ITEM 17203.3709 M - SUBSURFACE GROUTING

DESCRIPTION

Furnish and place grout mixes as shown on the plans or as ordered by the Engineer.

MATERIALS

Provide materials meeting the requirements of the following Subsections of Section 700-Materials:

701-01 Portland Cement - Type 1 or 2
711-10 Fly Ash
712-01 Water
712-02 Calcium Chloride

Provide a grout created by a mixture of water and cement with the possible addition of sand, fly ash, bentonite, and calcium chloride. Other additions will be acceptable only as approved by the Engineer. The initial grout mix listed in the plans may be modified as the work progresses to take into account conditions encountered.

Fly ash may be used in addition to cement. Addition of fly ash is limited to a maximum of 25% of the cement by weight.

Calcium chloride or other chemical accelerators may be added to the grout, according to manufacturer's recommendations, subject to approval by the Engineer.

Commercially available bentonite may be added to the grout in powdered form, subject to approval by the Engineer. Bentonite which has become caked due to moisture absorption will be rejected.

Submittals

Submit the following information prior to beginning grouting operations to the Engineer for approval:
1. Grouting plan.
2. Materials and equipment to be used for grouting.
3. A plan for the daily disposal of wasted and unused grout.

CONSTRUCTION DETAILS

General

Perform the grouting operation continuously and as specified in the plans.

Grouting Sequence

For the purposes of a grouting sequence where drilled grout holes are used, the holes may be identified as primary, secondary, tertiary, quaternary, etc. Place grout into the primary holes to

completion and, if required, followed by the grouting to completion of the secondary holes, tertiary holes, and quaternary holes in this order.

Grouting Methods

1. Perform the grouting operation utilizing the method indicated in the plans or proposal.

2. Fit a packer between the discharge pipe or nozzle and the top of the drilled hole or the grout access point to effectively seal the system during pumping operations.

3. Where casing is used, pull all casing after the grouting of a hole is complete. Cut off at or below the top of hole, AOBE at no additional expense to the State any casing which is unable to be pulled.

4. Backfill with Grout Type 1.0 and replace with another hole any grout hole that is lost or damaged due to mechanical failure of equipment, inadequacy of grout supply, or improper injection procedure.

Grout Mixes

1. Utilize the specified grout mix unless directed to modify by the Engineer.

2. The grout mixes will be designated by the numerical value of the water/cement ratio (by volume) to be used in proportioning grout, preceded by the word "Type" (i.e. Type 2.0 has a water/cement ratio of 2:1).

3. Water/cement ratios for the standard types of grout mixes are listed below or as shown on the plans:

Type	**Water/Cement Ratio (by volume)**
2.0	2:1
1.0	1:1
0.75	0.75:1
1.0 (with sand)	1:1

4. Sand/cement ratios of up to 3:1 by weight may be used in grout mixes at a water/cement ratio of 1:1.

5. Add bentonite, when used, to the grout incrementally at a rate of 2% of cement by weight.

Grout Injection

1. Unless otherwise specified, proceed with the grout injection in a continuous manner until refusal is reached. Start the injection with Grout Type 2.0, followed by Grout Type 1.0, then Grout Type 0.75, and finally Grout Type 1.0 (with sand) until the maximum number of batches are injected or until refusal. One batch is the quantity of grout mix produced by one

sack (43 kg) of cement, including all additives. The following is the maximum number of batches for each grout type to be pumped during each stage:

Hole Type	Grout Type	Batches
Primary	2.0	15 or to refusal
	1.0	15 or to refusal
	.75	15 or to refusal
	1.0 (with sand)	50 or to refusal
Subsequent Holes	2.0	10 or to refusal
	1.0	10 or to refusal
	.75	10 or to refusal
	1.0 (with sand)	50 or to refusal

2. Refusal is defined as a grout take of less than one batch in ten minutes at maximum grouting pressure.

3. Discard as wasted grout any grout that cannot be placed within two (2) hours after mixing.

4. Flush out partially grouted holes whenever grouting is interrupted for two hours or more. In the event of failure to flush out a partially grouted hole, the Engineer may provide direction to abandon and backfill the hole and drill and grout another hole. No payment will be made for the abandoned hole or grout.

Grouting Pressures

Maximum allowable grout pressures determined with pressure gages (at the collar) located adjacent to the top of a grout hole is 35kPa at the collar, or as specified on the plans.

Special Attention

1. Continuously observe adjacent water bodies during all grouting operations. Stop grouting and notify the Engineer immediately if there is any evidence of grout entering adjacent water. Resume work when directed by the Engineer. Follow any necessary procedures to prevent additional grout intrusion into adjacent water bodies.

2. Verify that the ambient air temperature inside holes at the time of grouting is above 4.5ºC.

Leakage of Packer

Monitor leakage of the packer at all times by circulating water above the packer during grouting operations. In the event of grout leakage, suspend grouting while the packer is reseated. If, on the resumption of grouting, it is found that premature refusal has occurred, flush that stage with clean water and re-grout. No extra payment will be made for flushing and re-grouting.

Backfilling

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Backfill all grout holes with Grout Type 1.0 to the top of the grout hole or as otherwise directed, using tremie method. Ensure that the final surface will be flush with the surrounding surfaces after curing and upon completion of the project.

Records

Furnish to the Engineer accurate records of all grouting at the end of each shift. Include the following for all holes in progress, and other data as the Engineer may require:

a. Depth of water before grouting
b. Times of starting and stopping grouting operation, details of grout mixes used, quantity of grout injected together with injection pressure attained for each ten (10) minute interval throughout the grouting period.

METHOD OF MEASUREMENT

The unit of measurement will be the actual number of sacks (43 kg) of cement used for grout, acceptably furnished, mixed and injected.

BASIS OF PAYMENT

The unit price bid per sack of cement shall include the cost of all labor and material necessary to satisfactorily complete the work, except that Furnishing Equipment for Grouting, Drilling Grout Holes, Sand for Subsurface Grouting, and Water Pressure Tests will be paid under their respective items.

Payment will be made for grout even though some of it will be used for delivery purposes and not necessarily incorporated in the work. In the event of equipment breakdown, the cost of the material required to refill the grouting equipment's discharge system shall be borne by the Contractor.