WYOMING DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION FOR MICROPILES

Project No. DR50924 and DR50925 Combined
Bret Slide/ Upper Shell Slide
Greybull – Burgess Junction US 14
Big Horn County

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

DESCRIPTION: This special provision describes the requirements for a Micropile support system. This is considered a specialty item in accordance with Subsection 108.1, Subletting of Contract.

This work consists of construction of a micropile foundation to provide lateral support within the landslide. Furnish all materials, products, accessories, tools, equipment, services, transportation, labor and supervision, incidentals, and manufacturing techniques necessary for installation of micropiles for this project.

Select the installation means and methods to ensure that each micropile is constructed at the locations, spacing, diameters, and lengths shown in the contract. Contain, haul, and legally dispose of all drilling fluids and excavated material. Perform the work in accordance with the contract.

DEFINITIONS:

Cased length: The designated length of pile that is not bonded to the surrounding ground.

Uncased (bond) length (load transfer length): The length of the micropile that is bonded to the surrounding ground and transfers axial loads to the surrounding soil mass.

MATERIALS: Do not deliver materials to the site until the engineer has approved the submittals outlined. When directed by the engineer, promptly remove defective materials from the site at no additional cost to the department. Protect the materials from theft, vandalism, traffic; and other potential sources of damage. Protect materials from the elements. Use materials for the micropile structure that are new and without defects.

Admixtures: Use grout admixtures that conform to the requirements of ASTM C 494 / AASHTO M194; admixtures are subject to the review and acceptance of the engineer. Ensure admixtures are compatible with the grout mix in accordance with the manufacturer's recommendations. Expansive admixtures, accelerators, and admixtures containing chlorides are not allowed.

Cement: Use Type I, II. Portland cement per Subsection 801.1.1, General.

Centralizers: Use centralizers and spacers fabricated from Schedule 40 PVC pipe or tube conforming to ASTM D-1785, and securely attach these to the reinforcement. Size centralizers and spacers such that they will position the reinforcement within ½ inch of plan location from the center of the pile, to allow grout tube insertion to the bottom of the drillhole, and to allow grout to flow freely up the drill hole and casing.

Grout: Provide a pumpable mixture of neat cement and water that is stable (bleed less than 2 percent), fluid, and has a water-cement ratio of 0.40 to 0.60. Provide grout with a 3-day compressive strength of at least 3000 psi and a 28-day compressive strength of at least 4000 psi, tested in accordance with ASTM C 1107.

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

1. Requirements of API 5CT, Grade N80; OR
2. May be new "Structural Grade" (i.e. "Mill Secondary") steel pipe, but without mill certification, free from defects (dents, cracks, tears), and with two coupon tests per truckload delivered to the fabricator, and meeting the tensile strength requirements of ASTM A252, Grade 3, except the yield strength must be 80 ksi or greater.

For permanent casing/pipe that will be welded, the following material conditions apply:

1. The carbon equivalency as defined in AWS D1.1, section X15.1, cannot exceed 0.45, as demonstrated by mill certifications.
2. The sulfur content cannot exceed 0.05 percent, as demonstrated by mill certifications.

For permanent casing/pipe that will be welded, the following fabrication or construction conditions apply:

1. Ensure the steel pipe is not joined by welded lap splicing.
2. Ensure welded seams and splices are complete penetration welds.
3. Partial penetration welds may be restored in accordance with AWS D1.1.
4. The proposed welding procedure certified by a licensed welding specialist must be submitted for approval.

Ensure threaded casing joints develop at least the required nominal resistance used in the design of the micropile.

Pile Top Attachments: Ensure structural steel plates and shapes for pile top attachments conform to ASTM A 36 / AASHTO M183, or ASTM A 572 / AASHTO M223, Grade 50.

Reinforcing Steel: Use deformed all-thread inner reinforcing bars in accordance with ASTM A 722, Grade 150, epoxy coated per ASTM A 775. When a bearing plate and nut are required to be threaded onto the top end of bars for the anchorage between pile top and footing, the threading may be provided by the bar deformations or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, provide the next larger bar number designation from that shown in the contract, at no additional cost to the department. Use bar couplers that develop the ultimate tensile strength of the bars without any evidence of failure, and use a maximum of two couplers per micropile, such that any bar portion of a coupled micropile is a 10.0 foot minimum finished length. Couplers are only allowed in the bond (uncased) length.

Water: As per Subsection 814.1.2, Water for Concrete.

CONSTRUCTION:

Qualifications: For minimum qualifications and related qualifications see SP-100KV Mandatory Pre-Bid Meeting.

Do not begin work or order material until the engineer has given written approval of the contractor's experience qualifications. 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 resulting from the suspension of work will be allowed.

Shop Drawings and Work Plan: Submit shop drawings in accordance with Subsection 105.2.2, Shop Drawings. Include the following on the shop drawings:

1. A plan view of the micropile structure that identifies the location of the structure within the project and any drainage structures near the micropile structure.
2. An elevation view of the micropile structure that shows micropile locations and elevations, vertical and horizontal micropile spacing, existing grade profiles at the wall layout line, and finished top of micropiles.
3. Sequence and schedule of constructing ground anchors and micropiles. Provide a sequence that complies with the following:

a. Excavate, drill, install, and grout the ground anchor/micropile system (lower row) before excavating, drilling, or installing ground anchors for the upper row mitigation.
b. Due to the active nature of landslide movement at this site, no more than 100 linear feet of excavation with unstressed ground anchors is allowed to be opened at one time in either row. Do not excavate more than a 100 foot segment of the upper bench for ground anchor drilling until the corresponding 100 foot segment (directly below) of micropiles and adjacent ground anchors in the lower bench are complete, tested, and locked off. Proceed in this manner in no more than 100 foot lengths.
c. During construction of the ground anchor/micropile system on the lower row, avoid placing any equipment on top of a micropile before the cap is complete.
d. Submit the sequence for review by the engineer. This sequence and schedule submittal also meets the submittal requirements for the sequence and schedule submittal under Special Provision for Ground Anchors, SP-600VT.

4. Certificates of compliance attesting proof of compliance with specification material requirements for micropile casing, threadbar, and grout, prior to delivery of material to the project site.
5. Proposed grouting plan, including grout mix design (with certified test data); methods and equipment for monitoring and recording grout volume and grout pressure (if pressure grouting is used) during grout placement; estimated curing time for grout to achieve specified strength; and procedure and equipment for monitoring of grout quality.
6. A thorough narrative describing the micropile installation schedule, procedures, including a description of all drilling equipment, tooling, and methods; plans for control and disposal of surface water, drill flush, dust control, and excess waste grout; and examples of installation forms including drill logs and grouting records.
7. Due to variable bedrock depths within the landslide, do not order more than 30% of the plan quantity of materials for micropiles until a portion of the micropiles have been installed and the engineer gives authorization to proceed. Micropiles may be lengthened or shortened to penetrate bedrock as shown in the contract or as directed. Provide description for lengthening or shortening micropiles if directed.

The engineer will approve, reject, or comment on the submittal within 15 working days after receipt of a complete submittal. Do not begin micropile structure construction or incorporate materials into the work until the submittal requirements are satisfied. No adjustments in contract time or delay or impact claims will be allowed due to incomplete submittals. Approval of the work plan does not relieve the contractor of any responsibility under the contract for the successful completion of the work.

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 working 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 Records: Submit full installation records within one work shift after each pile installation is complete. Complete a separate log for each micropile, containing:

1. Date of drilling, installation, and grouting
2. Drill logs of subsurface conditions and bedrock depths encountered during drilling.
3. Grouting records indicating the cement type, grout mix design, quantity injected, and grout pressures for each installed micropile.

Submit an installation summary report weekly containing:

1. As-built drawings and summary table of the installed micropiles showing the location of each micropile and total pile length.
2. Compilation of all mill test reports and coupon test results for reinforcing steel and permanent casing incorporated in the work.

Preconstruction Meeting: A preconstruction meeting will be scheduled by the engineer and held prior to the start of micropile construction. The engineer, the contractor, the supervising engineer, and the micropile foremen are required to attend the meeting. Submit the shop drawings and work plan prior to the preconstruction meeting. The purpose of the preconstruction meeting is to clarify the construction requirements, discuss the contractor's submittals, to coordinate the construction schedule and activities, and to identify the contractual relationships and delineation of responsibilities amongst the parties for issues related to excavation, subsurface conditions, micropile installation, micropile structure survey control, and site drainage control.

Schedule and Sequence of Micropile Work: Schedule installation of micropiles to be complete (excavate, drill, install, and grout micropiles) before drilling or installing adjacent ground anchors in the lower row, and before excavating for the ground anchors in the upper row, according to the accepted sequence and schedule submittal. Other work activities include reconstruction of a portion of the roadway subgrade. Install all micropiles prior to final paving unless otherwise approved by the engineer. Coordinate the work and the excavation so that the micropile structures are safely constructed.

Site Drainage Control: Control and properly dispose of drill flush and construction related waste, groundwater, excess grout and equipment washout water in accordance with the specifications and all applicable local codes and regulations. Provide positive control and discharge of all surface water that will affect micropile installation. No separate payment will be made for meeting these requirements.

Excavation and Backfill: Excavation is required to provide a working platform for installation of the micropiles and lower row of ground anchors, as shown in the contract. Excavate no more than 100 linear feet or as approved by the engineer. Coordinate excavation with upper row of ground anchors. Restore any areas disturbed for micropile installation to the existing conditions; Backfill excavations with the excavated material in accordance with Subsection 203.4.1, General; moisture density control is not required. Grade disturbed areas to match the existing contours.

Micropile Construction Tolerances: Install the micropiles within the following tolerances:

1. Centerline of piling cannot be more than 3 inches from indicated plan location.
2. Pile must be inclined at the correct angle, to within 2 percent of total length in the contract.
3. Top elevation of pile must be plus 1 inch or minus 2 inch maximum from vertical elevation shown in the approved shop drawings.
4. Centerline of reinforcing steel must be within ½ inch from centerline of micropile.
5. Field adjustments may be submitted for approval by the engineer.

Drilling: Use drilling methods suitable for the work and capable of drilling inclined holes for installation of micropiles through all subsurface materials. Select drilling means and methods based on the anticipated ground conditions and modify if necessary, at no cost to the department. Ground conditions may include soil, large boulders greater than 5 feet in diameter, and bedrock. Groundwater may be encountered at any depth and at any anchor location.

Make every attempt to keep the holes dry. Wetting of the subsurface materials will decrease the bond strength of the materials significantly. Wet drilling methods are not acceptable.

Control the dust during the drilling operations to limit the impacts to the environment, public traffic, and pedestrians.

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.

Permanent Steel Casing and Reinforcing Steel: Install permanent steel casing/pipe in the unbonded length prior to insertion of the reinforcing bar. Ensure permanent steel casing penetrates a minimum of 2 feet into bedrock. Place reinforcing steel prior to grouting and ensure permanent steel casing and reinforcing steel are free of deleterious substances that might contaminate the grout or coat the reinforcement and impair bond, such as mud, grease, or oil.

Provide centralizers and spacers (if used) at maximum 10-foot spacing. Locate the upper and lower most centralizers a maximum of 5 feet from the top and bottom of the micropile, respectively. Ensure centralizers and spacers permit the free flow of grout without misalignment of the reinforcing bars and permanent casing. Do not drive or force partially inserted reinforcing bars into the hole. Re-drill and re-insert reinforcing steel when necessary to facilitate insertion.

Grouting: Select the grouting procedure, and the grouting pressure to be used for the installation of the micropiles.

Mix grout to produce a mix free of lumps and undispersed cement. Provide means and methods of measuring the grout quantity and pumping pressure (if pressure grouting is used) during the grouting operations. Keep the grout mixture in agitation prior to placement, and place the grout within one hour of mixing, in one continuous operation.

Grout each hole within 2 hours of drilling the hole to reduce exposure of the drilled hole to air-slacking and water infiltration.

During production, test grout for 28-day compressive strength in accordance with ASTM C 1107 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 micropiles, whichever occurs more frequently. The compressive strength is the average of the three cubes tested. Take grout samples directly from the grout plant. Provide grout cube compressive strength test results to the engineer within 48 hours of testing.

Unacceptable Micropiles: In the event that a micropile cannot be completed in accordance with the contract, the contractor will tremie grout the hole and abandon the location. Offset the micropile at the option of the engineer. The contractor is responsible for replacing the unacceptable micropile at no additional cost to the department. Provide a plan for re-drilling the unacceptable micropile, or for offsetting and drilling an additional micropile at no additional cost, within five working days of the day the decision was made to grout and abandon the micropile. Do not implement proposed micropile replacement or modifications until written approval is received from the engineer.

MEASUREMENT AND PAYMENT: The engineer will measure micropiles to the nearest 0.1 ft, from the elevation shown on the approved shop drawings to the bottom of the hole as drilled. Permanent casing cut off for the contractor's convenience will not be included in the measured length, nor will overdrilled casing beyond the pile length shown in the contract, unless modifications have been approved in writing by the engineer.

The department will pay as follows:

Pay Item	**Pay Unit**	**Measure to the Nearest**	**Pay to the Nearest**
Special Item FT-C (7 Inch Micropiles)	FT	0.1 ft	FT

Excavation and backfill for installation of micropiles will be incidental to the work. Grout will be incidental to the work.

04-26-13