

SECTION 6.11 SHOTCRETE

6.11.01--Description: This item shall consist of a surface coating of portland cement mortar applied to the reinforcement by means of pneumatic equipment, built in the locations and to the dimensions and details shown on the plans and in conformity with these specifications.

6.11.02--Materials: The materials for mortar for this work shall conform to the requirements of Article M.11.04.

Reinforcement shall be of the type called for on the plans and shall conform to the requirements of Article M.06.01.

6.11.03--Construction Methods: The preparation and application of shotcrete shall be done under the supervision of experienced foremen, using only experienced men as machine and nozzle operators.

1--Preparation of Bonding Surface: The bonding surface to receive the shotcrete shall be rough and clean. Loose particles, dust and dirt shall be removed by the use of wire brushes or other approved means. Steel members to be protected with shotcrete shall be cleaned thoroughly of all loose rust, scale, grease, dirt, paint and any foreign material that will prevent or lessen the bond between the shotcrete and the steel.

The bonding surface shall be maintained constantly wet for a minimum of one hour prior to the application of the shotcrete. After wetting, a sufficient time shall elapse or special means shall be used, to remove all surplus surface water and to produce a damp surface that is slightly absorptive. The shotcrete shall be applied when this condition is attained. In no case shall shotcrete be applied to a dry surface.

2--Placing Reinforcement: Reinforcement shall be placed in accordance with the requirements of the plans; and where dowels or anchor bolts are specified, the reinforcement shall be securely fastened to them. When wire fabric reinforcement is used, adjoining sections shall be lapped not less than 100 mm. Fabric around the top flanges of beams and girders carrying concrete slabs shall be placed before the slab is poured and shall extend at least 130 mm below the bottom of the slab and be so located as to properly lap the web reinforcement. Exposed reinforcement in existing structures that are to be repaired or altered shall be thoroughly cleaned. No reinforcement shall be located closer than 20 mm from any finished surface.

3--Composition: Shotcrete shall be mixed in the proportions of 1 part portland cement to not more than 3 1/2 parts of fine aggregate, by dry, loose volume. Due consideration shall be given to the bulking effect of any moisture contained in the fine aggregate.

4--Placing: Shotcrete shall be placed by pneumatic pressure through a suitable machine, with the proper amount of water for hydration applied in the mixing nozzle. No shotcrete shall be placed when the air temperature is below 5° C or against surfaces containing frost.

Portland cement and fine aggregate shall be premixed dry in a batch mixer and screened through a 63 mm screen before being placed in the hopper of the machine. The sand so used shall have only a normal moisture content of 3 to 8 percent.

Water pressure in the delivery pipe shall be maintained at a pressure of 70 to 140 kPa above the air pressure in the machine.

A uniform pressure of not less than 240 kPa shall be maintained in the placing machine. Where the length of the hose between the placing machine and the point of application exceeds 30 m horizontally or 7.5 m vertically, the pressure shall be increased so as to secure a satisfactory velocity at the nozzle.

Shooting strips shall be employed to insure square corners, straight lines and the required thickness of shotcrete. These shooting strips shall be so placed that they will not trap rebound.

When "shooting" any surface, the stream of material flowing from the nozzle shall impinge as nearly as possible at right angles to the surface being covered. All deposits of loose sand shall be removed prior to "shooting." Should any such deposit be covered with shotcrete, it shall be cut out and removed by the Contractor at his own expense.

Shotcrete shall be applied in two or more coats, the next to the last coat being screeded to remove irregularities after which the final or "flash" coat shall be applied. This coat shall not be troweled or screeded but shall be left without further finish except that outside exposed surfaces shall be given a "float" finish as specified in Article 6.01.03.

5--Curing: Shotcrete shall be cured and protected in accordance with the requirements of Article 6.01.03

6.11.04--Method of Measurement: This work will be measured for payment as follows:

1--Shotcrete: When shotcrete is applied to new or repair work, the measurement for work under this item shall be based on the actual number of 42.64 kg bags of cement used to cover the exposed surface area to the full depth required within the neat lines as shown on the plans or as ordered and accepted by the Engineer.

2--Reinforcement: Reinforcement will be measured in accordance with the provisions of Article 6.02.04.

6.11.05--Basis of Payment: Payment for this work will be made as follows:

1--Shotcrete: This work will be paid for at the contract unit price per bag for "Shotcrete," complete in place, which price shall include all equipment, tools, labor and all materials except reinforcement.

2--Reinforcement: This material will be paid for at the contract unit price per kilogram for "Deformed Steel Bars" and per square meter for "Wire Fabric" complete in place, which price shall include all materials, equipment and labor incidental thereto.

Pay Item	Pay Unit
Shotcrete	Bag