SECTION 03740

concrete rehabilitation

# GENERAL

## DESCRIPTION

### The Contractor shall perform all concrete rehabilitation work necessary to provide an acceptable substrate for the protective lining or to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the DISTRICT. In addition, the Contractor shall perform all related work including surface preparation, reinforcing corrosion protection, priming, finishing and curing of the rehabilitation work.

## RELATED WORK SPECIFIED ELSEWHERE

### The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work

#### Section 01300 –Shop Drawings and Submittals

#### Section 01410 – Testing and Inspection

#### Section 09801 – Manhole Lining

## REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

### The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for:

#### Society for Protective Coatings (SSPC)

#### National Association of Corrosion Engineers (NACE)

#### American Society for Testing and Materials (ASTM)

##### ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

##### ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

##### ASTM C496 – Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

##### ASTM C579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

##### ASTM C882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear

##### ASTM D543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents

##### ASTM D638 – Standard Test Method for Tensile Properties of Plastics

##### ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics

##### ASTM D732 – Standard Test Method for Shear Strength of Plastics by Punch Tool

##### ASTM D790 – Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

##### ASTM D2240 – Standard Test Method for Rubber Property - Durometer Hardness

##### ASTM D2369 – Standard Test Method for Volatile Matter Content of Coatings

##### ASTM D4541 – Standard Test Method for Pull-off Strength of Coatings Using a Portable Adhesion Tester

#### Standard Specifications for Public Works Construction (SSPWC), “Greenbook”

##### SSPWC 211-2 – Chemical Resistance Test

## CONTRACTOR SUBMITTALS

### All submittals shall be submitted in accordance with Section 01300, “Shop Drawings and Submittals”.

### Technical Data: The Contractor shall submit technical data for materials which document compliance with the requirements of this section, including application, cure time, surface preparation procedures, and certification from coating/lining product manufacturer as to the compatibility of the repair material(s) and coating/lining system.

### Installation Recommendations: The Contractor shall provide written installation recommendations from the manufacturer for each of the products to be used in the work covered by this section of the specifications including application, cure time, and surface preparation procedures which permit optimum bond strength with coatings/linings. Specific procedures for the application with an epoxy coating or PVC lining shall be included.

### The Contractor shall provide certification of compatibility from all product manufacturers of protective linings, coatings, concrete rehabilitation products, grouts, sealants, or other materials used in the manhole rehabilitation process.

### The Contractor shall provide Material Safety and Data Sheets and Technical Data Sheets for all products utilized in Concrete Rehabilitation.

### Five (5) references of manufacturer indicating successful product performance greater than five (5) years in age of the submitted product(s) within the municipal wastewater environment.

### The Contractor shall provide a written warranty from all manufacturers against defects of materials for a period of one (1) year following DISTRICT acceptance of the installation.

## QUALITY ASSURANCE

### Packaging: The Contractor shall store all products to be used in their original, unopened packaging displaying the manufacturer’s name, labels, product identification and batch numbers as applicable. Damaged material must be removed from the site immediately.

### All products to be used in the work covered by this Section shall be delivered, stored, and handled in accordance with the product manufacturer’s written recommendations.

# PRODUCTS

## GENERAL

### All products proposed for use for all rehabilitation and protective coating/lining work covered in these Contract Documents shall be compatible and be manufactured from the same company or a statement shall be provided from the concrete repair material and protective coating/lining manufacturers certifying their products are mutually compatible with the other products used for this work.

### Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined by the DISTRICT.

## BONDING AGENT

### Bonding agent shall be a two-component, solvent-free, moisture-tolerant, epoxy-modified, cementitious product specifically formulated as a bonding agent containing an anti-corrosion agent that is compatible with the concrete repair material and manhole protective coating/lining material.

### The need for a bonding agent shall be based on the requirements of the concrete repair manufacturer. If it is determined that a bonding agent is not required, the concrete repair manufacturer shall submit a certification to the DISTRICT stating such prior to installation of the project.

### Bonding agent material shall meet the following requirements (@ 73 degrees F and 50 percent relative humidity):

| 1. | Pot Life |  | 45 - 120 minutes |
| --- | --- | --- | --- |
| 2. | Compressive Strength (ASTM D695): | 6,000 psi | @ 7 days |
| 3. | Tensile Strength (ASTM D638): | 4,000 psi | @ 14 days |
| 4. | Flexural Strength (ASTM D790): | 6,300 psi | @ 14 days |
| 5. | Shear Strength (ASTM D732): | 5,000 psi | @ 14 days |
| 6. | Bonding Strength (ASTM C882): | 2,500 psi | @ 14 days (moist cure) |

### All bonding agents for concrete shall conform to the following requirements:

#### Bonding agent shall have a coat window (time until the repair mortar is required to be placed) of at least 8 hours at 68 degrees F.

#### The bonding agent shall not create a vapor barrier.

### If the bonding agent is not manufactured by the same company as the protective coating/lining or concrete repair mortar manufacturer, all manufacturers must certify in writing that their products are compatible. Concrete repair mortar manufacturer shall certify in writing that the bonding agent used for the project is in accordance with their recommendations for this application and for use with the concrete repair mortar materials.

### Bonding agent shall be Sikadur 32 Hi-Mod, by Sika Corporation or approved equal.

## CONCRETE REPAIR MATERIALS

### Concrete repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces as determined necessary by the DISTRICT and the protective coating/lining applicator.

### Concrete repair material shall be either of the following and shall be on the written approved list of repair materials provided by the manhole protective coating/lining manufacturer:

#### 100-percent solids, solvent-free epoxy grout specifically formulated for epoxy top coating compatibility that meets the performance requirements specified herein and that has corrosion inhibitor properties and is recommended by the manufacturer for use in sewer manhole repairs. The epoxy grout manufacturer shall provide instructions for trowel or spray application and for epoxy top coating procedures.

#### Factory blended, rapid setting, high early strength, non-shrink and non- sag repair mortar that is specifically formulated to be suitable for epoxy topcoating. Repair mortar shall have corrosion inhibitor properties and shall be recommended by the manufacturer for use in sewer manhole repairs.

### Repair material shall meet the following minimum requirements (@ 73 degrees F and 50 percent relative humidity):

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Pot Life: |  | 15 minutes minimum |
| 2. | Compressive Strength (ASTM D695): | 4,000 psi | @ 7 days |
| 3. | Flexural Strength (ASTM D790): | 1,300 psi | @ 28 days |
| 4. | Bonding Strength (ASTM C882): | 2,200 psi | @ 28 days |

### The repair material shall be designed for vertical and overhead applications.

### The repair material shall not produce a vapor barrier.

### The repair material shall be capable of meeting the minimum and maximum application thicknesses required for rebuilding or repairing the manholes and as determined by the DISTRICT.

### If the concrete repair material is not manufactured by the same company as the protective coating/lining and bonding agent manufacturer, all manufacturers must certify in writing that their products are compatible.

### Repair material applicators shall be trained to properly apply the mortar according to manufacturer’s recommendations.

### Repair mortars shall be SikaTop 121-Plus, SikaTop 122-Plus or SikaTop 123-Plus, by Sika Corporation or approved equal, and shall be selected based on application type (vertical, overhead, spray, form, etc.).

## CRACK SEALANT

### Crack sealant shall be a two component, solvent free, moisture insensitive epoxy resin material suitable for crack grouting, by injection or gravity feed and bolt grouting and as a binder for mortar, concrete or grout in thermally stable environments and as a concrete sealer.

### Repair material shall meet the following minimum requirements (@ 73 degrees F and 50 percent relative humidity):

#### Component A: Component A shall be a modified epoxy resin of the epichlorohydrin bisphenol A type, containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.

#### Component B: Component B shall be primarily a reaction product of a selected amine blend with an epoxy resin of the epichlorohydrin bisphenol A type containing suitable viscosity control agents and accelerators.

#### The ratio of Components B:A shall be 1:2 by volume.

#### The material shall not contain asbestos.

|  |  |  |  |
| --- | --- | --- | --- |
| 5. | Pot Life: |  | 30 minutes |
| 6. | Compressive Strength (ASTM D695): | 10,500 psi | @ 28 days |
| 7. | Tensile Strength (ASTM D638): | 5,500 psi | @ 14 days |
| 8. | Flexural Strength (ASTM D790): | 12,500 psi | @ 14 days |
| 9. | Shear Strength (ASTM D732): | 4,500 psi | @ 14 days |
| 10. | Bond Strength (ASTM C882): | 2,000 psi | @ 2 days dry |

### If the crack sealant is not manufactured by the same company as other repair materials to be used, all manufacturers must certify in writing that their products are compatible.

### Crack sealant applicators shall be trained to properly apply the sealant according to manufacturer’s recommendations.

### Crack sealant shall be Sikadur Hi Mod LV, by Sika Corporation, or approved equal.

## LEAK REPAIR

### The CONTRACTOR shall stop infiltration/leaks prior to applying protective lining in accordance with this Section. The manufacturers of all materials used, including the protective lining manufacturer, shall provide written certification stating that their products are mutually compatible.

### Leak repair shall be achieved by use of a Portland cement mortar waterstop. The waterstop shall be a blend of selected Portland cements and specially graded aggregates. The materials shall be non-combustible, either before or after cure. The materials shall be supplied in a factory-proportioned unit. The Portland cement mortar shall not produce a vapor barrier.

### Leak repair material shall meet the following minimum requirements.

#### Compressive Strength (ASTM C109): 4,200 psi @ 1 day

#### 6,800 psi @ 7 days

#### Splitting Tensile Strength (ASTM C496): 600 psi @ 1 day

#### 700 psi @ 7 days

#### Sulfate Resistance Test (ASTM C88): No deterioration

### Portland cement mortar water stop shall be SikaSet Plug as manufactured by Sika Corporation, or approved equal.

# EXECUTION

## GENERAL

### Concrete removal, repairs and fabrication shall be as shown on the Contract Documents and as specified herein.

### Except as otherwise indicated, in all locations where new concrete is to be deposited against existing concrete, bonding agent shall be applied to the surfaces of the existing concrete prior to placement of new concrete.

### In all cases where the joint between new concrete and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the limit of concrete removal shall be defined by a 1-1/2-inch-deep saw cut on each exposed surface of the existing concrete.

### When the finished surface is not specified to be coated, the color of new concrete in the exposed surfaces shall match the color of the existing adjoining concrete as closely as possible.

### Where indicated or specified, existing concrete shall be removed to the depth indicated or required to expose sound concrete. The surface exposed shall be roughened by chipping, sandblasting, scarifying or other appropriate means before applying bonding compounds, or repair material as specified. The surface shall be saturated surface dry, but with no standing water.

### Reinforcing steel in existing concrete which is exposed as a result of removal of deteriorated concrete shall be wire brushed to remove all loose material and products of corrosion before proceeding with the repair.

### In all cases where concrete is repaired in the vicinity of an expansion joint or isolation joint the repairs shall be made so as to preserve the isolation between components on either side of the joint.

## BONDING AGENT APPLICATION

### The bonding agent material shall be applied, stored, handled, and transported in strict accordance with the manufacturer’s written recommendations.

### Mix manufacturer’s pre-measured components for bonding agent as recommended by manufacturer. Mix only the quantity of materials that can be applied within the specified pot life of the product. Do not apply bonding agent of any batch after the recommend pot life has elapsed.

### The bonding agent slurry shall be worked into the substrate surface with a stiff bristle brush or broom. Work slurry into all surface irregularities to achieve complete coverage.

### Apply repair material to bonding agent wet-on-wet or within the manufacturer’s recommended open time for bonding agent.

## CONCRETE REPAIR MATERIAL APPLICATION

### The concrete repair material shall be applied, stored, handled, and transported in strict accordance with the manufacturer’s written recommendations.

### Remove fractured, loose, deteriorated and unsound concrete by saw cutting, bush hammering, chipping or other appropriate means. Extents of concrete removal shall be finished with straight edges and square corners to a uniform depth. Feathering of edges shall not be allowed. Shape of concrete removal area shall have a maximum of 6 sides.

### Mix manufacturer’s pre-measured components of repair material as recommended by manufacturer. Mix only the quantity of materials that can be applied within the specified pot life of the product. If repair material is being extended with fine aggregate, mix the aggregate into the material as recommended by manufacturer.

### The Contractor shall apply the repair material into the substrate and around any exposed reinforcing bars. The repair material shall be consolidated eliminating any voids. It shall be built-up from the edges of the repair area towards the center. After filling, consolidate repair material and screed surface to match original shape of member as close as possible.

### The vertical face of the wall or column shall be cleaned of any fins or burrs on the surface.

### The repair material finish shall be “broom finish”.

### The thickness of the repair shall be in accordance with the minimum and maximum allowable thickness limits as recommended by manufacturer.

## CRACK REPAIR APPLICATION

### The crack repair material shall be applied, stored, handled, and transported in strict accordance with the manufacturer’s written recommendations.

### Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks.

### Cracks on vertical and overhead surfaces shall be repaired by pressure injecting crack sealant through polyethylene valves sealed to surface with epoxy paste adhesive.

## LEAK REPAIR APPLICATION

### Prepare surface and apply materials per the manufacturer’s written instructions.

### Adhere to all limitations and precautions for the instant setting of Portland cement water stop systems stated in the manufacturers technical data sheet and literature.

### Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature is 40 degrees Fahrenheit.

### Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

## CURING

### After the repair is completed, the Contractor shall be responsible for maintaining a humid environment to allow for proper curing of all surfaces. If necessary, the Contractor shall cover the surface with polyethylene sheet to trap moisture to the surface.

### Cure all repair surfaces as specified by the repair material and protective lining manufacturers to ensure compatibility and long term lining performance.

**END OF SECTION**