runoff of uncontrolled sediment, grout, etc. directly off of WYDOT property. No separate payment will be made for meeting these requirements.

Excavation and Backfill: Excavation is required to provide a minimum soil cover over the installed shear piles as shown in the contract. Excavation may be required to create suitable working platforms for equipment and installation of the shear piles. Restore any areas disturbed for shear pile installation to the existing conditions. Backfill excavations with the excavated material in accordance with Subsection 212.4.7, Backfill. Grade disturbed areas to match the existing contours. Excavation and backfill is considered subsidiary to the shear pile work and no separate payment will be made.

Shear Pile Construction Tolerances:

- Centerline of shear piles within 6 inches of indicated plan location.
- Pile plumb within 2 percent of total-length plan alignment.
- Centerline of reinforcing steel within 1 inch of indicated location within the shear pile.

Drilling: Use drilling methods suitable for the work and capable of drilling vertical holes for installation of shear piles through all subsurface materials. Select drilling means and methods to be consistent with the anticipated ground conditions and modify if necessary. Drilling is not to cause damage to the surrounding ground or to previously installed shear piles.

The contractor's proposed drilling method(s) is to provide drill hole support and prevent detrimental ground movements, which are defined as movement which requires remedial repair measures. The use of drilling fluid containing bentonite is not allowed.

Record the subsurface conditions and materials encountered along the length of each drill hole. Note if groundwater is present in the hole. The completion of a separate log by the department does not relieve the contractor of his responsibility to maintain complete and accurate drilling logs.

Onsite disposal of drill cuttings is available at the direction of the engineer.

Permanent Steel Casing and Reinforcing Steel: It is anticipated that permanent steel casing will be installed as the drill hole is advanced. Reinforcing steel may be inserted either prior to grouting or placed into the grout-filled permanent casing. Permanent steel casing and reinforcing steel shall be free of deleterious surfaces such as soil, mud, grease, or oil that might contaminate the grout or coat the steel and impair bond.

Provide centralizers at 20 ft maximum spacing. Locate the upper and lower-most centralizers a maximum of 5 ft from the top and bottom of the steel reinforcing. Centralizers are to permit the free flow of grout without misalignment of the reinforcing steel. Lower the central reinforcing steel with centralizers into the cased drill hole and set. This reinforcing steel must be capable of being inserted into the cased drill hole to the desired depth without difficulty. Do not drive or force the steel reinforcing into the cased drill hole. Redrill or flush the casing to facilitate insertion of the reinforcing steel.

Secure lengths of reinforcing steel to be spliced in proper alignment and in a manner to avoid eccentricity or angle between the axis of the two lengths to be spliced. Torque up the threaded casing joints to a snug condition prior to inserting.

Grouting: Use an approved neat cement or sand-cement grout. Do not use cement containing lumps or other indications of hydration. Use approved admixtures in accordance with the manufacturer's recommended ratios.

Colloidally mix grout to produce a mix free of lumps and undispersed cement. Do not use paddle mixers. Provide means and methods to measure the grout quantity and pumping pressure during the grouting operation. Use positive displacement or progressive cavity grout pumps. Use grout pump(s) equipped with a pressure gauge to monitor grout pressures. Place a second pressure gauge at the point of injection into the pile top. Use pressure gauges with range of 150 psi or twice the actual grout pressures, whichever is greater. Use equipment of sufficient capacity to enable grouting in one continuous operation. Use mixer capable of continuously agitating grout prior to placing. Place grout within 1 hour of mixing.

Grout shear piles within 24 hours of drilling the hole. Pull casing off the bottom of the hole to facilitate grouting the annular space between the permanent casing and the drill hole. Inject grout at the lowest point of the drill hole using a grout tube and continue grout placement until uncontaminated grout flows from the top of the permanent casing. Extend the grout tube below the level of the existing grout in the permanent casing. Once the casing is fully grouted, seal the top of the casing and pump grout through the top of the casing to provide pressure to force the grout up the annulus between the permanent steel casing and the drill hole. Continue pressure grouting the shear pile until grout return is noted from the annulus or one of the following occurs:

1. Grout volume reaches a total of 150 percent of the theoretical drill hole volume for the individual shear pile. The theoretical volume is defined as $\pi D_{DH}^2/4 \times \text{length of drill hole}$, where D_{DH} is the drill hole diameter. Do not discount the volume of the steel.

2. Grout pressure exceeds 150 psi.

Notify the engineer in either situation. The engineer may require additional grout to be placed. Record grout takes and pressures. Control grout pressures and takes to prevent excessive heave or fracturing of soil and rock formations. The grout tube may remain in the hole upon completion of grouting if the tube is filled with grout.

Monitor adjacent shear piles during the grouting operation for communication. If communication is observed, modify the construction sequence to prevent grout communication.

Grout Testing: During production, test grout for 28-day compressive strength in accordance with ASTM C109 / AASHTO T106 at a frequency of no less than one set of three 2-inch grout cubes from each grout plant each day of operation or per every 10 piles, whichever occurs more frequently. The compressive strength is the average of the three cubes tested.

Determine the fluid grout density per ASTM C188 / AASHTO T133 or API RP-13B-1 at a frequency of at least one test per shear pile, conducted just prior to start of pile grouting. The Baroid Mud Balance used in accordance with API RP-13B-1 is an approved device for measuring fluid density.

Take grout samples directly from the grout plant. Provide grout cube compressive strength and fluid density test results to the engineer within 48 hours of testing.

Shear Pile Installation Records: Prepare and submit to the engineer installation records for each shear pile installed. At a minimum, submit field logs of drilling and grouting operations within one work shift after that pile installation is complete. Submit final drill logs and grouting records as part of the Installation Summary Report.

Demonstration Pile: The first shear pile installed will be considered a test pile to demonstrate the contractor's selected drilling and grouting methods. If difficulties with drilling or grouting are experienced, the contractor shall re-evaluate his means and methods and propose modifications for review and approval by the engineer. Furthermore, the contractor will replace the shear pile at no additional cost to the department. If the installation of the demonstration pile meets the requirements of this special provision, it will be considered a production pile.

Ground Heave or Subsidence: During construction, monitor the conditions in the vicinity of shear pile installation for signs of ground heave or subsidence. Immediately notify the engineer if signs of movement are observed. Immediately suspend or modify drilling or grouting procedures if ground heave or subsidence is observed. If the engineer determines that the movement has adversely affected previously installed shear piles, the contractor will take corrective action to stop the movement and replace the damaged shear piles at no additional cost to the department.

Unacceptable Shear Piles: In the event that a shear pile cannot be completed in accordance with the contract, the contractor will tremie grout the hole and abandon the location. Offset the shear pile at the direction of the engineer. The contractor is responsible for replacing the unacceptable shear pile at no additional cost to the department.

MEASUREMENT and PAYMENT: Shear piles will be paid at the contract unit bid price per linear foot installed and approved by the engineer as Special Item FT-A. Shear piles will be measured to the nearest 0.1 ft based on the length of permanent steel casing and reinforcing steel installed to the specified minimum pile tip elevation. The engineer may adjust the minimum pile tip elevation based on actual subsurface conditions encountered. Permanent casing cut off for the contractor's convenience will not be included in the measured length, nor will overdrilled casing below the specified minimum pile tip elevation. Payment will be full compensation for the cost of excavating and backfilling; drilling, inserting, and grouting the shear piles; quality control testing; preparation of as-built and installation summary report; and all labor, materials, tools, and incidentals required to complete the work. The engineer may add or delete shear piles based on the actual subsurface conditions encountered.

Excess grout volume (defined as greater than 150 percent of the theoretical grout volume) placed by the contractor and approved by the engineer will be paid for using a force account in accordance with Subsection 109.4.4, Force Account. Excess grout volume will be calculated on a cumulative basis for the entire project and not on a per hole basis.

The department will pay as follows:

Pay Item	Pay Unit	Measure to the Nearest	Pay to the Nearest
Special Item FT-A	FT	0.1 ft	FT

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