



Formerly



brand products

## SECTION 03900

### CONCRETE RESTORATION AND REPAIR

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Concrete restoration and repair materials.
- B. Concrete mixes.
- C. Primers.
- D. Latex admixtures/bonding agents.

##### 1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: New concrete.

##### 1.3 REFERENCES

- A. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- B. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
- C. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens).
- D. ASTM C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
- E. ASTM C 190 - Method of Test for Tensile Strength of Hydraulic Cement Mortars (Withdrawn 1990, no replacement).
- F. ASTM C 191 - Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
- G. ASTM C 266 - Standard Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles.
- H. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.

- I. ASTM C 387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
- J. ASTM C 469 - Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
- K. ASTM C 488 - Standard Test Method for Conducting Exterior Exposure Tests of Finishes for Thermal Insulation.
- L. ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
- M. ASTM C 531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- N. ASTM C 666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- O. ASTM C 672 - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
- P. ASTM C 827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
- Q. ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
- R. ASTM C 928 - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- S. ASTM C 944 - Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method.
- T. ASTM C1042 Standard Test Method for Bond Strength of Latex Systems Used With Concrete By Slant Shear
- U. ASTM C 1090 - Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout.
- V. ASTM C 1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- W. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- X. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- Y. ICRI Guideline No. 03730 - Surface Preparation Guidelines for Repair of Deteriorated Concrete Resulting from Reinforcing Steel Oxidation.
- Z. ICRI Guideline No. 03731 – Selecting Application Methods for the Repair of Concrete Surfaces.
- AA. ICRI Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: Show location of repairs, details, anchorage, and other information required for review.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm specializing in the manufacture of concrete restoration and repair materials, with minimum 10 years experience.
- B. Installer Qualifications: Firm specializing in installation of concrete restoration and repair materials, with minimum 5 years documented experience with projects of similar scope, design, and materials.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

#### 1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bonsal / ProSpec, Bonsal American 8201 Arrowridge Blvd., Charlotte, NC 28273. Tel: 704.525.1621. Tel: 800.334.0784. Fax: 704.529.5261. Web: <http://www.prospec.com>. **Technical Contact Person: Peter Golter, PE**
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

## 2.2 CONCRETE RESTORATION AND REPAIR PRODUCTS

- A. Horizontal Thin Repairs (featheredge up to 2 inches in depth):
1. Bonsal / ProSpec Vinyl Concrete Mortar for Patching: Single component, fast setting, polymer modified portland cement based product for horizontal concrete repair; shrinkage compensating, superior abrasion resistance.
    - a. Acceptable Product: Bonsal / ProSpec Vinyl Concrete Patcher.
    - b. Exceeds ASTM C 387 for High Strength Mortar.
    - c. Can be featheredged on light traffic areas when modified with Bonsal ProSpec Acrylic Additive.
    - d. Set Time (ASTM C 191):
      - 1) Initial Set: 35 to 45 minutes.
      - 2) Final Set: 60 to 70 minutes.
    - e. Flexural Strength, (ASTM C 78): 7 days - >1,400 psi (9.7 MPa), 28 days - >1850 psi (12.8 MPa).
    - f. Compressive Strength, (ASTM C 109): 24 hours air cured - > 2,00 psi (16.5 MPa), 7 days - >5,000 psi (34.5 MPa), 28 days - >5,500 psi (37.9 MPa).
    - g. Length Change Percent, Air Cured (ASTM C 157): Minus 0.003 percent.
    - h. Tensile Strength, (ASTM C 190): 7 days - >500 psi (3.4 MPa), 28 days - >600 psi (4.1 MPa).
    - i. Modulus of Elasticity (ASTM C 469):  $2.45 \times 10^6$ .
    - j. Splitting Tensile Strength, (ASTM C 496): 28 Days - >450 psi (3.1 MPa).
    - k. Resistance to Deicing Salts (ASTM C 672): 25 cycles, zero visual rating.
    - l. Shear Bond Strength, (ASTM C 882): 28 Days - >1800 psi (12.2 MPa).
    - m. Abrasion Resistance, (ASTM C 944): 28 Days - 2.3 grams loss.
- B. Horizontal Resurfacing & Topping Repairs for Traffic Areas (Feather Edge to 1/2 inch (13 mm) in depth):
1. Horizontal Concrete Resurfacer: Pre-Blended, fast drying polymer modified repair mortar to resurface old distressed concrete or rain pitted new concrete; single component semi flowable consistency allows placements with squeegee, masonry brush or broom; high flexural & compressive strengths. Allows vehicle traffic in 48 hours; uniform superior bond strength. Self curing:
    - a. Acceptable Product: Bonsal /Prospec CR-Concrete Resurfacer
    - b. Working Time at 70 degrees F (21 degrees C): 20-30 minutes.
    - c. Set Time at 70 degrees F (21 degrees C) ASTM C191:
      - 1) Initial Set: 60-90 minutes.
      - 2) Final Set: 90-120 minutes
    - d. Compressive Strength, (ASTM C109): 3 hours – 1,500 psi (10.3 Mpa), 1 day – 2,400 psi (16.5 MPa), 7 days – 3,600 psi (24.7 MPa), 28 days - 5000 psi (34.5 MPa)
    - e. Length Change (ASTM C 157):
      - 1) Dry: 1 day – 0.004 percent, 7 days - .0000 percent, 28 days – 0.031 percent.
      - 2) Wet: 1 day - 0.007 percent, 7 days - 0.010 percent, 28 days – 0.031 percent.
- C. Horizontal Repairs for Heavy Duty Traffic Areas (1/2 inch to 8 inches in depth):
1. Magnesium Phosphate Concrete Repair Mix: Rapid setting, magnesium phosphate cement based concrete repair material that quickly develops high compressive strength; for use in below freezing temperatures; for repair of

horizontal surfaces, allowing heavy traffic within 2 hours; 1/2 inch (12.7 mm) to 8 inch (203 mm) depth.

- a. Acceptable Product: ProSpec Magna 100.
  - b. Meets rapid hardening requirement of ASTM C 928.
  - c. Set Time (ASTM C 191) at 70 degrees F (21 degrees C):
    - 1) Initial Set: 8 to 10 minutes.
    - 2) Final Set: 12 to 15 minutes.
  - d. Flexural Strength, (ASTM C 78): 28 days air cured - >750 psi (5 MPa).
  - e. Compressive Strength, (ASTM C 109): 2 hours - >3,500 psi (24 MPa).  
1 day - > 4,500 psi (31 MPa), 7 days - >5,500 psi (37 MPa), 28 days - >6,500 psi (44 MPa).
  - f. Freeze-Thaw Resistance (ASTM C 666A): 95 percent durability factor.
  - g. Bond Strength, (ASTM C 1042 modified): 7 days - >1,000 psi (6.9 MPa), 28 days - >2,000 psi (13.8 MPa).
2. Fiber Reinforced Concrete Repair Mortar(Very Rapid Repair Material):Pre-blended cement based mortar achieving high compressive strengths, 2000 psi + in one hour; open to heavy vehicle traffic in 60 minutes, wide temperature installation range 20 F to 100 F (-6 C to 38 C); high performance Fiber Reinforced Repair Mortar- Fast setting Portland cement based repair mortar cement technology with alkali resistant fibers for enhanced impact, flexural and tensile strengths; 1/2 inch (12.7mm) to 8 inches (203mm) depth; Non-Corrosive.
- a. Acceptable Product: Bonsal / ProSpec Premium Patch 100.
  - b. Meets rapid hardening requirement of ASTM C 928.
  - c. Working Time at 70 degrees F (21 degrees C): 15 minutes.
  - d. Set Time (ASTM C 191) at 70 degrees F (21 degrees C):
    - 1) Initial Set: 20 minutes.
    - 2) Final Set: 25 Minutes.
  - e. Compressive Strength, (ASTM C109) at 75 degrees F (24 degrees C):  
1 hour – 2,600 psi (18.3 MPa), 3 hours – 3,500 psi (24.1 MPa), 1 day – 6,000 psi (41.3 MPa), 7 days – 8,000 psi (55.1 MPa), 28 days - 10,000 psi (69.0 MPa).
  - f. Bond Strength, (ASTM C 882): 1 day – 1,400 psi (9.6 MPa), 7 days - >2000 psi (13.8 MPa).
  - g. Rapid Freeze Thaw (ASTM C 666B) Resistance 300 Cycles, no sign of spalling, 99.6 percent.
  - h. Scaling Resistance Freeze Thaw (ASTM C672),25 Cycles, No Visible Scaling.
  - i. Length Change Hardened Cement Mortar(ASTM C928); .038 percent water storage; Minus 0.06 Air Storage.
3. Fiber Reinforced , Polymer Modified Concrete Repair Mortar (Very Rapid/High Bond Strength Repair Material):Pre –Blended Cement based mortar achieving high compressive strengths, 2000 psi + in one hour; open to heavy vehicle traffic in 60 minutes, wide temperature installation range 20 degrees F to 100 degrees F (-6 degrees C to 38 degrees C); high performance Fiber Reinforced Repair Mortar- Fast setting Portland cement based repair mortar cement technology with alkali resistant fibers for enhanced impact, flexural & tensile strengths;1/2 inch (12.7mm) to 8 inches (203mm) depth;Non-Corrosive; high flexural and bond strength material.
- a. Acceptable Product: Bonsal / ProSpec Premium Patch 200.
  - b. Meets rapid hardening requirement of ASTM C 928.
  - c. Working Time at 70 degrees F (21 degrees C): 15 minutes.
  - d. Set Time, (ASTM C 191) at 70 degrees F (21 degrees C):
    - 1) Initial Set: 18 minutes.
    - 2) Final Set: 20 Minutes.
  - e. Compressive Strength, (ASTM C109), at 75 degrees F (24 degrees C):

- 1 hour – 2,650 psi (18.3 MPa), 3 hours – 3,800 psi (26.2 MPa), 1 day – 5,400 psi (37.2 MPa), 7 days – 7,800 psi (53.8 MPa), 28 days – 9,100 psi (62.7 MPa).
  - f. Bond Strength, (ASTM C 882): 7 days – 1,500 psi (10.3 MPa), 7 days >3000 psi (20.7 MPa).
  - g. Flexural Strength, (ASTM C 348): 7 days – 1,100 psi (7.5 MPa), 28 days – 1200 psi (8.3 MPa).
  - h. Rapid Freeze Thaw (ASTM C 666B) Resistance 300 Cycles, no sign of spalling, 99.6 percent.
  - i. Scaling Resistance Freeze Thaw (ASTM C672), 25 Cycles, No visible scaling.
  - j. Length Change Hardened Cement Mortar(ASTM C928); 28 days - .038 percent water storage; Minus percent .094 percent Air Storage.
- D. Vertical, Horizontal and Overhead Repairs with Corrosion Inhibitor (1/2 inch (13 mm) to 8 inches (203 mm) in depth):
1. General Purpose Polymer Modified Repair Mortar: single component rapid setting polymer modified repair mortar for repairing & resurfacing vertical, overhead and horizontal concrete surfaces-above or below grade; easily shaped, molded or trowel shaved to conform to irregular surface profiles; array of colors and set times to meet repair constraints.
    - a. Acceptable Product: Bonsal / ProSpec BlendCrete.
    - b. Meets rapid hardening requirement of ASTM C 928.
    - c. Working Time at 70 degrees F (21 degrees C): 15 minutes.
    - d. Set Time (ASTM C191) at 70 degrees F (21 degrees C):
      - 1) Initial Set: 20 minutes.
      - 2) Final Set: 30 minutes.
    - e. Compressive Strength (ASTM C 928): 1 hour – 1,925 psi (13.3 MPa), 1 day – 4,885 psi (33.7 MPa), 28 days - 6500 psi (44.8MPa).
    - f. Freeze /Thaw Resistance (ASTM B666), 300 cycles, 1 percent loss, slight scaling, no spalling.
    - g. Scaling Resistance (ASTM C 672): 25 cycles, no visible scaling.
    - h. Shear Bond Strength (ASTM C882): 1 day – 1,035 psi (7.1 MPa), 7 days - >1650 psi (11.4 MPa).
    - i. Flexural Strength (ASTM C348): 1 day – 1,142 psi (7.9 MPa), 28 days - 1180 psi (8.1MPa).
    - j. Colors:
      - 1) Gray #0.
      - 2) Gray #2.
      - 3) Gray #3.
      - 4) White.
- E. Vertical and Overhead Repairs with Corrosion Inhibitor (1/4 inch to 8 inches (6 mm to 203 mm) in depth):
1. Vertical and Overhead Repair Mortar: Pre-blended polymer-modified, portland cement based patching mortar; for vertical, and overhead surfaces; contains corrosion inhibitor; non-sag; no forms required up to 2 inches (51 mm); self-curing; low shrinkage; freeze-thaw resistant.
    - a. Acceptable Product: Bonsal / ProSpec V.O. Repair Mortar.
    - b. Set Time (ASTM C 191):
      - 1) Initial Set: approximately 14 minutes.
      - 2) Final Set: approximately 20 minutes.
    - c. Compressive Strength, (ASTM C 109): 1 day – 2,500 psi (17.2 MPa), 7 days – 4,000 psi (27.6 MPa), 28 days – 5,000 psi (34.5 MPa).
- F. Stopping Active Water Leaks:

1. Hydraulic Cement: High speed, single component cement repair material formulated for stopping active water leaks; can be applied under water; non-metallic; shrinkage compensated; for use above and below grade; for horizontal and vertical repairs.
  - a. Acceptable Product: Bonsal / ProSpec Instant Hydraulic Cement.
  - b. Set Time (ASTM C 191):
    - 1) Initial Set: 1 to 3 minutes.
    - 2) Final Set: 3 to 4 minutes.
  - c. Flexural Strength, (ASTM C 78): 7 days - >1,000 psi (6.9 MPa), 28 days 1,400 psi (9.6 MPa).
  - d. Compressive Strength, (ASTM C 109): 1 hour – 1,600 psi (11 MPa), 24 hours – 2,800 psi (19.3 MPa), 7 days – 6,500 psi (45.9 MPa).
  - e. Tensile Strength (ASTM C 307): 7 days – 350 psi (2.4 MPa).
  - f. Linear Length Change, 24 Hours (ASTM C 157): 24 hours - 0.010 percent.
  - g. Coefficient of Thermal Expansion (ASTM C 531): (inches per degree F)  $1.13 \times 10^{-5}$  inches per degree F, 0.010 percent.
  - h. Density, Wet: 124 lbs/cubic foot (1986 kg/cubic meter).
  
- G. Vertical Resurfacing, Filling and Smoothing Tilt Up/Cast Concrete/Precast/ Masonry Block (feather edge to 1/2 inch (13 mm)):
  1. Vertical Concrete Resurfacer: Polymer enhanced, single component screed mortar for resurfacing vertical concrete surfaces by filling and smoothing surface gaps, bug holes, honeycombs and depressions; contains smooth, non-angular aggregates; accepts most coatings/coverings within 30 minutes; freeze thaw resistant.
    - a. Acceptable Product: Bonsal / Prospec RubCrete.
    - b. Working Time at 70 degrees F (21 degrees C): 30 minutes.
    - c. Compressive Strength: (ASTM C109): 1 day – 600 psi (4.1 MPa), 3 days – 1,500 psi (10.3 MPa), 7 days – 2,000 psi (13.8 MPa), 28 days – 3,500 psi (24.1 MPa). 3500 PSI (24.1 MPa).

## 2.3 CONCRETE MIXES

- A. High Performance Concrete Repair Mix: Super plasticized high performance ready mix concrete; for full depth repairs 2 inches (51 mm) or greater; pumpable; structural applications and full depth repairs for highways, structural piers, bridge decks, balconies, parking garages, slabs, industrial floors and foundations.
  1. Acceptable Product: Bonsal /ProSpec Metro Mix 240.
  2. Exceeds ASTM C 387, Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
  3. Compressive Strength, (ASTM C 39): 1 day – 2,000 psi (14 MPa), 7 days – 5,000 psi (34 MPa), 28 days – 6,000 psi (41 MPa).
  4. Length Change, Dry (ASTM C 157):
    - a. Dry: Minus 0.04.
    - b. Wet: Plus 0.02.
  
- B. High Performance Concrete Repair Mix with Corrosion Inhibitor: Air entrained super plasticized high performance ready mix concrete with corrosion inhibitor; for full depth repairs 2 inches (51 mm) or greater; pumpable; structural applications and full depth repairs for highways, structural piers, bridge decks, balconies, parking garages, slabs, industrial floors and foundations.
  1. Acceptable Product: Bonsal / ProSpec Metro Mix 240 AE.
  2. Exceeds ASTM C 387, Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
    - a. Compressive Strength, (ASTM C 39): 1 day – 2,000 psi (14 MPa), 7

- days – 5,000 psi (34 MPa), 28 days – 6,000 psi (41 MPa).
- 3. >6000 psi (41 MPa).
- 4. Length Change (ASTM C 157):
  - a. Dry: Minus 0.04.
  - b. Wet: Plus 0.02.

## 2.4 REBAR PROTECTIVE COATING

- A. Rebar **Protective Coating**: Polymer based, zero VOC, primer with corrosion inhibitors; for use over prepared reinforcing steel and other steel components.
  - 1. Acceptable Product: Bonsal / ProSpec Rebar Coat.

## 2.5 LATEX ADMIXTURES/BONDING AGENTS

- A. Primer / Bonding Agent: Zero VOC concentrated liquid used prior to installation of cementitious toppings, underlayments, repair mortars and stucco to improve bond strength and curing time; interior or exterior; above and below grade.
  - 1. Acceptable Primer: Bonsal / ProSpec 118 Primer.
- B. Acrylic Latex Admixture: A solvent free/zero VOC liquid acrylic polymer emulsion admixture for cement based products, repair & setting mortars and stucco to enhance or improve bond strength, durability, curing time, workability, and tensile strength; interior or exterior; above or below grade.
  - 1. Acceptable Acrylic Latex Admixture : Bonsal / ProSpec Acrylic Additive

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION