# SECTION 03 93 00

# CONCRETE REHABILITATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Concrete repairs for thickness less than or equal to three inches.
2. Removal of deteriorated concrete and subsequent patching and rebuilding.
3. Floor joint repair.
4. Corrosion inhibiting sealers.
5. Epoxy crack injection.
6. Polymer overlays, including preparation.

B. Related Sections include the following:

1. Division 2 Section "Demolition."
2. Division 3 Section "Cast-in-Place Concrete."
3. Division 7 Section "Garage Waterproofing Systems" for traffic deck coating membrane applied to concrete.

### 1.3 UNIT PRICES

A. General: Unless noted otherwise, work will be paid for by the quantity computed on the basis of actual work completed approximating the dimensions measured to the nearest inch, as applicable.

1. For concrete repairs, reinforcing bar replacement will be paid for separately by the pound of replacement steel with welded and mechanical splices paid for by the unit.
2. Work completed shall include surface preparation, cleaning and final touchup.

B. Refer to the construction documents for basis of quantities and units of measurement for quantifying amount of work completed.

## 1.4 SUBMITTALS

A. Product Data: Include material descriptions, chemical composition, physical properties, test data, and mixing and application instructions.

1. Include Material Safety Data Sheets, if applicable.

B. Samples: Cured samples of overlay and patching materials.

C. Product Certificates: Signed by manufacturers certifying that products furnished comply with requirements and are recommended by manufacturer for uses indicated. Include compatibility certifications for all materials that come in contact with each other, including but not limited to bonding agents, patching mortars, concrete, corrosion-inhibiting treatments, sealers, overlays / deck coatings, galvanic anodes, etc.

D. Qualification Data: For installers and manufacturers to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1. For products required to be installed by workers approved by product manufacturers, include letters of acceptance by product manufacturers certifying that installers are approved to apply their products.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of bonding agents, patching mortars, epoxy adhesives, and other products with requirements indicated.

F. Rehabilitation program for each phase of the rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Retain installers that employ workers trained and approved by manufacturer to apply traffic deck coating membrane treatments, concrete patching and rebuilding materials, epoxy crack injection materials, polymer overlays, and other repair products as applicable.

B. Manufacturer Qualifications: Manufacturers shall have factory-trained representatives who are available for consultation and Project site inspection at no additional cost.

C. Source Limitations: Obtain each of the following through one source from a single manufacturer:

1. Concrete patching and rebuilding materials.
2. Epoxy crack injection materials.

D. Mockups: Build mockups for concrete removal and patching, floor joint repair, epoxy crack injection and polymer overlay to demonstrate qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

C. Store cementitious materials off the ground, under cover, and in a dry location.

D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within 8 hours.
2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within 8 hours.
3. Use only Class C epoxies when substrate temperatures are above 60 deg F.

B. Cold-Weather Requirements for Cementitious Materials: Do not apply unless air temperature is between 40 and 90 deg F and will remain so for at least 48 hours after completion of Work.

C. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.

## 1.8 WARRANTY

A. Special Manufacturer's and Installer’s Joint Warranty: Manufacturer's standard form in which the Manufacturer and the Installer jointly agree to furnish and repair or replace the product(s) that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period for all products and the installation of such products, listed in Part 2 of this Section, unless noted otherwise: Five years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure from the following:

1. Movement caused by structural settlement or errors attributable to design or construction resulting in stresses exceeding the manufacturer's written specifications for elongation and compression.
2. Disintegration from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in appearance caused by accumulation of dirt or other atmospheric contaminants.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent:

a. Euclid Chemical Company; CORR-BOND.
b. Kaufman Products, Inc; SurePoxy HM EPL or SurePoxy HM12.
c. Sika Corporation; Armatec 110 EpoCem.
d. Sto Corp., Concrete Restoration Division; Sto Bonding and Anti-Corrosion Agent.

2. Epoxy Bonding Agent:

a. Dayton Superior Corporation; Resi-Bond (J-58), Sure-Anchor Epoxy (J-50), or Sure-Inject (J-56).
b. Euclid Chemical Company; EUCO #352 EPOXY SYSTEM, EUCO #452 EPOXY SYSTEM, EUCO #620 EPOXY SYSTEM, or EUCOPOXY LPL MV.
c. Kaufman Products, Inc.; SurePoxy HM EPL or SurePoxy HM.
d. Sika Corporation; Sikadur 31 Hi-Mod Gel, Sikadur 32 Hi-Mod, Sikadur 32 Hi-Mod LPL, Sikadur 35 Hi-Mod LV, or Sikadur 35 Hi-Mod LV LPL.
e. Sto Corp., Concrete Restoration Division; Sto Epoxy Adhesive.
f. Unitex; Pro-Poxy 204 or Slow Set Bonding Agent.
g. BASF Building Systems; Concresive Liquid LPL

3. Cementitious Patching Mortar:

a. Kaufman Products, Inc.; HiCap.
b. Sika Corporation; SikaRepair 223 or SikaRepair SHB.
c. Sto Corp., Concrete Restoration Division; Sto Full-Depth Repair Mortar.
d. BASF Building Systems; LA Repair Mortar, LA40 Repair Mortar, LA40 PMAC Repair Mortar, Emaco S66 CI, Emaco S77 CI, or Emaco S88 CI.

4. Cementitious Patching Mortar, Rapid Setting:

a. Dayton Superior Corporation; Day-Chem Perma-Patch, Re-Crete 5 Minute, or Re-Crete 20 Minute.
b. Euclid Chemical Company; EUCO-SPEED.
c. Kaufman Products, Inc.; Duracrete II or Duracrete II FR.
d. Sika Corporation; SikaQuick 1000.
e. Sto Corp., Concrete Restoration Division; Sto Rapid Repair Mortar.
f. BASF Building Systems; 10-60 Rapid Mortar, 10-61 Rapid Mortar, Emaco T415, or Emaco T430.

5. Polymer-Modified, Cementitious Patching Mortar:

a. Dayton Superior Corporation; HD-50 or Thin Resurfacer.
b. Euclid Chemical Company; CONCRETE COAT, THINCOAT, or VERTICOAT.
c. Kaufman Products, Inc.; Patchwell, Patchwell Kit, Patchwell Deep, or Patchwell VO.
d. Sika Corporation; SikaTop 121 Plus, SikaTop 122 Plus, or SikaTop 123 Plus.
e. Sto Corp., Concrete Restoration Division; Sto Flowable Mortar, Sto Overhead Mortar, Sto Thin-Coat Mortar, or Sto Trowel-Grade Mortar.
f. BASF Building Systems; HBA Repair Mortar, HB2 Repair Mortar, Emaco 300 CI, Emaco 310 CI, or SD2 Repair Mortar.
g. Sherwin Williams; SherCrete Thin Coat, Vertical/Overhead Mortar, or Extended Deep-Pour Mortar.

6. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar:

a. Euclid Chemical Company; Verticoat Supreme.
b. Sika Corporation; Sika MonoTop 615.
c. Sto Corp., Concrete Restoration Division; Sto High-Strength Overhead Mortar.
d. BASF Building Systems; Emaco S88 CI, Gel Patch.

7. Epoxy-Modified, Cementitious Patching Mortar:

a. Sika Corporation; Sikagard 75 EpoCem.

8. Epoxy Joint Filler:

a. Euclid Chemical Company; EUCO 700.
b. Kaufman Products, Inc.; SurePoxy Flexijoint.
c. Metzer/McGuire; MM-80 SPAL-PRO XL.
d. Sika Corporation; Sikadur 51 NS or Sikadur 51 SL.
e. Unitex; Pro-Flex or Pro-Flex Gel.
f. BASF Building Systems; Epolith-G or Epolith-P

9. Epoxy Crack Injection Adhesive:

a. Dayton Superior Corporation; Sure-Inject (J-56).
b. Euclid Chemical Company; EUCO #352 LV, EUCO #452 LV, or EUCOPOXY INJECTION RESIN.
c. Kaufman Products, Inc.; SurePoxy HMLV, SurePoxy HMLV-Class B, or SurePoxy HM-SLV.
d. Sika Corporation; Sikadur 35 Hi-Mod LV, Sikadur 35 Hi-Mod LV LPL, Sikadur 52, or Sikadur Injection Gel.
e. Sto Corp., Concrete Restoration Division; Sto Epoxy Binder.
f. Unitex; Pro-Poxy 50 SuperLV or Pro-Poxy 100 LV.
g. BASF Building Systems; Concresive Standard LVI, SCB Concresive 1380 or EpoXeal GS Structural.

10. Corrosion-Inhibiting Treatments (Products with 100% active ingredients):

a. Evonik Industries; Protectosil CIT.
b. BASF Building Systems; Masterseal CP.
c. Sherwin Williams; SherCrete Flexible Waterproofer.

11. Polymer Overlays:

a. Kaufman Products, Inc.; SurePoxy VLM or SurePoxy VLM-Class B.
b. Unitex; Pro-Poxy Type III D.O.T.
c. BASF Building Systems; Trafficguard EP-35

## 2.2 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

B. Epoxy Bonding Agent: ASTM C 881, Type II.

C. Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 1 part fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.

## 2.3 PATCHING MORTAR

A. Patching Mortar: Unless otherwise indicated, use one of the following:

1. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.
2. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.
3. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.
4. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.
5. Epoxy-Modified, Cementitious Patching Mortar: Mixture of water-insensitive epoxy adhesive, portland cement, and graded aggregates.

B. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified above.

C. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.

## 2.4 CONCRETE

A. Concrete Materials and Admixtures: Comply with Division 3 Section "Cast-in-Place Concrete."

B. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Division 3 Section "Cast-in-Place Concrete."

C. Form-Facing Materials: Comply with Division 3 Section "Cast-in-Place Concrete."

D. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S, with 100 percent passing a 1-1/2-inch sieve, 95 to 100 percent passing a 1-inch sieve, 40 to 80 percent passing a 3/4-inch

sieve, 0 to 15 percent passing a 1/2-inch sieve, and 0 to 2 percent passing a 3/8-inch sieve.

E. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 sieve, 95 to 100 percent passing a No. 16 sieve, 55 to 80 percent passing a No. 30 sieve, 30 to 55 percent passing a No. 50 sieve, 10 to 30 percent passing a No. 100 sieve, 0 to 10 percent passing a No. 200 sieve, and having a fineness modulus of 1.30 to 2.10.

F. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.

G. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.

H. Pozzolans for Grout Used with Preplaced Aggregate: ASTM C 618.

## 2.5 MISCELLANEOUS MATERIALS

A. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of at least 80 per ASTM D 2240.

B. Epoxy Crack Injection Adhesive: ASTM C 881, Type I, Grade 1, except for gel time, solvent free.

C. Epoxy Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.

D. Corrosion-Inhibiting Treatment Materials: 100% active ingredient in multiple coat application treatment to reduce galvanic reaction in concrete.

E. Polymer Overlay: Epoxy adhesive complying with ASTM C 881, Type III.

1. Aggregate: Oven-dried, washed silica sand complying with ACI 503.3.

F. Polymer Sealer: Use corrosion inhibiting treatments specified above.

G. Joint Sealants, Traffic Deck Coating Membranes, and Expansion Joints: Comply with Division 7 Section "Garage Waterproofing Systems."

H. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. After fabricating, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. After preparation, apply 2-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20, at 2.5-mil dry film thickness and topcoat of high-build, 2-component, epoxy-polyamide, high-performance coating at 6-mil dry film thickness.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1) Carboline Company; Carboline 621 and 190 HB.
2) PPG Industries, Inc.; Aquapon Zinc-Rich Primer 97-670 and High-Build Polyamide-Epoxy 97-131.
3) Tnemec Company, Inc.; Tneme-Zinc 90-97 and Series 69 Hi-Build Epoxoline II.

I. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers; hot-dip galvanized to comply with ASTM A 153, Class C.

J. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical or Expansion anchors.
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

## 2.6 MIXES

A. Mix products in clean containers according to manufacturer's written instructions.

1. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
2. Do not add water, thinners, or additives unless recommended by manufacturer.
3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
4. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

B. Mortar Scrub-Coat: Mix with enough water to provide a consistency of thick cream.

C. Dry-Pack Mortar: Mix with just enough liquid to form a damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with Division 3 Section "Cast-in-Place Concrete."

E. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of delaminated concrete and reinforcing bars will be located.

B. Locate areas of delamination using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries of delaminated areas as directed by Architect.

C. Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer, using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

### 3.2 PREPARATION

A. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.

1. Erect temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles that must remain in operation during course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch exterior-grade plywood supported at 16 inches o.c. and covered with asphalt roll roofing.
2. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
3. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
4. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

B. Shoring: Install temporary supports before beginning concrete removal as necessary.

C. Concrete Removal: Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcing. Remove loose and deteriorated concrete by breaking up and dislodging from reinforcing.

1. Remove concrete between cuts to a depth of at least 1/2 inch.
2. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar to provide at least a 3/4-inch clearance.

3. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound concrete is completely removed.
4. Provide fractured aggregate surfaces with a profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level.
5. Thoroughly clean removal areas of loose concrete, dust, and debris.

D. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by high-pressure water cleaning, abrasive blast cleaning, needle scaling, or wire brushing until only tightly bonded light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in 2 or more adjacent bars, cut bars and remove and replace as directed by Architect. Remove additional concrete as necessary to provide at least a 3/4-inch clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318, by lapping, welding, or using mechanical couplings.

E. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges of spalls and to a depth of at least 3/4 inch. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

F. Surface Preparation for Traffic Deck Coating or Corrosion-Inhibiting Treatment: Clean concrete by low-pressure water cleaning, detergent scrubbing, or sand blasting to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment.

G. Surface Preparation for Traffic Deck Coating Membranes and Overlays: Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by sand blasting, shot blasting, scarifying, needle scaling, high-pressure water jetting, scabbling, flame blasting, or milling to produce a surface profile matching CSP 5 per ICRI 03732. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.

H. Surface Preparation for Sealers: Clean concrete by shot blasting, low-pressure water cleaning, or detergent scrubbing to remove dirt, oils, films, and other materials detrimental to sealer application.

1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
4. When pH is acceptable and surface is clean, vacuum dry.

**3.3 APPLICATION**

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

B. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat. Apply patching mortar or concrete while epoxy is still tacky. If bonding agent dries, recoat before placing patching mortar or concrete.

C. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches beyond repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub-coat dries, recoat before applying patching mortar or concrete.

D. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:

1. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar into substrate, filling pores and voids.
2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
3. For vertical and overhead patching, place material in lifts of not more than 1 inch nor less than 1/8 inch. Do not feather edge.
4. After each lift is placed, consolidate material and screed surface.
5. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
6. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a rough surface with a broom or burlap drag.
7. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

E. Dry-Pack Mortar: Use for deep cavities and where indicated. Place according to manufacturer's written instructions and as follows:

1. Provide forms where necessary to confine patch to required shape.

2. Wet substrate and forms thoroughly and then remove standing water.
3. Place dry-pack mortar into cavity by hand, and compact into place with a hardwood drive stick and mallet or hammer. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
4. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
5. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

F. Concrete: Place according to Division 3 Section "Cast-in-Place Concrete" and as follows:

1. Apply epoxy-modified, cementitious bonding and anticorrosion agent or epoxy bonding agent to reinforcing and concrete substrate.
2. Use vibrators to consolidate concrete as it is placed as necessary.
3. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
4. Where indicated place concrete by form and pump method.

   a. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and junctions of forms with existing concrete.
   b. Pump concrete into place, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi.

5. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
6. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

G. Grouted Preplaced Aggregate Concrete: Use for column and wall repairs and where indicated. Place as follows:

1. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and junctions of forms with existing concrete.
2. Apply epoxy-modified, cementitious bonding and anticorrosion agent or epoxy bonding agent to reinforcing and concrete substrate.
3. Place aggregate in forms, consolidating aggregate as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
4. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.

5. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi.
6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Repair voids with patching mortar and finish to match surrounding concrete.

H. Epoxy Joint Filler: Install in nonmoving floor joints where indicated.

1. Install filler to a depth of at least 3/4 inch. Use fine silica sand no more than 1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

I. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.
4. Inject cracks wider than 0.003 inch to a depth of 8 inches or to a width of less than 0.003 inch, whichever is less.
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

J. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete or applying a sealer or overlay.

1. Apply to all repaired concrete surfaces and polymer overlays not otherwise receiving traffic deck coating membrane application.

K. Polymer Overlay: Apply according to ACI 503.3.

1. Apply to traffic-bearing surfaces, including parking areas and walks as indicated on the Drawings.

## 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to sample materials and perform tests specified in Division 3 Section "Cast-in-Place Concrete" and as follows:

1. Patching Mortar, Packaged Mixes: Two randomly selected samples tested according to ASTM C 928.
2. Patching Mortar, Field Mixed: Two randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
3. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.

    a. Testing Frequency: 1 sample for each 25 cu. yd. of grout or fraction thereof, but not less than 1 sample for each day's work.

4. Epoxy Joint Filler: Core drilled samples to verify proper installation.

    a. Testing Frequency: One sample for each 100 feet of joint filled.
    b. Core size: ¾ inch diameter by 12 inches long.
    c. Where samples are taken, fill holes with epoxy joint filler.

5. Epoxy Crack Injection: Core drilled samples to verify proper installation.

    a. Testing Frequency: 3 samples from mockup and 1 sample for each 100 feet of crack injected.
    b. Core size: ¾ inch diameter by 12 inches long.
    c. Where samples are taken, fill holes with epoxy mortar.

END OF SECTION 03 93 00