

**SECTION 03 01 31**

**CONCRETE REMOVAL AND SURFACE PREPARATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Concrete removal and surface preparation prior to concrete replacement, including:
  - 1. Removal of unsound and sound concrete.
  - 2. Preparation of concrete and steel surfaces.
  - 3. Coating reinforcing bars and embedded steel with corrosion-inhibiting material.
  - 4. Supply and installation of supplemental reinforcing bars.
  - 5. Supply and installation of epoxy-grouted steel dowels.
- B. Related Sections:
  - 1. Section 03 01 34 - Concrete Replacements: Concrete replacement at removal areas.

**1.2 REFERENCES**

- A. Reference Standards: Latest edition as of Specification date.
  - 1. ASTM International:
    - a. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
    - b. A1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, plain and Deformed, for Concrete
    - c. F593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  - 2. International Concrete Repair Institute (ICRI):
    - a. Guideline 310.1R: Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
    - b. Guideline 310.2R: Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair
    - c. Guideline 310.3R: Guide for the Preparation of Concrete Surfaces for Repair using Hydrodemolition Methods.
  - 3. SSPC: The Society of Protective Coatings:
    - a. SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.
    - b. SSPC-SP 15: Commercial Grade Power Tool Cleaning.

**1.3 COORDINATION**

- A. Coordinate with Owner's Representative and with other trades to ensure that adjacent areas are not adversely affected by concrete removal Work.

**1.4 SUBMITTALS**

- A. Product Data: Manufacturer's literature and technical data for corrosion-inhibiting coating material, and epoxy for epoxy-grouted dowels, indicating applicability of product for proposed use.
  - 1. Include Safety Data Sheets (SDS) for information only.

- B. Certificates:
  - 1. For installer of epoxy-grouted dowels: ACI-CRSI Certification as Adhesive Anchor Installer.
- C. Reinforcing Steel:
  - 1. Mill test reports for steel reinforcement, indicating conformance with ASTM A615/A615M.
- D. Confinement, Collection, and Disposal Plan: Written plan for confining, collecting, and disposing of broken concrete, sandblast grit, dust, debris, existing reinforcing, and other waste material resulting from removal operations and surface preparation.

**1.5 QUALITY ASSURANCE**

- A. Qualifications for Installer of Epoxy-Grouted Dowels: Experienced individual with current ACI-CRSI certification as Adhesive Anchor Installer.
  - 1. Applicable only for anchors in horizontal or upwardly inclined orientations.
- B. Mockups: Demonstrate adequacy of concrete removal and surface preparation procedures as part of mockups in 03 01 34.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Site in original containers and packaging with seals unbroken, labeled with manufacturer’s name, product brand name and type, date of manufacture, lot number, directions for storing, and complete manufacturer’s written instructions.
- B. Keep materials dry and do not allow materials to be exposed to moisture during transportation, storage, handling, or installation. Reject and remove from Site new materials which have been exposed to moisture to their detriment.
- C. Store and handle materials in accordance with manufacturer’s written instructions, safety requirements, and all applicable laws and regulations. Remove from Site, and replace at no cost to Owner, any materials that are damaged or otherwise negatively affected by not being stored or handled in accordance with manufacturer’s written instructions.
- D. Store materials in original, undamaged containers and packaging in clean, dry, location on raised platforms and protected from weather, within temperature range required by manufacturer. Protect stored materials from direct sunlight and sources of ignition. Manufacturer’s standard packaging and covering alone is not considered adequate weather protection.
- E. Locate materials in a secure location approved by Owner’s Representative
- F. Conspicuously mark damaged or opened containers, containers with contaminated materials, damaged materials, and materials that cannot be used within stated shelf life and remove from Site as soon as possible. Replace discarded materials in a timely manner at no cost to Owner.
- G. Limit stored materials on structures so as to preclude damage to materials and structures.
- H. Maintain copies of all applicable Safety Data Sheets (SDS) with materials in storage area, such that they are available for ready reference on Site.

## 1.7 PROJECT CONDITIONS

- A. Verify existing dimensions and details prior to start of concrete removal Work. Notify Engineer of conditions found to be different than those indicated in the Contract Documents. Engineer will review situation and inform Contractor and Installer how to proceed.
- B. Comply with Owner’s limitations and restrictions for Site use and accessibility.
- C. Maintain adequate ventilation during preparation and application of materials.

## 1.8 CHANGES IN WORK

- A. During rehabilitation work, existing conditions may be encountered which are not known or are at variance with the Contract Documents. Such conditions may interfere with the Work and may consist of damage or deterioration of the substrate or surrounding materials or improper location of embedded elements such as reinforcing steel, which could jeopardize the integrity or performance of the Work.
  - 1. Notify Engineer prior to proceeding with the Work of conditions that may interfere with, preclude proper execution of, or jeopardize the performance of the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Corrosion-Inhibiting Coating Materials: Use material specifically intended for reinforcing steel embedded in concrete.
  - 1. Cementitious Coating: Sika Armatec 110 EpoCem by Sika Corporation, or approved equal.
  - 2. Epoxy: Sikadur 32 Hi-Mod by Sika Corporation, or approved equal.
  - 3. Zinc-rich Steel Primer: MasterProtect P 8100 AP by BASF Construction Chemicals, LLC, or approved equal.
- B. Reinforcing Bars: Deformed bars conforming to ASTM A615/A615M, Grade 60. Sizes as shown on Drawings or directed by Engineer.
  - 1. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Bar supports shall be manufactured from steel wire, plastic, or precast concrete in accordance with “Bar Support Specifications and Standard Nomenclature” in *CRSI Manual of Standard Practice*.
    - a. For concrete surfaces exposed to wastewater where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire bar supports or CRSI Class 2 stainless-steel bar supports.
- C. Steel Wire and Welded Wire Reinforcement, Plain and Deformed: Steel wire and welded wire reinforcement shall conform with 65,000 psi minimum yield strength conforming to ASTM A1064.
  - 1. Welded Wire Reinforcement shall be 6x6-W4xW4, unless otherwise approved by Engineer based on existing reinforcing. Use 6x6-W4xW4 for all new installations where not otherwise specified.
- D. Grouted Dowels:
  - 1. Dowels: ASTM A615/A615M, Grade 60, uncoated deformed steel bars, cut true to length with ends square and free of burrs.

2. Dowels: ASTM F593, Group 2 (Type 316) stainless steel; threaded rods.
3. Grout for Dowels: Use one of the following or approved equal:
  - a. HIT-HY 200-R hybrid adhesive by Hilti, Inc.
  - b. SET XP High-Strength Epoxy Adhesive by Simpson Strong-Tie.

## 2.2 EQUIPMENT

- A. Pneumatic Chipping Hammers:
  1. Nominal 30-lb class or less for removal of concrete at repair areas.
  2. Nominal 15-lb class or less for detail work adjacent to and beneath reinforcing steel.
- B. Saws capable of sawcutting concrete to specified depth.
- C. Sandblasting equipment capable of removing laitance, dirt, loose pieces of concrete, and surface contaminants from exposed concrete surfaces and rust, concrete, and surface contaminants from exposed steel surfaces.
- D. High-pressure, oil-free compressed air equipment capable of removing dust and dirt from exposed concrete removal areas.
- E. Percussive or rotary drilling equipment for making holes in concrete substrate for dowel installation.

## 2.3 FABRICATION

- A. Fabricate and detail steel reinforcement to shapes and dimensions shown on Drawings in accordance with and within fabricating tolerances shown in CRSI's *Manual of Standard Practice*.
- B. Bends and hooks shall conform to dimensions defined as "ACI Standard Hooks" in CRSI's *Manual of Standard Practice* unless otherwise shown on Drawings.
- C. Welded Wire Reinforcing shall conform to the recommendations of the Wire Reinforcing Institutes WWR 400-R-03.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements and other conditions affecting concrete removal Work.
  1. Ensure that work done by other trades is complete and ready for concrete removal Work.
  2. Verify that areas and conditions under which concrete removal Work is to be performed permit proper and timely completion of Work.
  3. Notify Engineer in writing of conditions which may adversely affect concrete removal Work and recommend corrections.
  4. Do not proceed with concrete removal Work until adverse conditions have been corrected and reviewed by Engineer.
  5. Commencing concrete removal Work constitutes acceptance of Work surfaces and conditions.

### 3.2 PROTECTION

- A. Take precautions to ensure safety of people (including building users, passers-by, and workers) and protection of property (including adjacent building elements, landscaping, and motor vehicles).
- B. Erect temporary protective canopies and walls, as necessary, at walkways and at points of pedestrian and vehicular access that must remain in service during Work.
- C. Take precautions to protect against air-borne materials and run-off.
- D. Protect paving, sidewalk, and adjacent building areas from mechanical damage due to scaffolding and other equipment.
- E. Prevent dust, debris, coating overspray/spatter, and other construction materials from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
- F. Limit access to Work areas.
- G. Assume responsibility for injury to persons or damage to property due to Work, and remedy at no cost to Owner.
- H. Protect from damage, all elements of completed work and original construction to remain.

### 3.3 CONCRETE REMOVAL AND SURFACE PREPARATION

- A. Hammer sound concrete surfaces and mark with paint areas of unsound concrete. Engineer will review markings before concrete removal Work begins.
- B. Prior to concrete removal Work:
  - 1. Remove or temporarily shore plumbing and electrical lines and associated fixtures that interfere with Work. Reattach at completion of Work.
  - 2. Install shoring as specified or directed by Engineer.
  - 3. Develop plan for confining and disposing of broken concrete and other debris from removal Work.
- C. Concrete Removal Areas:
  - 1. Where possible, make rectangular in shape in plan.
  - 2. Avoid re-entrant corners.
  - 3. Extend at least four inches beyond edge of unsound concrete.
  - 4. Extend full-depth areas at least two inches over nearby supports such as beams, girders, joists, and drop panels, as directed by Engineer.
- D. Create square edges of removal areas.
  - 1. Sawcut 3/4 inches at top surface removal areas. Do not damage reinforcing steel, embedded electrical conduits, or other embedments.
  - 2. Sawcut square edges of overhead and vertical removal areas at least 1/2 inches deep.
- E. Remove unsound concrete and, as necessary, sound concrete to create:
  - 1. A minimum removal depth of two inches
  - 2. Gaps around partially exposed reinforcing bars (with greater than 50 percent of their circumference exposed) of at least 3/4 inches.

- F. Exercise care to avoid cracking underlying sound concrete, punching through member, or damaging embedments such as electrical conduit.
- G. Avoid abrupt changes in depth of removal.
- H. Leave roughened surface to match CSP 7 or higher from ICRI 310.2R. Meet replacement material manufacturer requirement if greater than value specified here.
- I. Limit chipping hammer size and impact angle to minimize damage to sound concrete. Impact angle shall be no more than 60 degrees to surface.
- J. At full-depth removal areas, slope removal area edges downward and inward at a slope of one to one.
- K. Inspect and sound concrete surfaces in and around removal areas. Remove additional unsound concrete. Sawcut or chip square new removal area perimeter as necessary.
- L. Clean surfaces of removal area, including vertical edges, to remove surface contaminants, loose pieces of concrete, and concrete that is bruised or micro-fractured and to roughen surfaces. Clean removal area surfaces with dry, oil-free compressed-air jet. Acceptable cleaning methods include:
  - 1. Abrasive blasting. If wet abrasive blasting is used a corrosion inhibitor shall be added to the water.
  - 2. High-pressure water blasting. Pressures exceeding 5,000psi, or as necessary to meet the requirements above.
- M. Inspect prepared concrete surfaces and remedy defects. Allow Engineer at least 48 hours to observe prepared surfaces prior to concrete placement.

**3.4 REINFORCMENT PREPARATION**

- A. Leave existing reinforcing in place unless otherwise directed by Engineer.
- B. Notify Engineer of reinforcing bars that are incorrectly located or have less than 1/2 inch of concrete cover; are damaged or fractured; or have lost more than ten percent of their original cross-sectional area at any point. Engineer will determine remedial action.
- C. Prepare exposed steel surfaces, including existing exposed reinforcement and steel embedments. Exercise care to prepare undersides of reinforcing bars. Use one of the following methods:
  - 1. Abrasive blast, to SSPC-SP 6/NACE No. 3 finish, with minimal rust or concrete debris.
  - 2. Commercial grade power tool cleaning, to SSPC-SP 15 at locations explicitly approved by Engineer in writing. Prepare to condition of minimal rust or concrete debris.
- D. Clean steel surfaces with dry, oil-free compressed-air jet. Exercise care to clean undersides of reinforcing bars.
- E. Inspect prepared steel surfaces and clean remaining contaminants. Allow Engineer at least 48 hours to observe prepared surfaces prior to coating steel.
- F. Apply two coats of corrosion-inhibiting material on exposed steel surfaces.
  - 1. Batch, mix, and apply material according to recommendations of material supplier.
    - a. Minimum dry film thickness: 10 to 12 mils.

2. Exercise care to coat difficult-to-reach surfaces, such as undersides of reinforcing bars.
  3. Minimize spillage on concrete surfaces. Remove materials that will act as bond breaker by chipping or other means.
  4. Inspect coated steel surfaces and apply additional coats to uncoated or thinly-coated areas. Allow Engineer at least 48 hours to observe prepared coated surfaces prior to concrete placement.
- G. Install supplemental reinforcement as directed by Engineer.
1. Remove additional sound concrete to properly position bars with minimum clear concrete cover of 1 1/2 inches and full encasement by the replacement material; and to achieve specified lap splice length with existing bars.
    - a. Coat new bars in accordance with the requirements of this section.
  2. Do not weld reinforcement unless specifically approved by Engineer
  3. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### **3.5 NEW STEEL REINFORCEMENT**

- A. General: Comply with CRSI Manual of Standard Practice for placing reinforcement
- B. Clean reinforcement of loose rust and mill scale, earth, ice and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Do not weld reinforcement unless specifically approved by Engineer.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges of adjoining sheets at least one mesh spacing plus 2 inches. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- G. Coat new bars in accordance with requirements for existing reinforcing.

### **3.6 INSTALLATION OF EPOXY-GROUTED STEEL DOWELS**

- A. Remove and replace unsound concrete at dowel locations.
- B. Dry drill holes perpendicular to concrete surface, unless otherwise detailed in drawings.
  1. Locate existing reinforcement with reinforcing bar locator and position holes to avoid existing reinforcement.
  2. Do not damage existing reinforcement.
  3. Drill hole diameter at least 1/8 inch larger than dowel diameter, unless otherwise recommended by epoxy manufacturer.
- C. Clean holes with stiff brush and dry, oil-free compressed-air jet to remove loose concrete, dust, and debris.
- D. Inject epoxy with tube into back of hole and fill hole to front, withdrawing tube.
  1. Carefully proportion and mix two-part epoxies according to manufacturer's directions. Scrape out entire contents of both containers to assure accurate proportions.

2. Mix epoxy for approximately three minutes with paint stirrer attached to low speed (400 to 600 rpm) electric or pneumatic drill, unless otherwise specified by manufacturer. Move stirrer up and down and around sides of mixing container until even, streak-free color is attained. Do not whip in air.
  3. Install sufficient epoxy material to completely fill annular space around dowel.
- E. Insert dowel to bottom of hole and secure in center of hole, perpendicular to surface, until epoxy has set.
- F. Promptly remove excess epoxy.
- G. Apply two coats of corrosion-inhibiting material on exposed steel surfaces.

### **3.7 CLEANING**

- A. After completing Concrete Removal and Surface Preparation Work:
1. Clean all materials resulting from Work that are not intended to be part of the finished Work using appropriate cleaning agents and procedures. Exercise care to avoid damaging surfaces.
  2. Repair at no cost to Owner all items damaged during the Work.
  3. Remove and legally dispose of debris and surplus materials from Site.

**END OF SECTION**