

# MANHOLE REHAB SPECIFICATION

## Product Application Procedure

### Cementitious Spray Applied Structural Repair Liner for Manhole Rehab

## Overview of Application of Manhole Mortar

Surface of preparation is the first step in a successful application of manhole mortar. Surface shall be hydro blasted to clean, remove loose debris, and to etch the surface back to solid substrate up to ¼” anything beyond ¼” is not surface prep but hydro demolition a different scope of work. Once that is completed the next step is to moisten the surface of the substrate with water just enough to be damp or SSD Saturated Surface Dry. Then the structure is ready to have Manhole Mortar applied to it. Once all gases have reached a safe level naturally or by supplied fresh air the Nozzlemen shall conform to OSHA confined space regulations and lowered into place to be able to start spray applying the product to the substrate surface at its proscribed thickness not to exceed 4 inches in a single application. Once surface area has been completely sprayed by the Nozzlemen it will then be steel trowel out having a sealed smooth surface. If a top coating of Epoxy is to be applied to this surface it will receive a brushed tooled finish to allow the epoxy to anchor onto it (see epoxy manufactures recommendation, ASTM, or SSPC standards). Once all these steps have been executed properly the mortar will have already begun to cure and will increase in strength within 24 hours, 7days, and peak at 28 days. In order to be considered an approved equal product must meet or exceed physical properties shown on the Manhole Mortar Data sheet. The information subsequent to this paragraph goes into further technical details of the entire process which conform to ASTM F2551 guidelines for using a cementitious liner system to rehab manholes. The following procedures come direct from ASTM.

## Surface Preparation:

### 5.4 Surface Cleaning Procedures:

5.4.1 High Pressure Cleaning—Properly cleaning the surface of the structure is critical to the success of this rehabilitation method. Use a high-pressure washer delivering a minimum of 3500 psi (2413 MPa). A minimum of two and a half gallons per minute (9.46 litres per minute) should be delivered through the spray

tip. The spray tip should be kept between 6 and 12 in. (15.24 and 30.48 cm) from the surface and be held at an angle between 45° and 90° to the surface being cleaned. The spray tip should be directed across the surface at a speed of no more than one foot per second (0.3 metres per second). If the surface is especially dirty or greasy, cleaning agents may be added to the pressure washer water or the water may be heated. When hot water is required, it should be heated to 210°F (99°C). Care should be taken to clean the frame sealing surface where the lid fits into the frame, removing any debris or other materials that negatively impact the lids ability to seal against the frame. Cleaning should begin with the frame surface and progress down to and include the bench. A rotating spray nozzle may be used for cleaning, if it meets pressure and flow requirements. Care should be taken to avoid further structural damage to the existing surface. Prepare surfaces to be repaired by water blasting, abrasive blast, hand or power tool to remove unsound concrete, contaminants, dirt, and/or debris.

## Mixing of Prepackaged Cementitious Repair Materials

6.1 The applicator shall bear complete responsibility for mixing of the materials, applying, and finishing of the sewer manhole repair system.

6.1.1 The prepackaged cementitious liner material should be mixed with water in accordance with the manufacturer's recommendations. Tempering of the material above the manufacturers published limits should not be allowed.

6.1.2 Use clean and potable water for mixing.

6.1.3 No modifications or changes should be made to the product without prior written approval of the manufacturer.

6.1.4 During hot weather, the cementitious liner material should be mixed at temperatures below 90°F (32.2°C) in order to avoid rapid loss of workability, to decrease water evaporation, and to prevent premature set time. Retarding admixtures Type A, B, or D that meet Specification C 494/C 494M may be used to allow work in hotter weather. However, applicators should obtain manufacturers permission or use products recommended by Southern Trenchless Representative. Apply admixtures in accordance with ACI 305R-99 recommendations for hot weather conditions.

6.1.5 If work is to be performed near 40°F (4.4°C), preheat the water and keep prepackaged material warm. The mix should be kept near 70°F (21.1°C).

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Apply in accordance with **ACI 306R-88** recommendations for cold weather concreting. Some liner materials are capable of setting in cold weather; consult Southern Trenchless Representative for suitability.

#### Application of the Cement Liner

##### 7.1 Spray Application—Manual Surface Sealing:

**7.1.1** Dampen the manhole wall surface. Surface must be damp without noticeable free water droplets or running water (surface, saturated, dry). Spray or apply the cementitious liner material to a uniform thickness as specified. Use a hand trowel to hand work and compact the manhole cementitious liner material into all the voids and crevices but do not over trowel. Allow the cementitious liner material to set as recommended by the manufacturer.

**7.1.2** Spray the cementitious liner material to a nominal thickness of  $\frac{1}{2}$  in. (1.25 cm) in one or more passes. The thickness of the cementitious lining material applied to the surface depends on a wide array of variables. These variables include overall condition of the manhole, depth, construction materials, location, dynamic traffic load, source and state of corrosion, diameter, hydrostatic pressure, soil type, and any other factors that might impact the design of the cementitious liner. The design engineer should determine appropriate liner thickness and liner material properties and may be prepared to include the addition of protective coatings or other methods used to limit or eliminate corrosion factors. Use a wet gauge to measure applied cementitious liner material thickness at three sections of the manhole: the cone/corbel section, middle of barrel, and the barrel near the invert. The liner shall be even and uniform with a troweled, brushed, or natural finish.

**7.1.3** Not all manufacturers recommend the use of a protective coating over the cementitious liner material. If the liner is to receive a top coating, then an anchor tooth finish is recommended and shall be free of curing or similar compounds. For dry gunite applications, finish in accordance with **ACI 506R**, using the recommended trowel.

**7.1.4** Apply the prepackaged cementitious liner material from the top of the manhole down to the bench. Overlay the bench with a gradual slope from the wall to the edge of the channel. The wall and bench intersection should have a rounded and uniform radius. The thickness of the bench shall be no less than  $\frac{1}{2}$  in.

(1.25 cm) at the edge of the channel and shall increase in the direction of the wall so as to provide the required slope.

##### 7.2 Spray Application—Centrifugal Process:

**7.2.1** Position the high-speed, bi-directional, rotating applicator within the center of the manhole at the lowest point desired for the new wall and commence pumping the mixed prepackaged cementitious liner material. Man-entry may be required to assure the lining has been effectively applied, as on the underside of any brickwork or around laterals. As the cementitious liner material begins to be centrifugally cast evenly around the interior, retrieve the applicator head at the prescribed speed for applying the thickness that has been selected. Controlled multiple passes in both clockwise and counterclockwise directions are made until the desired thickness is attained.

**7.2.2** If the procedure is interrupted for any reason, simply arrest the retrieval of the applicator head until flows are recommenced. Verify the desired thickness with a wet gage. The liners shall be even and uniform with a brushed or natural finish. If the liner is to receive a top coating refer to **7.1.3**.

Benches and channels are finished by hand as in **7.1.4**.

#### Quality Assurance

Since the nozzleman is a key element to quality in the shotcrete process the applicator performing this work must hold an ACI Nozzleman Certification and be an employee at the applicator firm. The name and certification ID must be submitted at the time of bid. Applicator shall also present OSHA confined space credentials at the time of the bid. Credentials, qualifications, and all applicable certifications must also be submitted at the time of the bid in order to qualify the applicator as capable to perform this scope of work. The stated quality assurance requirements described above are obtainable to anyone and help protect the owner from faulty craftsmanship from unqualified firms who do not meet these requirements.

#### Reference

**ACI:** American Concrete Institute

**ASA:** American Shotcrete Association

**NASSCO:** National Association of Sewer Service Companies

**SSPC:** The Society for Protective Coatings

**NACE:** National Association of Corrosion Engineers

**ASTM:** American Society for Testing and Materials