SPECIFICATIONS GROUP

General Requirements Subgroup

DIVISION 01 - GENERAL REQUIREMENTS
NOT APPLICABLE

Facility Construction Subgroup

DIVISION 02 - EXISTING CONDITIONS
NOT APPLICABLE

DIVISION 03 - CONCRETE
03 0130 MAINTENANCE OF CAST-IN-PLACE CONCRETE
03 3000 CAST-IN-PLACE CONCRETE
03 6372 THIN BONDED POLYMER OVERLAY

DIVISION 04 - MASONRY
NOT APPLICABLE

DIVISION 05 - METALS
NOT APPLICABLE

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
NOT APPLICABLE

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 9200 JOINT SEALANTS

DIVISION 08 - OPENINGS
NOT APPLICABLE

DIVISION 09 - FINISHES
NOT APPLICABLE

DIVISION 10 - SPECIALTIES
NOT APPLICABLE

DIVISION 11 - EQUIPMENT
NOT APPLICABLE

DIVISION 12 - FURNISHINGS
NOT APPLICABLE

DIVISION 13 - SPECIAL CONSTRUCTION
NOT APPLICABLE

DIVISION 14 - CONVEYING EQUIPMENT
### Facility Services Subgroup

**DIVISION 21 - FIRE SUPPRESSION**  
NOT APPLICABLE

**DIVISION 22 - PLUMBING**  
NOT APPLICABLE

**DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**  
NOT APPLICABLE

**DIVISION 25 - INTEGRATED AUTOMATION**  
NOT APPLICABLE

**DIVISION 26 - ELECTRICAL**  
NOT APPLICABLE

**DIVISION 27 - COMMUNICATIONS**  
NOT APPLICABLE

**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**  
NOT APPLICABLE

### Site and Infrastructure Subgroup

**DIVISION 31 - EARTHWORK**  
NOT APPLICABLE

**DIVISION 32 - EXTERIOR IMPROVEMENTS**  
NOT APPLICABLE

**DIVISION 33 - UTILITIES**  
NOT APPLICABLE

END OF TABLE OF CONTENTS
SECTION 036372 – THIN BONDED POLYMER OVERLAY

PART 1 - GENERAL

1.1 SUMMARY

A. Thin bonded polymer overlay system applied to concrete decks.
B. Removal of existing membrane from concrete decks.
C. Repair of damaged areas of a polymer overlay system

1.2 REFERENCES

A. ASTM C 25: Chemical Analysis of Limestone, Quicklime, and Hydrated
B. ASTM C 88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C. ASTM C 131: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
D. ASTM C 566: Total Evaporable Moisture Content of Aggregate by Drying
E. ASTM C 579: Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing’s, and Polymer Concretes
F. ASTM C 881: Epoxy-Resin-Base Bonding Systems for Concrete
G. ASTM D 570: Water Absorption of Plastics
H. ASTM D 638: Tensile Properties of Plastic
I. ASTM D 790: Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
J. ASTM D 2240: Rubber Property — Durometer Hardness
K. ASTM D 4285: Indicating Oil or Water in Compressed Air
L. ASTM D 4580: Measuring Delamination’s in Concrete Bridge Decks by Sounding
M. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate Welding certificates.
N. ASTM D 6928: Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
O. ASTM E 274: Skid Resistance of Paved Surfaces Using a Full-Scale Tire
American Concrete Institute (ACI)

International Concrete Repair Institute (ICRI)

1.3 DEFINITIONS

A. Polymer Overlay System — A thin bonded polymer overlay applied as a wearing surface consisting of a two-part polymer resin broadcasted with aggregate to refusal before it cures.

B. Installer — The entity preparing the surface and installing and finishing the polymer overlay system.

C. Provider — The manufacturer furnishing the polymer overlay system.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, testing and inspecting agency representative, overlay installer and overlay system manufacturer's representative.

2. Review methods and procedures related to overlay installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including surface preparation and repairs.

5. Review structural loading limitations of deck during and after overlay.

6. Review primers, flashings, special details, drainage, penetrations, and condition of other construction that affects overlay system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for overlay system during and after installation.

9. Review observation and repair procedures after overlay installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Manufacturer's Product Data Sheets and recommended installation instructions.

2. Material Safety Data Sheets

3. The Provider's certification stating that the provider is the sole provider of the components of the polymer overlay system and that the components are:

   a. In accordance with this Section.
   b. Fully compatible with one another.

4. The Installer's certification with the Provider's written concurrence that the polymer overlay system is fully compatible with all deck repair materials.

B. Shop Drawings: Include plans, sections, details and phasing plans.
C. Samples for Verification: For the following products:
   1. Overlay system aggregate.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer. Include the following at a minimum:
   1. Company name.
   2. Name and phone number of the Provider's Technical Support Representative.
   3. List of projects using the submitted products with at least two years of satisfactory performance under similar environmental conditions as the project in which it is to be applied. Refer to this Section, Article 1.8 B. List the following for each project:
      a. Project name
      b. Location
      c. Scope of work
      d. Products used
      e. Approximate date of the system opening to traffic.

B. Certified test report from an independent nationally recognized laboratory stating that the polymer resins in the polymer overlay system components meet the requirements in this Section.
   1. Test results must be from within a three year period of the submittal

C. Certified Test Report from an AASHTO accredited testing laboratory confirming the compliance of the aggregate material with the test requirements of this Section.
   1. Test results must be from within a one year period of the submittal.

D. Method for mixing of the polymer resins
   1. The Provider's written concurrence that the selected mixing method is acceptable and compatible with the polymer overlay system.
   2. Mixing ratio of the polymer resins

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overlay system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Technical Support Representative
   1. Provide a Technical Support Representative from the Provider onsite during surface preparation and application of the polymer overlay system on the first day the polymer overlay system is installed on a structure.
      a. The Technical Support Representative must have a minimum of 3 years of experience with the system and with guiding and assisting installers in the polymer overlay system installation.
      b. The Technical Support Representative will instruct the workers in proper mixing, application technique, safety precautions, traffic opening time, and environmental requirements.
c. The Technical Support Representative must be available for consultation but not necessarily present at the job site for the remaining work.

2. The Owner reserves the right to require the Technical Support Representative to be onsite if at any time the Owner is concerned with the product installation quality.

B. Prior Performance:
1. The selected polymer overlay system must have at least five years of satisfactory performance.

C. Installer Qualifications:
1. Installer shall have at least five years of experience in installing materials specified and shall have successfully completed at least five projects of similar size and complexity using the specified components of the thin bonded polymer overlay system.
2. Installer shall designate a single individual as project superintendent who shall be on site at all times during installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Polymer Resin
1. Identify the containers as Part A and Part B and plainly mark with:
   a. Manufacturer's name
   b. Manufacturer's address
   c. Name of the product
   d. Mixing proportions and instructions
   e. Lot and batch numbers
   f. Date of manufacture
   g. Quantity
2. Transport to and store on the job site in a dry, weather protected environment away from moisture, and within the maintained temperature range of 60 to 100 degrees F and according to Provider's recommended installation instructions.

B. Broadcast Aggregate
1. Store aggregate in a clean, dry location, protected from rain and other moisture sources.
2. Protect the aggregate from contaminants on the job site.

C. Handling Liquid Materials
1. Use protective gloves, clothing, boots, and goggles when directly exposed to the material.
2. Provide manufacturer's safety data sheets to workers and inspectors.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of polymer overlay system that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.
   2. Include in the letter:
      a. Owner
      b. Project Name
      c. Structure Information
      d. Contractor, Provider, and Installer Name
   3. Defects (performance failures) include:
      a. Spalling: Broken or missing pieces of polymer overlay system.
      b. Scaling: Visible, exposed, rough surface texture resulting from a loss of aggregate or resin.
      c. Delamination: Visible or audible debonding of the polymer overlay system at the bond line (interface) with the existing bridge receiving surface.
      d. Cracking: Visible cracks not reflected from a crack in the existing deck.
      e. Loss of skid resistance: Skid resistance less than 40 as measured according to ASTM E 274.
   4. The guarantee covers 100 percent of the polymer overlay system materials and installation costs.
   5. Removal and replacement of the polymer overlay system for failed sections.
   6. The Owner will notify the Contractor of defects to be repaired during the guarantee period.
      a. Submit detailed plans and procedures of corrective work according to Provider's recommendations and obtain the Department's authorization before commencing work.
      b. Perform corrective work within 60 days of notification.

PART 2 - PRODUCTS

2.1 POLYMER OVERLAY SYSTEM

A. Use a thin bonded polymer overlay system that chemically cures to provide an impervious wearing surface consisting of the following:
   1. Penetrating Crack Filler
   2. Polymer Resin
   3. Broadcast Aggregate

B. Penetrating Crack Filler
   1. Provide a penetrating crack filler as required by the Provider.

C. Polymer Resin
   1. Two-part Epoxy-Urethane Co-Polymer (Type 1) that meets the requirements of Table 1.
   2. Free of fillers, volatile solvents, and external/conventional flexibilizers.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength, min. psi</td>
<td>5,000</td>
<td>ASTM C 579</td>
</tr>
</tbody>
</table>
### Table 2

**BASALT OR FLINT AGGREGATE PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soundness, ASTM C 88</td>
<td>3.0 max</td>
</tr>
<tr>
<td>LA Abrasion, Grade D, ASTM</td>
<td>20.0% max.</td>
</tr>
<tr>
<td>Micro Deval Abrasion, ASTM D 6928</td>
<td>10.0% max.</td>
</tr>
<tr>
<td>Mohs Scale Hardness</td>
<td>7.0 min.</td>
</tr>
</tbody>
</table>

### Table 3

**BASALT OR FLINT AGGREGATE GRADATION**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.93 inch; No. 8</td>
<td>95 - 100</td>
</tr>
<tr>
<td>0.046 inch; No. 16*</td>
<td>20 - 30</td>
</tr>
<tr>
<td>0.024 inch; No. 30</td>
<td>0 - 3</td>
</tr>
</tbody>
</table>

* 100 percent of the aggregate has at least one mechanically fractured face for materials being retained on the #16 sieve according to ASTM D 5821.

### Table 4

**CALCINED BAUXITE AGGREGATE PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soundness, ASTM C 88</td>
<td>3.0 max</td>
</tr>
<tr>
<td>LA Abrasion, Grade D, ASTM</td>
<td>20.0% max.</td>
</tr>
<tr>
<td>Micro Deval Abrasion, ASTM D 6928</td>
<td>5.0% max.</td>
</tr>
<tr>
<td>Mohs Scale Hardness</td>
<td>8.0 min.</td>
</tr>
</tbody>
</table>

D. Broadcast Aggregate

1. Thoroughly washed and kiln dried to maximum moisture content of 0.2 percent by weight according to ASTM C 566.
2. Use aggregate with the properties shown in Table 2 with aggregate gradation according to the requirements in Table 3, or use aggregate with the properties shown in Table 4 with aggregate gradation according to the requirements in Table 5.
Table 5
CALCINED BAUXITE AGGREGATE GRADATION

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>O. 187 inch; No.4</td>
<td>100</td>
</tr>
<tr>
<td>O. 132 inch; No.6</td>
<td>95 - 100</td>
</tr>
<tr>
<td>0.046 inch; No. 16*</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

* 100 percent of the aggregate has at least one mechanically fractured face for materials being retained on the #16 sieve according to ASTM D 5821.

2.2 EQUIPMENT
A. Membrane Removal
   1. Use a diamond tipped grinder or approved method to remove existing membrane from the deck.
B. Metered Mixing
   1. Use equipment capable of heating, metering, mixing, and distributing the polymer resin at no less than 15 gallons per minute.
      a. Use equipment that features positive displacement volumetric metering pumps controlled by hydraulic or electric power
      b. Use motionless, in-line mixing.
   2. Use equipment that is approved by the Provider.
C. Hand Mixing
   1. Not approved.
D. Broadcasting Aggregate
   1. Use a chip spreader capable of dispensing the aggregate vertically onto the deck in a uniform manner as required by the Provider. Horizontal blowing or broadcasting aggregate with sand or fertilizer spreaders not approved.

PART 3 - EXECUTION

3.1 MEMBRANE REMOVAL
A. Remove the existing membrane as shown or as required by the Engineer.
   1. Do not damage concrete deck when removing membrane.

3.2 SURFACE PREPARATION
A. Surface Defects
   1. Repair deck surface defects before installing the polymer overlay system.
a. Use a concrete repair material that meets Provider's recommendations and is compatible with the polymer overlay system being used.

b. Use concrete repair materials free of magnesium phosphate.

B. Shot-Blasting

1. Clean the entire concrete deck surface with steel shot blast to remove oil, dirt, rubber, and other materials that may be detrimental to the polymer overlay bonding and curing according to the Provider's recommendations.

   a. Use sandblasting equipment or mechanical grinders only in areas that cannot be reached with steel shot-blasting.

      1) Sandblast or grind before shot-blasting. Refer to ASTM D 4285.

2. Produce a surface relief that meets the International Concrete Repair Institute (ICRI) Surface Preparation CSP 5-7.

C. Traffic

1. Do not allow traffic on the deck that has been shot-blasted.

2. Only allow the polymer overlay system equipment on cleaned surfaces.

3.3 APPLICATION

A. Concrete Surface

1. Complete deck repairs and surface preparation before applying the polymer overlay system.

2. Clean the concrete surface and apply a penetrating crack filler as required by the Provider.

3. Do not apply the polymer overlay system when it has rained within 24 hours or is expected to rain within 8 hours of application.

4. Verify the moisture content in the concrete substrate does not exceed 4.0 percent when measured by an electronic meter.

5. Apply the polymer overlay system only when the deck and ambient air temperature is a minimum 50 degrees F and rising.

6. Verify that treated surfaces are dry at the time of second application.

B. Mixing

1. Measure and mix the polymer resin components as recommended by the Provider.

   a. Maintain mix ratios according to the Provider's recommendations.

2. Mix polymer resin immediately before dispensing.

3. Verify the mix ratio by volumetric sampling at the beginning of the application, mid operation, and at the end of the application of each

   a. Use containers with graduated markings with not less than 5 gallon capacity.

   b. Remove the static mixer and dispense each component into separate containers.

      1) Dispense at least five gallons of the primary component for ratio comparison.

      2) Uncontaminated samples may be returned to the reservoirs they were originally dispensed from.

   c. The Owner, Architect or Technical Support Representative may request additional sampling.

C. First and Second Layers of Overlay
1. Evenly distribute the polymer resin on the clean, dry deck surface at the rate recommended by the Provider.
   a. Use new notched squeegees, 3/16 inch minimum, on the first lift of every application to verify sufficient thickness of the overlay.

D. Overlay Thickness
1. Provide the number of layers and application rates of the liquid in each layer according to the Provider's recommendations.
2. Provide a total overlay thickness of at least 3/16 inch.

E. Time Limits for Broadcast Aggregate
1. Use the following maximum time allowed after application of liquid before broadcasting the aggregate in Table 6 unless directed otherwise by the Provider.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 90°F</td>
<td>10 minutes</td>
</tr>
<tr>
<td>80°F to 90°F</td>
<td>15 minutes</td>
</tr>
<tr>
<td>70°F to 80°F</td>
<td>20 minutes</td>
</tr>
<tr>
<td>60°F to 70°F</td>
<td>25 minutes</td>
</tr>
<tr>
<td>50°F to 60°F</td>
<td>35 minutes</td>
</tr>
</tbody>
</table>

F. Broadcasting Aggregate
1. Broadcast the aggregate before the polymer begins to gel.
   a. Cover the surface until no wet spots remain.
2. Drop the aggregate vertically so the level of the liquid is not disturbed.

G. Joints in the Overlay
1. Stagger and overlap joints between successive layers 6 to 12 inches so that no ridges appear between two adjacent applications.
2. Maintain straight construction joints between adjacent placements and lifts.

H. Traffic
1. Do not allow vehicles on the polymer overlay while it is curing.
2. Allow traffic on the final layer or in between layers after the resin has cured, as determined by the Provider, and after removal of excess and loose aggregate.
   a. Brush blast the surface with shot blast according to the Provider's recommendations before applying additional layers when traffic has been allowed on the cured surface between layers.

I. Work performed contrary to the Technical Support Representatives instructions will be deemed nonconforming.

3.4 LIMITATIONS

A. New Decks
1. Cure newly placed concrete for at least 28 calendar days before beginning installation of polymer overlay system.
B. Prevent material and debris from falling into streams, pedestrian areas, live traffic, or railroad tracks.

3.5 POLYMER OVERLAY REPAIR

A. Locate and mark visible polymer overlay repair areas as shown and in the presence of the Owner.
   1. Sound the polymer overlay around repair area for delamination of the polymer overlay to determine repair limits.
   2. Square off the edges of polymer overlay system repair area six inches beyond the determined limits and parallel to the travel lane.
   3. Saw cut the perimeter of polymer overlay system repair area with a 1/2 inch deep saw cut.

B. Remove existing membrane within the repair area according to this Section, Article 3.1.
   1. Sound the concrete deck in the repair area for delamination of the concrete deck to determine the need for structural pothole patching. Refer to ASTM D 4580.

C. Prepare the deck surface within the repair area according to this Section, Article 3.2.
   1. Do not substitute sandblasting or mechanical grinding where shot blasting is required.

D. Apply the polymer overlay system within the repair area according to this Section.

END OF SECTION 036372
SECTION 030130 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
   2. Epoxy crack injection.

B. Related Sections include the following:
   1. See Division 03 Section "Cast-in Place-Concrete" for reinforcement, forms, and additives.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For installers.
   1. For Concrete Repair Specialist and supervisor on the project, submit list of at least 5 similar concrete repair projects that the Concrete Repair Specialist and supervisor on the project have completed successfully.
   2. 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.

C. Material Certificates: For each type of product indicated, signed by manufacturers.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for patching mortars and epoxy adhesives.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer that employs workers trained and approved by manufacturer to apply corrosion-inhibiting treatments and concrete patching and rebuilding materials.

B. Manufacturer Qualifications: Manufacturer that employs factory-trained representatives who are available for consultation and Project-site inspection.

C. Source Limitations: Obtain concrete patching and rebuilding materials through one source from a single manufacturer.
D. Mockups: Build mockups for concrete removal and patching to demonstrate aesthetic effects and set quality standards for materials and execution.

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

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 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.

1.5 PROJECT CONDITIONS

A. Cold-Weather Requirements for Cementitious Materials: Do not apply unless air temperature is above 40 deg F (5 deg C) and will remain so for at least 48 hours after completion of Work.

B. Cold-Weather Requirements for Cementitious Materials (if allowed on a temporary basis): Comply with the following procedures:
   1. When air temperature is below 40 deg F (5 deg C), heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F (5 and 32 deg C).
   2. When mean daily air temperature is between 25 and 40 deg F (minus 4 and plus 5 deg C), cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
   3. When mean daily air temperature is below 25 deg F (minus 4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.

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 (32 deg C) and above.
PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain each color, grade, finish, type, and variety of product from single source with resources to provide products of consistent quality in appearance and physical properties.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

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.

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

2. Products: Subject to compliance with requirements, provide one of the following:
   a. Sika Corporation; Armatec 110 EpoCem.
   b. BASF Corporation; Sonoprep.

B. Mortar Scrub-Coat: Slurry paste from mixed repair mortar or concrete that is to be used for the repairs.

2.3 PATCHING MORTAR

A. Patching Mortar, General:
   1. Unless otherwise indicated, use any of the products specified in this Article.
   2. Overhead/Vertical Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
   3. 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.


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

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cementitious Patching Mortar:
      1) Cementitious Patching Mortar, Rapid Setting:
         a) Sika Corporation; SikaQuick 1000 or SikaQuick 2500.
         b) BASF Corporation; T1061, Emaco T415 or Emaco T430.
C. 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.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Sika Corporation; Sikacrete-211 SCC Plus, SikaTop 122 Plus, SikaTop 123 Plus, or Sika MonoTop 611.
   b. BASF Corporation; Emaco R320 CI or Emaco R350 CI.

2.4 CONCRETE

A. Concrete Materials and Admixtures: Comply with Division 03 Section "Cast-in-Place Concrete."

B. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Division 03 Section "Cast-in-Place Concrete."

C. Form-Facing Materials: Comply with Division 03 Section "Cast-in-Place Concrete."

2.5 MISCELLANEOUS MATERIALS

A. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; hot-dip or mechanically zinc coated.

B. Post-installed Anchors: Chemical anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, 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.

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Sika Corporation; Sikadur 35, Hi-Mod LV Sikadur 35, Hi-Mod LV LPL Sikadur 52 or Sikadur Injection Gel.
   b. BASF Corporation; MasterInject 1500 or MasterInject 1380.

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: Slurry paste from mixed repair mortar or concrete that is to be used for the repairs.

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

D. Concrete: Comply with Division 03 Section "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Chip out at edges of damaged area until sound concrete is exposed. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb, unless otherwise indicated.

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 and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch (19-mm) exterior-grade plywood supported at 16 inches (405 mm) 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. If practical, remove items, store, and reinstall after potentially damaging operations are complete. Do not cover autos without written permission from the Owner.
3. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means 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 that could reduce structural integrity of the existing structure.

C. Concrete Removal:
1. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement. Avoid chipping on steel reinforcement that can cause vibration and require additional removal of concrete.
2. Saw-cut perimeter of damaged areas after extent of deteriorated concrete is confirmed. Saw-cut perimeter of repair area to a depth of at least 1 inch (26 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement. For overhead and sides of vertical repair, make saw cuts angle into sound concrete 5 to 10 degrees.
3. Remove additional concrete, if necessary, to provide a depth of removal of at least 3/4 inch (19 mm) over entire removal area.
4. 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 more than tightly bonded light rust, remove concrete from entire perimeter of bar to provide at least a 3/4-inch (19-mm) clearance around bar.
5. Test areas where concrete has been removed by tapping with brick chipping hammer (do not tap on reinforcement), and remove additional concrete until unsound and disbonded concrete is completely removed.
6. Provide fractured aggregate surfaces with a profile of at least 1/8 inch (3 mm) that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces of repair area level and as deep as possible without cutting existing reinforcement, unless otherwise directed.
7. Thoroughly clean removal areas of loose concrete, dust, and debris.

D. Reinforcing Bar Preparation: Remove loose and flaking/scaled 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 20 percent, or 15 percent in 2 or more adjacent bars, provide supplemental reinforcement as directed by Engineer. Remove additional concrete as necessary to provide at least 3/4-inch (19-mm) clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 (ACI 318M), by lapping, or using mechanical couplings.

3.3 APPLICATION

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars 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 become tacky before placing patching mortar or concrete. Do not apply to concrete surface unless mortar or concrete is to be placed the same day. Remove anticorrosion agent that has cured on concrete by mechanical means.

C. Surface Preparation:

1. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches (150 mm) beyond repair area to a saturated surface dry (SSD) condition. Remove standing water and apply scrub-coat with a stiff brisled brush, scrubbing it into surface and thoroughly coating repair area, especially edge surfaces. If scrub-coat dries, recoat before applying patching mortar or concrete.

2. Wetting Form & Pour Repair areas: Keep existing concrete surfaces continually moist for 15 to 20 minutes prior to placing repair mortar in forms.

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

1. Wet substrate thoroughly to SSD condition and then remove standing water. Scrub a slurry of neat patching mortar into substrate with stiff bristled brush, 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 patching, place material in lifts of not more than 1-1/2 inches (38 mm) nor less than 1/4 inch (6 mm). Do not feather edge.

4. For overhead patching, place material in lifts of not more than 1-1/2 inches (38 mm) nor less than 1/4 inch (6 mm). Do not feather edge.

5. After each lift is placed in vertical or overhead repairs, consolidate material and screed surface.

6. 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.

7. Where multiple lifts are required, only fill the edge of the repair area level with the final lift installed. The edges of the repair area shall be brought up to the surface of the existing concrete with the final lift. Do not feather edge any lift.

8. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a wood or sponge float.

9. 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.

10. Finish repair to match adjoining existing concrete without a noticeable offset in the surface or appearance in the texture.

E. Dry-Pack Mortar: Use for deep cavities and where indicated. Unless otherwise recommended by manufacturer, apply as follows:

1. Provide forms where necessary to confine patch to required shape. Cover surface of form in contact with concrete with form release agent.

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 03 Section "Cast-in-Place Concrete." and as follows:

1. Apply epoxy-modified, cementitious bonding and anticorrosion agent to reinforcement.

2. Wet substrate thoroughly to SSD condition and then remove standing water. Scrub a slurry of neat concrete that will be placed into concrete substrate with stiff bristled brush, filling pores and voids.

3. Use vibrators to consolidate concrete as it is placed.

4. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.

5. Where approved by Engineer, 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. Cover surface of form in contact with concrete with form release agent.
   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 (96 kPa).

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. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

8. Finish repair to match adjoining existing concrete without a noticeable offset in the surface.

G. 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 (6 mm) thick by 1 inch (25 mm) wider than crack.

4. Inject cracks wider than 0.003 inch (0.075 mm) to a depth of 8 inches (200 mm) or to a width of less than 0.003 inch (0.075 mm), 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 epoxy off of concrete surfaces as required to match adjacent surfaces as close as reasonably possible.
3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to sample materials and perform tests as follows:

1. Patching Mortar, Packaged Mixes: Three randomly selected samples tested according to ASTM C 928.
2. Patching Mortar, Field Mixed: Three randomly selected samples tested for compressive strength according to ASTM C 109/C 109M
3. Concrete: As specified in Division 3 Section "Cast-In-Place Concrete."

END OF SECTION 030130
SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related sections include the following:
   1. Division 3 section “Maintenance of Cast-In-Place Concrete.”

1.2 SECTION REQUIREMENTS

A. Submittals: Product Data, concrete mix designs, and submittals required by ACI 301.

B. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.

C. Comply with ACI 301, “Specification for Structural Concrete.”

D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS


2.2 MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed, epoxy coated.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Portland Cement: ASTM C 150, Type I or II.

D. Fly Ash: ASTM C 618, Class C or F.

E. Normal-Weight Aggregate: ASTM C 33, graded, 3/8-inch (10-mm) nominal maximum aggregate size.

F. Water: ASTM C 94/C 94M; potable.

H. Chemical Admixtures: ASTM C 494, water reducing, high-range water reducing, water reducing and accelerating, and water reducing and retarding. Do not use calcium chloride or admixtures containing calcium chloride.

I. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

J. Vapor Retarder: Reinforced sheet, ASTM E 1745, Class A.

K. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

L. Water: Potable.

M. Joint-Filler Strips: Closed cell superior grade polyethylene, non-extruded PVC, or ASTM D 1752, cork, self-expanding cork.

2.3 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 (ACI 301M), as follows:
   1. Minimum Compressive Strength: 5000 psi (31 MPa) at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   4. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
   5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/8-inch (10-mm) nominal maximum aggregate size.
   6. Drying Shrinkage Limit: 0.04 percent.

C. Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116.

   1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 CONCRETING

A. Construct formwork according to ACI 301 and maintain tolerances and surface irregularities within ACI 347R limits of Class A, 1/8 inch (3.2 mm) for concrete exposed to view and Class B, 1/4 inch (6 mm) for other concrete surfaces.
B. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

C. Install construction, isolation, and contraction joints where indicated, joint depth shall be a minimum of 1/4 the thickness of the slab. Install full-depth joint-filler strips at isolation joints.

D. For placing new concrete against or over existing concrete, wet existing substrate thoroughly to SSD condition and then remove standing water. Scrub a slurry of neat concrete into substrate with stiff bristled brush, filling pores and voids.

E. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

F. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.

G. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.

H. Slab Finishes: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Provide the following finishes:

1. Scratch finish for surfaces to receive mortar setting beds.
2. Float finish for surfaces to receive waterproofing, roofing, or other direct-applied material.
3. Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings.
4. Trowel and fine-broom finish for surfaces to receive thin-set tile.
5. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.

I. Cure formed surfaces by moisture curing for at least seven days.

J. Begin curing concrete slabs after finishing. Keep concrete continuously moist for at least seven days. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

K. Owner will engage a testing agency to perform field tests and to submit test reports.

L. Protect concrete from damage. Repair and patch defective areas, comply with Division 03 Section "Maintenance of Cast-In-Place Concrete."

END OF SECTION 033000
SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Silicone joint sealants.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each joint-sealant product.

   B. Sustainable Design Submittals:
      1. Product Data: For sealants, indicating VOC content.
      2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

   C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

   D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

   E. Joint-Sealant Schedule: Include the following information:
      1. Joint-sealant application, joint location, and designation.
      2. Joint-sealant manufacturer and product name.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.


E. Field-Adhesion-Test Reports: For each sealant application tested.

F. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to provide labor and materials required to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
   1. Architectural sealants shall have a VOC content of 250 g/L or less.
   2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
   3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
   4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Product Requirements
   a. Low-modulus silicone specifically formulated to seal cement concrete pavement joints.
   b. Furnish in a one-part, non-acid curing formulation. Refer to ASTM C 309.
   c. Meet the requirements of Table 1 for silicone joint sealer and Table 2 for self-leveling silicone joint sealer.

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Stress – 150 percent max elongation, 7-day cure</td>
<td>45 psi Maximum</td>
<td>ASTM D 412 (DIE C)</td>
</tr>
<tr>
<td>Flow</td>
<td>0.3 inch maximum</td>
<td>MIL-S-8802</td>
</tr>
<tr>
<td>Extrusion Rate 100 degrees F</td>
<td>0.2 – 0.6 lbs/min</td>
<td>MIL-S-8802</td>
</tr>
<tr>
<td>Tack-Free Time</td>
<td>20 – 75 minutes</td>
<td>MIL-S-8802</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.01 – 1.51</td>
<td>ASTM D 792</td>
</tr>
<tr>
<td>Durometer Hardness, Shore A – cured 7 days at 77±3</td>
<td>10 – 25</td>
<td>ASTM C 661</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>6 month minimum from date of shipment from plant or point of manufacture.</td>
<td></td>
</tr>
<tr>
<td>Ozone and Ultraviolet (UV) Resistance</td>
<td>No chalking, cracking or bond loss</td>
<td>ASTM C 793</td>
</tr>
<tr>
<td>Movement capability and adhesion.</td>
<td>No Failures</td>
<td>ASTM C 719</td>
</tr>
</tbody>
</table>
Table 2

Requirements for Self-leveling (Silicone Joint Sealer)

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheological Properties – Type 1</td>
<td>Pass</td>
<td>ASTM C 639</td>
</tr>
<tr>
<td>Elongation, percent minimum</td>
<td>800%</td>
<td>ASTM D 412 DIE C, mod.</td>
</tr>
<tr>
<td>Tensile Stress at 150 percent Elongation</td>
<td>40 psi maximum</td>
<td>ASTM D 412</td>
</tr>
<tr>
<td>Accelerated Weathering</td>
<td>No chalking, cracking or bond loss</td>
<td>ASTM C 793</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>6 month minimum from date of shipment from plant or point of manufacture.</td>
<td></td>
</tr>
<tr>
<td>Durometer Hardness, Shore OO – cured 14 days at 77±3 degrees F and 45-55 percent relative humidity (rh).</td>
<td>40 – 80</td>
<td>ASTM C 661</td>
</tr>
<tr>
<td>Movement capability and adhesion. Magnitude of cycles movement is appropriate for sealant category, cure 14 days in air at 77±3 degrees F then 7 days in water at 77±3 degrees F.</td>
<td>No Failures</td>
<td>ASTM C 719</td>
</tr>
</tbody>
</table>

d. Sealant must be delivered in the manufacturer’s original sealed container, displaying lot number, expiration date of the shelf-life warranty and the sealer trade name.

2.3 JOINT-SEALANT BACKING

A. Use closed-cell, polyethylene-foam rods that meet the requirements in Table 3.

Table 3

Backer Rod Requirements and Test Methods

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>Joint width + 1/8 inch</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>2 lbs/ft³</td>
<td>ASTM D 1622</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>25 psi</td>
<td>ASTM D 1623</td>
</tr>
<tr>
<td>Absorption</td>
<td>0.5 % by volume</td>
<td>ASTM C 509</td>
</tr>
<tr>
<td>Compression</td>
<td>25 percent at 8 psi</td>
<td>ASTM D 1621</td>
</tr>
<tr>
<td>Deflection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

G.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without
deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   
   1. Joint Locations:
      
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated on Drawings.

   2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 9200