

520.06. BASIS OF PAYMENT.

The accepted quantities, measured as provided above, will be paid for at the contract price per unit of measurement for the pay item listed below if shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. Payment will be made under:

- (A) PREPARATION OF CRACKS, ABOVE WATER LINEAR FOOT (METER)
- (B) PREPARATION OF CRACKS, BELOW WATER LINEAR FOOT (METER)
- (C) EPOXY RESIN, ABOVE WATER GALLON (LITER)
- (D) EPOXY RESIN, BELOW WATER GALLON (LITER)

SECTION 521 PNEUMATICALLY APPLIED MORTAR

521.01. DESCRIPTION.

This work consists of furnishing and placing of pneumatically applied mortar for the construction of portions of structures, repairing concrete structures, texturing concrete surfaces, encasement of structural steel members, lining ditches and channels, paving slopes and for other miscellaneous work, all as specified in the contract documents.

This work shall also include the preparation of surfaces to receive the mortar and the furnishing and placing of any reinforcing steel and the anchors for reinforcement.

Pneumatically placed mortar shall consist of either dry mixed fine aggregate and Portland Cement pneumatically applied by a suitable mechanism, to which mixture the water is added immediately before its expulsion from the nozzle, or mortar premixed by mechanical methods and pneumatically applied through a nozzle onto the prepared surface.

521.02. MATERIALS.

- (a) **General.** Provide materials conforming to the following subsections, except as otherwise specified:

Fine Aggregate	701.05
Coarse Aggregate	701.06
Water	701.04
Portland Cement	701.02
Reinforcing Steel for Structures	723.01
Wire Mesh	723.03

Use fine aggregate only, or a combination of fine and coarse aggregates with the percentage of coarse aggregate to total aggregate not exceeding 30%. Coarse aggregate, if used, shall conform to AASHTO M43, No. 8 or 89 gradation. Recovered rebound which is clean and free of foreign material may be reused as fine aggregate in quantities not to exceed 20% of the total fine aggregate requirements.

- (b) **Anchor Bolts or Studs.** Anchor studs used to support reinforcing wire fabric or bars when placing mortar against existing concrete or rock shall consist of $\frac{1}{4}$ inch (6 mm) minimum diameter expansion hook bolts placed in drilled holes. Each bolt shall have sufficient engagement in sound masonry to resist a pullout force of 150 pounds (670N) .

When permitted by the Engineer, driven steel studs of not less than $\frac{1}{8}$ inch (3 mm) diameter and a minimum length of 2 inches (50 mm) may be used. The equipment used for driving such studs shall be of the type that uses an explosive for the driving force, and shall be capable of inserting the stud or pin to the required depth without damage to the surrounding concrete.

521.04. CONSTRUCTION METHODS.

- (a) **Proportioning.** Submit the proposed mix design to the Engineer for approval before the start of the work. Unless otherwise specified in the contract documents, provide in the mix design a cement to aggregate ratio, based on dry loose volumes, of not less than 1:3.5 for the construction and repair of concrete structures and for encasing steel members, or not less than 1:5 for lining ditches and channels and for paving slopes. The water content shall be as low as practical. Adjust the water content so that the mix is sufficiently wet to adhere properly and sufficiently dry so that it will not sag or fall from vertical or inclined surfaces or separate in horizontal work.
- (b) **Mixing.** Perform mixing either by the dry mix or wet mix process. Before being charged into the placing equipment, thoroughly and uniformly mix the materials using a paddle-type or drum-type mixer designed for use with pneumatic application. Transit mix equipment and methods may be used for the wet process.
- (c) **Surface Preparation.**
1. *Earth.* When placing pneumatically applied mortar against earth, accurately grade the area to the elevation and dimensions specified in the contract documents. Thoroughly compact the area using sufficient moisture to provide a firm foundation and to prevent absorption of water from the mortar. Limit the application of moisture so that free surface water is not present after compacting.
When shown in the contract documents, provide joints, side forms, headers, and shooting strips for backing or paneling. Use ground or gaging wires where necessary to establish thicknesses, surface planes and finish lines.
 2. *Forms.* When placing mortar against forms, provide forms conforming to the requirements of Section 502.
 3. *Concrete or Rock.* When placing mortar against concrete or rock, remove all deteriorated or loose material by chipping with pneumatic or hand tools. Cut square or slightly undercut shoulders approximately 1 inch (25 mm) deep along the perimeter of repair areas. Sandblast the surface as necessary to clean all rust from exposed steel and to produce a clean rough textured surface on the concrete or rock. Keep the surface, against which mortar is to be placed, wet for at least one hour and then allow to dry to a surface dry condition just before applying the mortar.

(d) **Installation.**

1. *Placement of Reinforcing.* Install reinforcing steel in conformance to Section 511. Place reinforcement in new construction as specified in the contract documents. Secure to insure no displacement from impact of the pneumatically placed mortar during application.

For repair work support reinforcing steel by anchor studs installed in the existing masonry except where existing reinforcing steel in the repair area is considered by the Engineer to be satisfactory for support. Space anchors no more than 12 inches (300 mm) center-to-center on overhead surfaces, 18 inches (450 mm) center-to-center on vertical surfaces, and 36 inches (920 mm) center-to-center on top horizontal surfaces. Use at least three anchors in each individual patch area.

Notify the Engineer before starting the installation of anchor studs. Locate stud such that damage will not occur to the prestressing tendons or conduits embedded in the concrete.

Unless otherwise specified in the contract documents, for repair work, reinforce all areas where the mortar exceeds 1½ inch (38 mm) with a single layer of either 2 x 2 (50 mm x 50 mm) - W1.2 x W1.2 or 3 x 3 (75 mm x 75 mm) - W1.4 x W1.4 welded wire fabric. For areas where the thickness of the mortar exceeds 4 inches (100 mm), reinforce each 4 inch (100 mm) thickness of patch or fractional part thereof with a single layer of wire fabric. Place all fabric parallel to the proposed finish surface. Before installing the succeeding layer of fabric, completely encase in mortar each layer of fabric and allow the mortar to set. Place fabric no closer than ½ inch (12 mm) to the prepared masonry surface. Carefully prebend fabric before installing to fit around corners and into re-entrant angles. Do not bend in place.

Place all steel items, including anchors, reinforcing bars, and wire fabric, no closer than 1 inch (25 mm) to the finished surface of the mortar.

2. *Placement of Mortar.* Employ only experienced personnel. Furnish satisfactory evidence of such experience when requested by the Engineer.

Apply the mortar by pneumatic equipment that sprays the mix onto the prepared surface at a high velocity as needed to produce a compacted dense homogeneous mass. Use an air compressor and delivery hose lines of adequate capacity and size to provide a minimum pressure of 35 psi (240 kPa) at the nozzle for 1 inch (25 mm) nozzles and proportionally greater for larger nozzles. Maintain the velocity of the material as it leaves the nozzle at a uniform rate determined for the given job conditions to produce minimum rebound.

Supply water added at the nozzle at a uniform pressure of not less than 15 psi (100 kPa) greater than the air pressure at the nozzle.

Apply the mortar as dry as practicable to prevent shrinkage cracking. Employ shooting strips to insure square corners, straight lines and a plane surface of mortar, except as otherwise specified in the contract documents or approved by the Engineer. Place the strips so as to keep the trapping of rebound at a minimum. At the end of each day's work, or similar stopping periods requiring construction joints, slope off the mortar to a thin edge. Before placing an adjacent section, thoroughly clean and wet the construction joint as required under Subsection 521.04(c). In shooting all surfaces, direct the stream of material flowing from the nozzle to impinge as nearly as possible at right angles to the surface being covered, and hold the nozzle between 2 feet (0.6 m) and 4 feet (1.2 m) from the working surface.

Apply a sufficient number of mortar coats to obtain the required thickness. On vertical and overhead surfaces, limit the thickness of each coat to a maximum of 1 inch (25 mm), except as approved by the Engineer. Place each coat so that it will neither sag nor decrease the bond of the preceding coat. Allow sufficient time between successive layers in sloping, vertical, or overhanging work for initial but not final set to develop. When initial set is developing, clean the surface to remove the thin film of laitance to provide for a bond with succeeding applications.

Remove rebound or accumulated loose sand from the surface to be covered before placing any layer of mortar. Do not embed such material in the work. Apply materials within 45 minutes of mixing unless otherwise permitted by the Engineer.

After curing and before final acceptance, sound all repaired areas. Remove and replace all unsound and cracked areas.

- 2.1 *Weather Limitations.* Do not place pneumatically placed mortar on a frozen or hot surface (less than 32°F (0°C) or more than 100°F (35°C)) or if the ambient temperature is anticipated to drop below 35°F (2°C) within 24 hours after placement.

Suspend the application of mortar if high winds prevent proper application or if rain occurs which would wash out the mortar.

- 2.2 *Protection of Adjacent Work.* During the progress of the work, protect adjacent facilities that may be permanently discolored, stained, or otherwise damaged by overspray, dust, or rebound. Clean contacted areas by early scraping, brushing, or washing, as the surroundings permit.

3. *Finishing.* After placing mortar to the required thickness, cut off all high spots with a sharp trowel, or screed to a true plane as determined by shooting strips or by the original masonry surface, or as directed. When using cutting screeds, lightly apply the screed to all surfaces so as not to disturb the mortar for an appreciable depth and work the screed in an upward direction on vertical surfaces. Unless otherwise specified in the contract documents, give the finished mortar surface a final flash coat of about 1/4 inch (3 mm) of mortar. Take special care to obtain a uniform appearance on all exposed surfaces.
4. *Curing and Protecting.* Cure pneumatically placed mortar in conformance with the requirements of either "Water Method," or "Waterproof Cover Method" in Subsection 509.04(f). Cure for a minimum duration of 96 hours. Protect the mortar from freezing during the curing period. Comply with Subsection 509.04(b).

521.05. METHOD OF MEASUREMENT.

Pneumatically placed mortar shall be measured by the square yard (square meter) of finished surface area of acceptable mortar placed in the work along the plane or curve of each surface.

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- (A) PNEUMATICALLY PLACED MORTAR.....SQUARE YARD (SQUARE METER)