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# TECHNICAL SPECIFICATIONS



# LIST OF DRAWINGS

**END OF SECTION**

**BASE BID and ALTERNATES WORK ITEM PROPOSAL**

Parking Structure #6 Repairs and Maintenance

**UNIT PRICES:**

A. The following schedules of unit prices shall be filled out and submitted as part of the Proposal. Failure to fill in all unit prices may result in disqualification of Bidder.

1. These projects are considered individual projects. Contractor is not required to submit Bids on both projects; however, Contractor must fill in unit prices for all Work Items for any particular project being bid. See "Combined Project Award Deduct" on page 9 of this Section if Contractor were to be awarded both projects.

B. Unit prices stated by Bidder shall include all materials and Work installed and completed in place in accordance with all applicable portions of the Drawings and Specifications, and shall include all costs associated with such items including, but not limited to: materials, labor, supervision, overhead, and profit for General Contractor and/or subcontractors, general conditions, permits, shoring, and other related items.

C. The quantities stated in the Bid Schedule are approximate only and are prepared for comparison of Bids. Each Bidder is responsible for verifying all quantities and shall base his Bid thereon. Payment to the Contractor will be made only for the actual quantities of Work accepted and performed in accordance with the Contract unit prices.

D. Contractor shall not exceed stated Base Bid quantities without prior written approval from Owner/Engineer. Note: Contractor will not receive payment for un-authorized Work performed (Base Bid or Alternates) that exceeds stated Bid quantities. The Owner reserves the right to delete one or more line items contained within the Work Item Schedules, and/or to increase or decrease stated quantities, to best meet the Owner's requirements.

E. Also, at the discretion of the Owner, the quantities of Work to be performed for each Work Item (Base Bid or Alternate) shall be reviewed and approved by the WSU PM prior to beginning Work, and may be decreased or increased throughout the Project. Refer to Section 020010 for specific Work Item requirements.

F. In the event of a math error occurring on a submitted Bid, (i.e., stated unit price multiplied by stated quantity does not equal stated extension) stated unit price shall be considered basis for Bid to calculate extension.

G. INCREASED OR DECREASED WORK ITEM QUANTITIES:

1. Owner/Engineer shall have right under Contract to make increases and decreases in quantities and changes in plans, as may be necessary to ensure completion of contemplated work subject to following qualifications:
2. As used herein, major item is defined as any item whose total cost, determined by multiplying Bid quantity and Contract unit price, is equal to or greater than 5% of original total Contract price. All other items are considered minor items and are not subject to unit price adjustment.
3. Where cost of final work prior to consideration of adjustment is within 5% of original total contract price, or if amount of adjustment is less than $100, or if item

is exempted from such adjustment elsewhere in Contract, no adjustment in Contract unit prices will be considered for any increased or decreased quantities.

4. Where cost of final work has increased more than 5% of original total Contract price prior to consideration of any adjustment, requests for adjustments will be considered on following basis:
5. Where quantity of an item of work required to complete project is not increased nor decreased from original estimate by more than 25%, payment for quantity of said item will be made at Contract unit price.
6. Where quantity of any major item of work is increased by more than 25%, then unit price for quantity of that item of work over 125% of original Contract quantity will be decreased by 10% of unit price bid.
7. Where quantity of any major item of work is decreased by more than 25%, then adjusted unit price will be obtained by multiplying Contract unit price for that item of work by factor obtained as follows:

   Factor = 1 + (0.10 (P-C))/C

   Where:

   P = Contract Quantity

   C = Constructed Quantity

8. In no case shall product of adjusted unit price and number of units of work performed exceed product of Contract unit price and 75% of original contract quantity. Neither will unit price be adjusted to more than twice original Contract unit price.

**ALTERNATES:**

A. The Alternate Work Items listed on the following pages identify potential changes in the Work under consideration for this Contract. The Owner reserves the right to accept any or all of the listed Alternates, regardless of the order of their listing. Alternate items may also be selected and incorporated into the Project with increased or decreased quantities from those listed, to best suit the Owner's needs.

B. For each of the Alternates listed, state the unit price if the individual Alternate is selected for inclusion in the Contract scope. Amount shown shall include all costs to perform the Work; no extras will be permitted for failure to include, but not limited to, such items as: extra permits, overtime, weather protection, materials, labor, supervision, general conditions, overhead, and profit for general contractor and/or subcontractors, shoring, and other related items.

C. Alternates may be accepted by Owner after initial award. Contractor shall hold prices stated below for possible incorporation into the Project at a later date during construction as determined by the Owner. Alternate Work must be accepted in writing by WSU PM prior to beginning any Work.

D. Any additional Temporary Signage, Temporary Barriers, or Traffic Markings required to properly perform any selected Alternate Work shall be incidental, regardless of the amount of Alternate Work selected.

**ALLOWANCES:**

A. Allowances shall be included with the Bid as identified on the Bid Proposal form. Any charges against the Allowances shall include a description of the Work, an itemized breakdown for all labor, materials, equipment, and 5% mark-ups (for overhead and profit), and shall be authorized by the WSU PM. Allowances shall be tracked on the payment applications. Any balance remaining on Allowance items shall be deducted from the Contract, by change order, prior to completion of the Project.

B. No Work that is to be billed under Allowance items shall be performed without prior written approval from Owner, no exceptions. Refer to Section 020010 for description of Allowances.

**DESCRIPTION OF ABBREVIATIONS**:

| | |
|---|---|
| L.F. = Lineal Feet | L.S. = Lump Sum |
| Ea. = Each | S.F. = Square Feet |
| Allow. = Allowance | Incidental = Not a separate pay item |

**PS#6 - WORK ITEM SCHEDULE - BASE BID**

| WORK ITEM | DESCRIPTION | UNITS | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|---|
| 1.1 | Project Mobilization | LS | 1 | $ | $ |
| 1.5 | Temporary Signage & Barriers | LS | 1 | $ | $ |
| 1.9 | Means of Access - Exterior Façade | LS | 1 | $ | $ |
| 3.1A | Floor Repair - Partial Depth (Pre-topped) | SF | 400 | $ | $ |
| 3.1B | Floor Repair - Partial Depth (Concrete Washes) | SF | 8,200 | $ | $ |
| 3.2 | Floor Repair - Slab-on-Grade | SF | 2,100 | $ | $ |
| 3.3A | Floor Repair - Full Depth (Pre-topped) | SF | 300 | $ | $ |
| 3.3B | Floor Repair - Full Depth (Concrete Washes) | SF | 1,500 | $ | $ |
| 4.9 | Remove Loose Concrete and Coat | LS | 1 | $ | $ |
| 6.1 | Column Repair - Partial Depth | SF | 100 | $ | $ |
| 6.2 | Column Repair - Haunch Partial Depth | SF | 50 | $ | $ |
| 7.1 | Wall Repair - Partial Depth | SF | 100 | $ | $ |
| 8.1 | Tee Stem Repair - Partial Depth | SF | 10 | $ | $ |
| 10.6 | Replace Stair Tower Isolation Joint | LF | 20 | $ | $ |
| 11.1 | Seal Floor Cracks | LF | 1,500 | $ | $ |
| 11.2A | Replace Joint Sealant - Washes | LF | 8,000 | $ | $ |
| 11.2B | Replace Joint Sealant - Tee-to-Tee | LF | 16,000 | $ | $ |
| 11.4 | Tool & Seal Control Joints (For Reference Only) | Incidental | | $ | $ |
| 11.7 | Cove Sealant | LF | 7,700 | $ | $ |
| 16.1A | Traffic Coating - New System | SF | 210,000 | $ --------- | $ --------- |
| 16.2 | Traffic Coating - Repair | SF | 1,000 | $ | $ |
| 16.4B | Traffic Coating - Recoat (Full System) | SF | 8,500 | $ | $ |
| 18.1 | Temporary Shoring | EA | 100 | $ | $ |
| 25.1 | Mechanical/Electrical Allowance | Allow | 1 | $ 7,500.00 | $ 7,500.00 |
| 25.2A | Mechanical - Replacement Drain - Supported Sl | EA | 11 | $ | $ |
| 25.3 | Mechanical - Pipe & Hangers | LF | 100 | $ | $ |
| 26.6 | Allowance - Standpipe Repairs | Allow | 1 | $ 10,000.00 | $ 10,000.00 |
| 40.3 | Re-weld Shear Connector | EA | 80 | $ | $ |
| 40.4 | Supplemental Shear Connector | EA | 20 | $ | $ |
| 45.1 | Paint Traffic Markings | LS | 1 | $ | $ |
| | | | | **PS#6 - TOTAL BASE BID** | $ |

**PS#6 WORK ITEM SCHEDULE - ALTERNATES**

| WORK ITEM | DESCRIPTION | UNITS | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|---|
| 10.9 | Replace S.O.G. Transition Joint | LF | 125 | $ | $ |
| 11.3 | Replace Façade Sealant | LF | 2,400 | $ | $ |
| 11.8 | Replace Capstone Sealant | EA | 14 | $ | $ |
| 11.9 | Replace Roof Flashing Sealant | LF | 150 | $ | $ |
| 26.5 | Pressure Test Fire Suppression System | LS | 1 | $ | $ |
| 41.1 | Stairs - Replace Tread Pan/Concrete | EA | 50 | $ | $ |
| 41.2 | Stairs - Replace Landing Pan/Concrete | SF | 300 | $ | $ |
| 45.2 | Paint Standpipes | LS | 1 | $ | $ |
| 45.4 | Clean/Paint Rebar at Wall Openings | LS | 1 | $ | $ |
| 45.4A | Replace Damaged Rebar at Wall Openings | EA | 50 | $ | $ |
| 45.5 | Clean / Paint Column Base Plate | EA | 3 | $ | $ |
| 45.6 | Clean/Paint S.O.G. Transition Angles | EA | 18 | $ | $ |
| 45.6A | Replace S.O.G.Transition Angles | EA | 6 | $ | $ |
| 51.1 | Guard at Wall Openings | LS | 1 | $ | $ |
| 51.2 | Stair Railing Infill | EA | 12 | $ | $ |
| | | | | **PS#6 - TOTAL ALTERNATES BID** | $ |

Additional Temporary Signage, Temporary Barriers, and Traffic Markings required to perform any Alternate Work Items shall be incidental.

## LIST OF SUBCONTRACTORS

A. Contractor shall fill in following table listing ALL proposed subcontractors.

### LIST OF SUBCONTRACTORS / INSTALLERS

| | COMPANY: | CONTACT: NAME, PHONE, EMAIL ADDRESS |
|---|---|---|
| Temporary Signage, Barriers, and Protection | | |
| Temporary Shoring | | |
| Steel Reinforcement | | |
| Concrete Removals | | |
| Ready-Mix Concrete Supplier | | |
| Post-Tensioning Repairs | | |
| Sealants & Caulking | | |
| Pavement Markings | | |
| Sealants | | |

| | COMPANY: | CONTACT: NAME, PHONE, EMAIL ADDRESS |
|---|---|---|
| Traffic Coating | | |
| Masonry | | |
| Painting | | |
| Drains / Piping | | |
| Other | | |
| Other | | |
| Other | | |
| Other | | |
| Other | | |
| Other | | |
| Other | | |

# SECTION 020010 - WORK ITEMS

## PART 1 - GENERAL

### RELATED DOCUMENTS

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

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

A. Unit prices stated by Bidder for all Work Items shall include all materials and Work installed and completed in place in accordance with all applicable portions of the Drawings and Specifications, and shall include all costs associated with such items including, but not limited to: materials, labor, supervision, overhead, and profit for General Contractor and/or subcontractors, general conditions, permits, shoring, and other related items.

### WI 1.0 GENERAL REQUIREMENTS

A. Scope of Work

1. Work consists of performing all tasks, specifically required and incidental, which are not identified under separate Work Item designation, but necessary to perform the work identified in this project. This work includes, but is not limited to:

WI 1.1 – Project Mobilization
WI 1.5 – Temporary Signage & Barriers
WI 1.9 – Means of Access – Exterior Facade

### WI 1.1 PROJECT MOBILIZATION

A. Scope of Work

1. Work consists of coordinating, scheduling, obtaining, and assembling at construction site all equipment, materials, permits, supplies, manpower, and other essentials and incidentals necessary to perform all Work defined in this Contract. Payment of lump sum amount for Mobilization shall be according to following schedule and shall be based on percentage of original Contract amount earned.

2. Contractor shall be responsible for obtaining all permits required to perform work as specified, per all authorities having jurisdiction.

B. Materials (Not Applicable)

C. Execution

1. At execution of Agreement by all parties, payment of not more than 25% of Mobilization lump sum amount.
2. When amount earned is greater than 10% but less than 25% of original Contract amount, an additional amount will be paid to bring total payment for Mobilization to 50% of Mobilization lump sum amount.
3. When amount earned is equal to or greater than 25% but less than 50% of original Contract amount, an additional amount will be paid to bring total payment for Mobilization to 75% of Mobilization lump sum amount.
4. When amount earned is equal to or greater than 50% of original Contract amount, an additional amount will be paid to bring total payment for Mobilization to 100% of Mobilization lump sum amount.

## WI 1.5 TEMPORARY SIGNAGE & BARRIERS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to provide, install, and remove following completion of project, Temporary Signage and Barriers as required for protection, safety, dust control, site access, traffic control, user information, and as required by Owner/Engineer during the duration of the project. Temporary Signage and Barriers shall be installed prior to start of work, and shall remain in place until all work is completed.
2. Payment for this item is lump sum to install all required signage, barriers, and dust control, maintain and adjust throughout project at all work areas, and remove upon completion of work.

B. Materials

1. Temporary signage shall meet following minimum requirements:
    a. Minimum size: As required for proper visibility based on intended audience (pedestrian or vehicle).
    b. Backing material: 0.5 in. medium density overlay plywood.
    c. Colors:
        1) Background: Medium orange or white.
        2) Symbols/Lettering: Black.
    d. Lettering: Silk screened or die-cut.
        1) Font Style: Helvetica or similar.
        2) Size: 2 in. high minimum for pedestrian information; 4 in. high minimum for traffic information.
2. Barriers shall meet following minimum requirements:
    a. Provide positive separation between pedestrians/vehicles and the designated work areas.
    b. Contain all construction-generated dust and debris within designated work areas.

C. Execution

1. Mounting height: 5 ft. to bottom of sign. Provide mounting brackets as required.
2. Contractor shall submit shop drawings detailing sign size, layout, colors, and mounting schemes for approval prior to fabricating signs and mounting brackets.
3. Typical regulatory signs (that is, STOP, YIELD, etc.) and "Handicap" signs shall conform to all Federal, state, and local requirements for sizes, materials, and colors.
4. Temporary Signage shall be sufficient to ensure pedestrian and vehicle safety, provide clear and concise user information, and maintain traffic control throughout the entire structure, including:
    a. Signage at all pedestrian entrances to the structure informing public of ongoing construction Project, maintained for the duration of the Project.
    b. Signage at all vehicle entry/exits to notify public of ongoing construction Project and closed work areas, etc.
    c. Signage in all stair and elevator towers on all levels, indicating which levels/areas are closed and which remain open.
    d. Signage at all work area perimeters on all levels where Work is to be performed (including above and below active work areas), clearly defining work area limits and explicitly prohibiting vehicle and pedestrian access, maintained for the duration of the repairs.
    e. Signage as necessary to maintain normal traffic flow throughout structure and around closed work areas, including access to all areas of the structure remaining open for public use during repairs. Provide signs indicating route to follow for additional areas of parking, and route to follow to exit structure, at all levels and areas adjacent to work areas.
    f. Other signage as required by Owner/Engineer, and as needed throughout the Project.
5. Temporary Barriers shall be sufficient to maintain a positive barrier around all work areas, prevent pedestrian and vehicle access into work areas (including above and below active work areas), and contain all construction-generated dust and debris within the work areas. Barriers shall be installed in a manner to maintain ADA-compliant access to stair/elevator towers and structure exits at all times.
6. Dust control measures shall ensure that all construction-generated dust & debris maintains confined within the work areas, including above and below repair areas. Elevators and stair towers shall be protected from dust, debris, and water at all times. Contractor shall be responsible for cleaning all construction-generated dust and debris from structure upon completion of repairs, including stair towers and elevators.
7. Submit plan to Engineer for review prior to start of work.

## WI 1.9 MEANS OF ACCESS – EXTERIOR FACADE

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to provide, erect, operate, maintain, and remove fixed or suspended scaffolding, work platforms/lifts and/or other similar equipment

necessary to access exterior work areas as needed to complete work outlined in Work Item 11.3 on the exterior of the structure.

2. Submit access plan to Owner and Engineer for review/approval prior to start of any Work at any of the structures.

B. Materials

1. Lifts/access equipment shall be capable of safely conducting work.
2. Contractor is responsible for obtaining all permits to comply with requirements applicable at project site for constructing/operating access equipment (including for example: street lane closure permits, sidewalk closure permits, etc.).
3. Where suspended scaffolds are used on masonry or non-structural frame parapet/spandrel walls, contractor shall employ an outrigger support system that does not bear on the parapet/spandrel walls.
4. Parapet hooks/clamps shall not be used on non-structural frame parapet/spandrel walls. If parapet hooks/clamps are used, Contractor is responsible for providing calculations by a registered Professional Engineer in the project jurisdiction showing that parapet hook/clamp loads for the project do not exceed the structural capacity of the wall/building element to which they are attached.
5. The contractor is responsible for distributing the staging and support system loads to the structure in a manner which will not damage any part of the roof/slab system, or overload any of the structural elements.
6. Suspended scaffolds and/or buckets shall be of the motorized type (no rope stages allowed), capable of handling labor, equipment and material loads required for the project.
7. Electrical system shall be checked for voltage drop along the power cords for power supply. Special power supply may be needed to assure uninterrupted services.
8. Suitable existing electrical power supply/connection for construction work is not guaranteed by Owner.
    a. Contractor is responsible for determining suitability of existing power supply/connection considered for use during construction, and that use will not cause power disruption to building Owner/occupants.
    b. If suitable power connection does exist, Contractor is responsible for installing, maintaining, and removing upon completion of work, suitable connections, meeting all local electrical code requirements.
    c. If existing power supply is inadequate, Contractor is responsible for providing alternate power supply and suitable connections meeting all local electrical code requirements for construction.

C. Execution

1. Erect overhead protection/temporary signage/traffic control as required prior to mobilization of access equipment.
2. Contractor shall verify and provide documentation upon request that verifies erection, maintenance, and removal of scaffolding (fixed or movable), and all rigging is in accordance with OSHA standards.
3. Contractor personnel erecting, operating, maintaining, and removing scaffold and rigging equipment shall be certified/trained according to current standards of the scaffold and construction industry.

4. Upon request by the Owner or Engineer, the Contractor shall submit to Owner and Engineer a detailed action plan for their scaffolding (erection, maintenance, and removal) prior to proceeding for general conformance and informational purposes only.
5. Independent lifelines shall be provided for every person working on suspended scaffolding, per scaffold industry standards. Lifelines shall not be secured to the same points used for suspended scaffold rigging connections.
6. Contractor shall provide access to Architect/Engineer or appointed project representative for performing observations during construction.
7. Contractor shall repair landscaping and all other existing features and return to pre-project condition at no additional cost.

## WI 3.0 CONCRETE FLOOR REPAIR

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate existing spalls, locate and remove delaminated and unsound concrete, prepare cavities, and install patching material to restore floor slab to original condition and appearance. Refer to Detail Series 3.0 for specific requirements.

B. Materials

1. Concrete repair materials shall be as specified in Section “Cast-in-Place Concrete Restoration”, Section “Pre-Packaged Repair Mortar”, and on Drawings.
2. Epoxy-coated steel reinforcement shall be as specified in Section “Cast-in-Place Concrete Restoration”.

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching”.
2. Contractor shall locate all embedded items prior to start of work (reinforcement, conduit/wiring, tendons, etc.) by use of ground-penetrating radar or other acceptable means. Do not cut, nick, or damage any embedded items.
3. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching”, Article “Preparation”. Remove all unsound concrete within marked boundary prior to saw-cutting and preparation of patch edges.
4. Engineer shall inspect all cavities for condition according to Section “Surface Preparation for Patching”, Article “Inspection of Repair Preparation”.
5. All steel exposed within cavities shall be cleaned to bare metal by sand-blasting as specified in Section “Surface Preparation for Patching”, Article “Cleaning of Reinforcement within Delamination and Spall Cavities”, and damaged and defective reinforcement replaced as specified in Section “Surface Preparation for Patching”, Article “Reinforcement and Embedded Materials in Repair Areas”. Exposed steel shall be coated with an approved corrosion inhibitor as specified in Section “Cast-in-Place Concrete”.

6. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
7. Patch materials and associated reference Specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced Specifications for selected material.

## WI 3.1A FLOOR REPAIR – PARTIAL DEPTH (PRE-TOPPED)

A. Refer to Work Item 3.0 "Concrete Floor Repair" for scope of work, materials, and procedure associated with this Work Item. Refer to Detail 3.1A for specific requirements.

B. This Work includes floor repairs at localized delaminated/spalled areas on supported levels as located in field with Engineer.

C. Payment for this Work Item shall be per square foot of work actually performed, located, and measured in field with Owner/Engineer.

D. Installation of traffic coating is required on all floor repairs that occur in previously coated areas (incidental to WI 3.1A). Refer to WI Series 16.0 for coating requirements.

## WI 3.1B FLOOR REPAIR – PARTIAL DEPTH (CONCRETE WASHES)

A. Refer to Work Item 3.0 "Concrete Floor Repair" for scope of work, materials, and procedure associated with this Work Item. Refer to Detail 3.1B for specific requirements.

B. This Work includes floor repairs at localized delaminated/spalled areas on supported levels as located in field with Engineer.

C. Payment for this Work Item shall be per square foot of work actually performed, located, and measured in field with Owner/Engineer.

D. Do not damage any embedded reinforcement or precast connections. Allow engineer to observe repair cavities and conditions of embedded connections. Clean all exposed steel surfaces and apply corrosion inhibitor prior to concrete placement (incidental).

E. Installation of traffic coating is required on all floor repairs that occur in previously coated areas (incidental to WI 3.1B). Refer to WI Series 16.0 for coating requirements.

## WI 3.2 FLOOR REPAIR – SLAB-ON-GRADE

A. Refer to Work Item 3.0 "Concrete Floor Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 3.2 for specific requirements.

B. Payment for this Work Item shall be per square foot of work actually performed, located, and measured in field with Owner/Engineer.

## WI 3.3A FLOOR REPAIR - FULL DEPTH (PRE-TOPPED)

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate and remove full depth unsound floor concrete, prepare cavity, install formwork, install supplemental reinforcement, and install patching material to restore floor to original integrity and appearance. Refer to Detail Series 3.3A for specific requirements. Refer to Work Item 3.0 "Concrete Floor Repair" for scope of Work, materials, and procedures associated with this Work Item.
2. Installation of supplemental reinforcement required on Detail Series 3.3A shall be incidental to this Work and NOT payable under other Work Items. This work also includes tooling and sealing entire perimeter of repairs (incidental). See W.I. 11.4.
3. Payment for this Work Item shall be per square foot of work actually performed, located, and measured in field with Owner/Engineer.
4. Installation of traffic coating is required on all floor repairs that occur in previously coated areas (incidental to WI 3.3A). Refer to WI Series 16.0 for coating requirements.

B. Materials

1. Concrete repair materials shall be as specified in Section "Cast-in-Place Concrete Restoration" and/or Section “Prepackaged Repair Mortar” and on Drawings.
2. Epoxy-coated steel reinforcement shall be as specified in Section "Cast-in-Place Concrete Restoration”.
3. Epoxy adhesive shall be Hilti HIT-HY 200 Safe Set.
4. Sealant shall be as specified in Section “Concrete Joint Sealants”.

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section "Surface Preparation for Patching", Article "Inspection".
2. Contractor shall locate all embedded items prior to start of work (reinforcement, conduit/wiring, tendons, etc.) by use of ground-penetrating radar or other acceptable means. Do not cut, nick, or damage any embedded items.
3. Do not damage any embedded reinforcement or precast connections. Allow engineer to observe repair cavities and conditions of embedded connections. Clean all exposed steel surfaces and apply corrosion inhibitor prior to concrete placement (incidental).
4. All concrete shall be removed from within marked boundaries until sound concrete is reached on all sides.
5. Sawcut shall then be made approximately 3 in. from edge of cavity. This sawcut shall be to depth of 0.75 in. and all edges shall be straight. Underside of slab shall have its repair edge ground to depth of 0.5 in. Patches shall be as square or rectangular-shaped as practical. All concrete within sawcut shall be removed to minimum depth of 0.75 in. Also see Section “Surface Preparation for Patching", Article "Preparation".
6. Do not cut or damage any existing reinforcement, including WWR.
7. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
8. All steel exposed within cavities shall be cleaned to bare metal by sandblasting according to Section "Surface Preparation for Patching", Article "Cleaning of

Reinforcement within Delamination and Spall Cavities", and damaged and defective reinforcement replaced as specified in Section "Surface Preparation for Patching", Article "Reinforcement and Embedded Materials in Repair Areas". Exposed steel shall receive corrosion inhibitor coating as specified in Section “Cast-in-Place Concrete Restoration”.

9. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
10. Patch materials and associated reference specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced specifications for selected material.

## WI 3.3B FLOOR REPAIR - FULL DEPTH (CONCRETE WASHES)

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate and remove full depth unsound floor concrete, prepare cavity, install formwork, install supplemental reinforcement, and install patching material to restore floor to original integrity and appearance. Refer to Detail Series 3.3B for specific requirements. Refer to Work Item 3.0 "Concrete Floor Repair" for scope of Work, materials, and procedures associated with this Work Item.
2. Installation of supplemental reinforcement required on Detail Series 3.3B shall be incidental to this Work and NOT payable under other Work Items. This work also includes tooling and sealing entire perimeter of repairs (incidental). See W.I. 11.4.
3. Payment for this Work Item shall be per square foot of work actually performed, located, and measured in field with Owner/Engineer.
4. Installation of traffic coating is required on all floor repairs that occur in previously coated areas (incidental to WI 3.3B). Refer to WI Series 16.0 for coating requirements.

B. Materials

1. Concrete repair materials shall be as specified in Section "Cast-in-Place Concrete Restoration" and/or Section “Prepackaged Repair Mortar” and on Drawings.
2. Epoxy-coated steel reinforcement shall be as specified in Section "Cast-in-Place Concrete Restoration”.
3. Epoxy adhesive shall be Hilti HIT-HY 200 Safe Set.
4. Sealant shall be as specified in Section “Concrete Joint Sealants”.

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section "Surface Preparation for Patching", Article "Inspection".
2. Contractor shall locate all embedded items prior to start of work (reinforcement, conduit/wiring, tendons, etc.) by use of ground-penetrating radar or other acceptable means. Do not cut, nick, or damage any embedded items.
3. All concrete shall be removed from within marked boundaries until sound concrete is reached on all sides.

4. Sawcut shall then be made approximately 3 in. from edge of cavity. This sawcut shall be to depth of 0.75 in. and all edges shall be straight. Underside of slab shall have its repair edge ground to depth of 0.5 in. Patches shall be as square or rectangular-shaped as practical. All concrete within sawcut shall be removed to minimum depth of 0.75 in. Also see Section “Surface Preparation for Patching", Article "Preparation".
5. Do not cut or damage any existing reinforcement, including WWR.
6. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
7. All steel exposed within cavities shall be cleaned to bare metal by sandblasting according to Section "Surface Preparation for Patching", Article "Cleaning of Reinforcement within Delamination and Spall Cavities", and damaged and defective reinforcement replaced as specified in Section "Surface Preparation for Patching", Article "Reinforcement and Embedded Materials in Repair Areas". Exposed steel shall receive corrosion inhibitor coating as specified in Section “Cast-in-Place Concrete Restoration”.
8. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
9. Patch materials and associated reference specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced specifications for selected material.

## WI 4.9 REMOVE LOOSE CONCRETE & COAT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate and remove delaminated and loose overhead concrete, and coat resulting cavities with specified material. Removals shall include physically loose concrete, as well as visibly spalled, cracked, and/or delaminated areas; sound concrete is not to be removed. Removal of loose overhead concrete on exterior facades is included in this Work. See W.I. 1.9 for access requirements.
2. Payment for this Work Item shall be lump sum to remove all sections of loose concrete on all overhead surfaces throughout the structure, on all levels, including exterior facade.
3. Contractor shall verify overhead removal heights and general scope of removal requirements prior to submitting bid.

B. Equipment

1. Removals shall be performed using hand tools. If required, chipping hammers shall be 15-lbs or less, only as directed by Engineer.

C. Materials

1. Sika Armatec 110 EpoCem, or approved equivalent.

D. Execution

1. Contractor shall locate areas for concrete removal in field. Engineer will verify types of removals to be performed by Contractor prior to start of Work. Contractor is responsible for locating and performing all removals on all overhead surfaces (ceilings, beams, stems, walls, etc.) and entire exterior facade.
2. All steel exposed within loose concrete removal areas shall be cleaned to bare metal by sand-blasting or wire brush. Removal area shall be prepared per Section “Surface Preparation for Patching”.
3. Contractor shall coat each removal area with specified epoxy-coating material (incidental).

## WI 6.0 CONCRETE COLUMN REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals including shoring necessary to locate existing spalls, locate and remove delaminated and unsound concrete, prepare cavities, and install patching materials to restore concrete columns to original condition and appearance. Refer to Detail Series 6.0 for specific requirements.

B. Materials

1. Concrete repair materials shall be as specified in Section "Cast-in-Place Concrete Restoration”, “Pre-Packaged Repair Mortar” and/or Section “Shotcrete.
2. Trowel applied repair material not allowed.

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section "Surface Preparation for Patching", Article "Inspection".
2. All live loads shall be removed from floor slab above and below repairs. Install temporary shoring as needed prior to start of concrete removals. Verify in field with Engineer.
3. Procedure for delaminated and unsound concrete removal shall be as specified in Section "Surface Preparation for Patching", Article "Preparation".
4. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
5. All steel exposed within cavities shall be cleaned to bare metal by sandblasting according to Section "Surface Preparation for Patching", Article "Cleaning of Reinforcement within Delamination and Spall Cavities", and damaged and defective reinforcement replaced as specified in Section "Surface Preparation for Patching", Article "Reinforcement and Embedded Materials in Repair Areas". Exposed steel shall be coated with an approved corrosion inhibitor as specified in Section "Cast-in-Place Concrete”.
6. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
7. Patch materials and associated reference specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced specifications for selected material.

8. Contractor shall take care to protect adjacent areas from overspray if "Shotcrete" is used. Area adjacent to repair shall be cleaned to Owner's satisfaction prior to leaving site.

## WI 6.1 COLUMN REPAIR – PARTIAL DEPTH

A. Refer to Work Item 6.0 “Concrete Column Repair” for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 6.1 for specific requirements.

B. Payment for this Work Item shall be per square foot of repairs performed. Provide localized signage and barriers around work areas per W.I. 1.5. Install localized temporary shoring (as needed); verify in field with Engineer prior to removals.

## WI 6.2 COLUMN REPAIR – HAUNCH PARTIAL DEPTH

A. Refer to Work Item 6.0 “Concrete Column Repair” for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 6.2 for specific requirements.

B. Payment for this Work Item shall be per square foot of repairs performed. Provide localized signage and barriers around work areas per W.I. 1.5. Install localized temporary shoring (as needed); verify in field with Engineer prior to removals.

## WI 7.0 CONCRETE WALL REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate existing spalls, locate and remove delaminated and unsound concrete, prepare cavities, and place patching materials to restore concrete walls to original condition and appearance. Refer to Detail 7.1 for specific requirements.

B. Materials

1. Repair materials shall be as specified in Sections "Cast-in-Place Concrete Restoration”, “Prepackaged Repair Mortar”, or “Shotcrete”.
2. Trowel applied repair materials not allowed.

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section "Surface Preparation for Patching", Article "Inspection".
2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section "Surface Preparation for Patching", Article "Preparation".
3. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
4. All steel exposed within cavities shall be cleaned to bare metal by sandblasting according to Section "Surface Preparation for Patching", Article "Cleaning of Reinforcement within Delamination and Spall Cavities", and damaged and defective reinforcement replaced as specified in Section "Surface Preparation for Patching", Article "Reinforcement and Embedded Materials in Repair Areas".

Exposed steel shall be coated with an approved corrosion inhibitor coating as specified in Section "Cast-in-Place Concrete Restoration".

5. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
6. Patch materials and associated reference specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced specifications for selected material.
7. Contractor shall take care to protect adjacent areas from overspray if "Shotcrete" is used. Area adjacent to repair shall be cleaned to Owner's satisfaction prior to leaving site.

## WI 7.1 WALL REPAIR - PARTIAL DEPTH

A. Refer to Work Item 7.0 "Concrete Wall Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 7.1 for specific requirements.

B. Payment for this Work Item shall be per square foot of work actually performed, as identified in field with Engineer.

## WI 8.0 PRECAST TEE STEM REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals including shoring necessary to locate, support, and repair damaged or deteriorated tee stems. Refer to Detail Series 8.0 for specific requirements.

B. Materials/Equipment

1. Repair materials shall be as specified in Sections “Cast-in-Place Concrete Restoration”, “Prepackaged Repair Mortar”, or "Shotcrete".
2. Trowel applied repair materials not allowed.
3. Chipping hammers shall be 15 lb. or less unless approved by Engineer.

C. Execution

1. Contractor shall locate and mark tee stem repairs indicated on Drawings according to Section "Surface Preparation for Patching", Article "Inspection". Confirm in field with Engineer prior to start of concrete removals.
2. Contractor shall provide shoring as required on Details in accordance with Section "Cast-in-Place Concrete Restoration". Submit Shop Drawings and receive Engineer's approval prior to starting removal operations.
3. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section "Surface Preparation for Patching", Article "Preparation".
4. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
5. All steel exposed within cavities shall be cleaned to bare metal by sandblasting as specified in Section "Surface Preparation for Patching", Article "Cleaning of Reinforcement within Delamination and Spall Cavities", and damaged

reinforcement replaced as specified in Section "Surface Preparation for Patching", Article "Reinforcement and Embedded Materials in Repair Areas". Exposed steel shall be coated with approved corrosion inhibitor coating as specified in Section “Cast-in-Place Concrete Restoration”.

6. Contractor shall prepare cavities for patch placement in accordance with Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
7. Patch materials and associated reference specifications are listed in Article "Materials" above. Patch installation procedures shall be in accordance with referenced specifications for selected material.
8. Contractor shall maintain forms and shores in place until concrete has achieved at least 75% of 28-day strength.
9. Contractor shall take care to protect adjacent areas from overspray if "Shotcrete" is used. Area adjacent to repair shall be cleaned to Owner's satisfaction prior to leaving site.

## WI 8.1 TEE STEM REPAIR - PARTIAL DEPTH

A. Refer to Work Item 8.0 "Precast Tee Stem Repair" for scope of Work, materials and procedure associated with this Work Item. Refer to Detail 8.1 for specific requirements.

B. Payment for this Work Item shall be per square foot of repair performed as directed by Engineer.

## WI 10.6 REPLACE STAIR TOWER ISOLATION JOINT

A. Refer to Work Item 10.0 "Expansion Joint Repair and Replacement" for scope of Work, materials and procedure associated with this Work Item. Refer to Detail 10.6 for specific requirements.

B. Payment for this Work shall be per lineal foot to install new isolation joints between the parking deck and stair/elevator towers. Included in this work is removing existing joints (patching of blockouts/cavities as needed, paid under W.I. 3.1A). Contractor also required to provide and install aluminum non-slip cover plates at all locations where this work occurs at stair and elevator doorways, incidental to this work. Submit shop drawings for approval prior to ordering/fabricating cover plates.

C. New joint shall be pre-compressed silicone expanding foam system (see Division 07 Section “Expansion Joint Assemblies”).

D. Repair blockout as needed per other work items to provide suitable blockout per expansion joint manufacturer’s requirements.

E. Expansion joint installation shall comply with all written requirements of expansion joint manufacturer.

## WI 10.9 REPLACE S.O.G. TRANSITION JOINT (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate and mark failed joint sealant, remove existing sealant, prepare edges, and reseal joints and cracks. Refer to Detail 10.9 for specific requirements.

B. Materials

1. Approved materials for use in this Work are specified in Division 07 Section "Concrete Joint Sealants."

C. Execution

1. Contractor shall locate failed transition joint on plan sheets.
2. Contractor shall remove existing sealant from joints.
3. When existing joint dimensions do not conform to Detail 10.9, joints shall be routed or sawcut to an adequate width and depth to match Work Item Detail. Routing shall be performed by mechanized device that has positive mechanical control over depth and alignment of cut.
4. Cavities shall be thoroughly cleaned by grinding and sandblasting to remove all remaining sealant and unsound concrete which may interfere with adhesion. Groove shall also be air blasted to remove remaining debris.
5. Sealant materials and installation procedures shall be in accordance with referenced specifications for selected material.

## WI 11.1 SEAL FLOOR CRACKS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, prepare, and seal random cracks in concrete floors. Refer to Detail 11.1 for specific requirements.
2. Payment for this Work Item shall be per lineal foot of work actually performed, measured in field with Owner/Engineer.

B. Materials

1. Approved sealant materials shall be as specified in Section "Concrete Joint Sealants".
2. Joint sealant material shall be compatible with traffic topping materials specified in Section "Traffic Coatings".

C. Execution

1. Contractor shall thoroughly clean and inspect concrete slabs for cracks. Those identified as either greater than 0.03-inch wide or showing evidence of water and/or salt staining on ceiling below shall be sealed. All cracks and joints identified for repair shall be marked with chalk to aid in precision routing. Obtain depths to top reinforcing bars in area of repair by use of a pachometer. Determine depth of electrical conduit (if applicable). Do not exceed these depths of routing where the crack to be repaired crosses the embedded items. Damage to embedded items will require repair or replacement at no cost to Owner.

2. Cracks shall be ground or sawcut to an adequate width and depth as required by Work Item Detail. Routing shall be performed by mechanized device that has positive mechanical control over depth and alignment of cut. Hand-held power grinders with abrasive disks shall not be used on control/construction joints, but may be used on random cracks per this Work Item.
3. Cavities shall be thoroughly cleaned by grinding and sand-blasting to remove all laitance, unsound concrete, and curing compounds which may interfere with adhesion. Groove shall be air-blasted to remove remaining debris.
4. Sealant materials and associated reference specifications are listed in Article “Materials” above. Sealant installation procedures shall be in accordance with referenced specifications for selected material.
5. Sealant type shall be compatible with traffic coating specified in Section “Traffic Coatings”.

## WI 11.2A REPLACE JOINT SEALANTS - WASHES

A. Refer to Work Item 11.2B for similar scope of Work, materials, and procedures addociated with this Work Item. Refer to detail 11.2A for specific requirements.

B. This Work Item applies at all washes throughout the structure, and is payable per lineal foot of repair performed.

## WI 11.2B REPLACE JOINT SEALANTS – TEE-TO-TEE

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate and mark failed joint sealant, remove existing sealant, prepare edges, and reseal joints and cracks. Refer to Detail 11.2B for specific requirements.

B. Materials

1. Approved materials for use in this Work are specified in Division 07 Section "Concrete Joint Sealants."

C. Execution

1. Contractor shall locate failed sealant by visual inspection.
2. Contractor shall remove existing sealant from joints and/or cracks.
3. When existing joint dimensions do not conform to Detail 11.2B, joints shall be routed or sawcut to an adequate width and depth to match Work Item Detail. Routing shall be performed by mechanized device that has positive mechanical control over depth and alignment of cut.
4. Cavities shall be thoroughly cleaned by grinding and sandblasting to remove all remaining sealant and unsound concrete which may interfere with adhesion. Groove shall also be air blasted to remove remaining debris.
5. Sealant materials and installation procedures shall be in accordance with referenced specifications for selected material.
6. Traffic topping manufacturer shall verify in writing that joint sealant is compatible with traffic topping.

## WI 11.3 REPLACE FAÇADE SEALANTS (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing sealant, prepare surfaces, and install backer rod and silicone sealant at all exterior façade sealants, all elevations. Refer to Detail 11.3 for specific requirements.
2. Some of the joint sealants occur behind the existing metal architectural elements. Contractor to verify access requirements in field prior to submitting Bid.
3. Joint widths vary (+/-1.5” average).
4. Means of access shall be per W.I. 1.9.

B. Materials

1. Backer rods, sealants, compressible closed cell foam filler, and bond breaker tape shall be as specified in Division 07 Section "Architectural Joint Sealants."
    a. Colors to be as selected by Owner to match surrounding substrates from Contractor-provided samples/mockups. Multiple colors required.

C. Execution

1. Contractor shall locate and mark all façade joints requiring placement as detailed on Drawings.
2. Contractor shall remove existing joint sealant and filler/backing material. Care shall be taken not to damage adjacent masonry or architectural features.
3. Any debris/material within the full depth of the façade joint shall be removed.
4. Joint shall be thoroughly cleaned by grinding to remove all mortar, residual joint filler material, joint sealant material, and unsound brick and/or masonry. Joint shall be air blasted to remove remaining debris.
5. Damage to surrounding architectural features shall be repaired by Contractor at no cost to Owner.
6. Contractor shall install new compressible filler backer rod and joint sealant in accordance with Details and manufacturer's recommendations.
7. Adjoining surfaces on both sides of joint shall be protected/masked prior to sealing joint. Remove protection/masking material upon completion of sealing joint.
8. Sealed joints shall be neat in appearance. Poorly sealed or improperly sealed joints shall be removed and replaced at Contractor's expense.

## WI 11.4 TOOL AND SEAL CONTROL JOINTS (FOR REFERENCE ONLY) (INCIDENTAL)

A. Scope of Work

1. Work consists of providing all labor, materials, equipment, supervision, and incidentals necessary to provide tooled and sealed control joints in concrete repairs to maintain existing joint layout. Refer to Detail 11.4 for specific requirements.
2. This work is incidental to all concrete repair work items.

B. Materials

1. Sealant materials shall be as specified in Division 07 Section "Concrete Joint Sealants."

C. Execution

1. Contractor shall locate and provide control joints in all concrete floor repairs as needed to maintain existing floor joint layout.
2. Control joints shall be tooled and formed in plastic concrete. Saw-cutting joints after concrete sets will not be allowed.
3. Tooled joints shall be of proper dimension in plastic concrete.
4. Sealant materials and installation procedures shall be in accordance with referenced specifications for selected material.

## WI 11.7 COVE SEALANT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing sealant, prepare concrete surfaces, and install cove sealant between floor and vertical surfaces as shown on Drawings. Refer to Detail 11.7 for specific requirements.
2. This Work occurs at all applicable walls, curbs, and columns within bays where coating work is to occur and where indicated on Drawings.

B. Materials

1. Joint sealant materials shall be as specified in Section "Concrete Joint Sealants".
2. Joint sealant material shall be compatible with traffic coating materials specified in Section "Traffic Coatings".

C. Execution

1. Wall-floor intersection to be sealed shall be thoroughly cleaned by sandblasting to remove all contaminants and foreign material.
2. Entire Work area shall then be cleaned with compressed air to assure that all loose particles have been removed and that intersection is dry.
3. Properly prepared intersection shall be coated evenly and completely with joint primer material on each of intersecting faces in accordance with sealant manufacturer's recommendations.
4. After primer has cured, apply cove sealant to intersection such that sealant extends 0.75 in. onto each of intersecting faces.
5. Work cove sealant into joint so that all air is removed and tool to concave shape such that minimum throat dimension of no less than 0.5 in. is maintained.
6. Remove excess sealant and allow to cure.
7. Apply coating on horizontal and vertical surfaces where shown on Drawings in even layers in strict accordance with manufacturer's recommendations. Sealant material and associated reference specifications are listed in Article "Materials" above.

## WI 11.8 REPLACE CAPSTONE SEALANT (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate existing capstone joints, remove existing mortar and joint sealant material, prepare substrates, and install flexible joint sealant material (including backer rod and bond breaker). Refer to Detail 11.3 for similar requirements.

2. This work is payable per each capstone joint sealed. Existing capstone joints are +/- 1/2” wide and +/- 16” long.

B. Materials

1. Backer rods, sealants and bond breaker tape shall be as specified in Division 07 Section "Architectural Joint Sealants."

C. Execution

1. Contractor shall locate and mark all joints requiring replacement as required on Drawings.
2. Contractor shall remove existing joint sealant and backer rod. Care shall be taken not to damage adjacent masonry or architectural features.
3. Joint shall be thoroughly cleaned by grinding to remove all mortar, residual joint filler material, joint sealant material, and unsound capstone material for depth of new joint sealant. Joint shall be air-blasted to remove remaining debris.
4. Unnecessary damage to surrounding wall assembly shall be repaired by Contractor at no cost to Owner.
5. Contractor shall install new joint sealant in accordance with specifications.”
6. Adjoining masonry surfaces on both sides of joint shall be covered with tape prior to sealing joint. Remove tape upon completion of sealing control joint.
7. Sealed joints shall be neat in appearance. Poorly sealed or improperly sealed control joints shall be removed and replaced at Contractor's expense.

## WI 11.9 REPLACE ROOF FLASHING SEALANT (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing sealant, prepare surfaces, and install sealant along existing roof flashing. Refer to Detail 11.3 for similar requirements.

A. This work occurs where the roofing of the adjacent building to the west terminates onto the exterior of the parking structure. The roof of the adjacent building to the west can be accessed from the interior of the parking structure.

B. See Work Item 11.3 for similar materials and procedures.

## WI 16.0 TRAFFIC COATING

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to prepare existing floor surface and install traffic topping as

shown on Detail 16.1 and Drawings. Coating of all vertical surfaces within Work area (as required on Detail) shall be incidental to installation of traffic topping.

B. Materials

1. Approved materials for use in this Work are as specified in Section "Traffic Coatings".
2. **All coating systems shall use #3 flint aggregate broadcast to rejection. Seed and back roll additional aggregate as needed to maintain a uniform finish.**
3. Contractor shall submit samples of coating and obtain Owner/Engineer approval prior to start of Work. Approved sample shall be basis for acceptance criteria including, but not limited to: surface texture, color, amount of aggregate used, slip-resistance. Refer to Section “Traffic Coatings” for specific requirements.

C. Execution

1. Floor surface preparation shall be performed by coating system applicator or under its direct supervision. Shotblast surface preparation is required for floors.
2. Traffic topping shall be installed by licensed applicators in strict accordance with manufacturer's recommendations and referenced specification section listed in Article "Materials" above.
3. Coating system shall be thoroughly cured prior to Work areas being returned to service.

## WI 16.1A TRAFFIC COATING – NEW SYSTEM

A. Refer to Work Item 16.0, "Traffic Topping" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 16.1A for specific requirements.

B. This Work includes preparing surfaces and installing new coating system on existing bare concrete surfaces.

## WI 16.2 TRAFFIC COATING – REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to prepare surface of previously traffic topped areas, and install traffic topping on prepared concrete and existing traffic topping. Refer to Detail 16.2 for specific requirements.

B. Materials

1. Traffic topping materials shall be as specified in Division 07 Section "Traffic Coatings" and shall be compatible with existing system. Obtain written approval from new traffic topping manufacturer that existing coating surface is acceptable for installing new coating before beginning Work.

C. Execution

1. All loose/debonded/damaged existing coating shall be removed, and exposed existing concrete surfaces prepared in accordance with manufacturer's recommendations and referenced specifications.
2. Prepare existing surfaces to receive new coating material by shotblasting. Ensure existing coating to remain is adequately bonded to existing concrete slab.
3. Install primer, base coat, and intermediate coat(s) as needed to build up new coating system to match thickness of adjacent existing coating, incidental to this work.

## WI 16.4B TRAFFIC COATING – RECOAT (FULL SYSTEM)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to prepare and recoat the existing traffic topping as shown on Drawings. Refer to Detail 16.4B for specific requirements.

B. Materials

1. Traffic topping materials shall be as specified in Division 07 Section "Traffic Coatings" and shall be compatible with existing system. Obtain written approval from new traffic topping manufacturer that existing coating surface is acceptable for installing new coating before beginning Work.

C. Execution

1. Removal of loose/failed existing coating, preparation of exposed concrete surfaces and existing traffic topping membrane shall be in strict accordance with manufacturer's recommendations and referenced specification section. Floor surface preparation shall be performed by coating system licensed applicator or under its direct supervision.
2. Shotblast surface preparation is required for floors.
3. Coating system shall be installed by licensed applicators in strict accordance with manufacturer's recommendations and referenced specification section.
4. Crack preparation, including installation of sealant material where required, shall be performed per W.I. Series 11.0.
5. Prior to recoating the area, any patches and/or bare concrete areas shall be coated with a base coat and an appropriate number of intermediate coats to bring the new membrane up to the level of the existing membrane (incidental to WI Series 3.0). After this has been completed, the entire area shall be recoated per this Work Item.
6. W.I. 16.4B: Existing prepared traffic topping membrane shall be recoated with a minimum of one intermediate coat with aggregate and one topcoat.
7. Coating system shall be thoroughly cured and traffic marking completed prior to returning work areas to service.

## WI 18.1 TEMPORARY SHORING

A. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to provide, install, maintain for duration of Project, and remove upon completion of Work, Temporary Shores at localized concrete repair areas, and remove upon completion of Work.

B. Payment for this Work Item shall be per each post shore installed at repair areas as directed by Engineer.

C. Temporary shoring required on Details, and/or indicated as incidental to other Work Items NOT eligible for payment under this Item.

D. If Contractor is unsure whether a particular repair requires temporary shoring (or how much shoring is required), verify in field with Engineer prior to concrete removals. Engineer shall approve of localized shoring procedures prior to start of Work. Contractor shall not be compensated for excessive use of shores per this Work Item.

E. To be eligible for payment under this Work Item, amount and location of temporary shoring must be approved by Engineer prior to installation.

## WI 25.1 MECHANICAL / ELECTRICAL ALLOWANCE

A. Mechanical / Electrical Allowance shall be related utility work (drain lines, sprinkler lines, electrical conduit/wiring, junction boxes, etc.) associated with interruptions of these utilities to repair existing structural areas.

B. All utilities removed during Work shall be re-installed in accordance with latest edition of electrical and mechanical codes. Work **ineligible** for this Allowance includes Work covered by or incidental to other Work Items within this Specification or for Work required through Contractor's negligence.

C. Method of Payment:

1. Mechanical/Electrical Work, as approved in writing by Owner/Engineer prior to implementation, shall be paid for by Contractor. Contractor shall forward actual invoices from mechanical/electrical contractors and General Contractor's markup to Engineer with each pay request. Contractor shall attach actual invoices to written authorization. At completion of Project, any variation between Mechanical/Electrical Allowance and actual payment receipts (including markup) will be reflected in an adjustment of Allowance amount.
2. Contractor shall not perform any work to be billed under this Allowance without prior written approval from Owner.
3. Contractor shall submit proposal for Owner approval for all work to be performed under this Allowance. Provide detailed breakdown of proposed work and costs for Owner approval. Work shall be performed on a T&M basis. Contractor shall provide a "not-to-exceed" cost amount for Owner approval prior to proceeding with T&M work.
4. Any unused allowance amount will be credited back to Owner at end of project.

## WI 25.2A MECHANICAL – REPLACE DRAIN – SUPPORTED SLAB

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove concrete full-depth, disconnect and remove

existing floor drain, install supplemental dowels, install new drain, place concrete, and install sealant around perimeter of drain. Refer to Detail 25.2A for specific requirements. Work Item 25.3 is directly related to this Work Item.

2. Payment for this Work Item shall be per each replacement drain installed as required, including all associated work required in this Section and on Detail 25.2A.

3. Concrete removal shall be performed by chipping hammers, coring not allowed. Locate embedded items prior to start of work. Do not cut, nick, or damage embedded reinforcement, tendons, or conduit/wiring.

B. Materials

1. Approved materials for this Work are shown on Detail 25.2A.
2. Existing drain sizes vary at the different parking structures. Contractor responsible to match existing (verify in field prior to ordering materials).
3. Sealant materials shall be as specified in Section “Concrete Joint Sealants”.

C. Execution

1. Contractor shall locate and mark all areas where existing drains are to be removed and replacement floor drains are to be installed.
2. Concrete removals and replacement shall be as shown on Detail 25.2A, payable under other Work Items.
3. Install and epoxy-anchor supplemental reinforcement as shown on Detail 25.2A.
4. Concrete removals required to install replacement drains and reinforcement shall be performed with conventional chipping hammers. Saw-cutting or coring through slab NOT allowed. Do not cut existing reinforcement.
5. Drains shall be installed as shown on Detail 25.2A.
6. Contractor shall set and verify all final drain elevations to ensure proper drainage and provide minimum 1% slope to maximum of 2% slope on floor surfaces. Notify Engineer of any discrepancies prior to placing concrete. No ponding allowed.

## WI 25.3 MECHANICAL – PIPE & HANGERS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to connect new floor drains installed per W.I. 25.2A to existing drainage system or to replace cracked/deteriorated drain pipe at scattered locations. Refer to Detail 25.3 for specific requirements.

2. Payment for this Work Item shall be per lineal foot of piping installed as required, including all associated incidental work required on Detail 25.3.

B. Materials

1. Approved materials for this Work are as shown on Detail 25.3.
2. Match existing pipe sizes (verify in field prior to submitting Bid).

C. Execution

1. Contractor shall locate and mark all areas where floor drain piping and hangers are to be installed.

2. Pipes and hangers shall be installed as shown on Detail 25.3 and in accordance with all applicable codes and ordinances.

## WI 26.5 PRESSURE TEST FIRE SUPPRESSION SYSTEM (ALTERNATE)

A. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to charge the standpipe system and checking/testing for leaks, upon completion of all work in areas that may affect the integrity of the fire suppression system.

B. Payment shall be lump sum to charge the system and locate all leaks. All work shall comply with all local codes, ordinances, and regulations.

C. Repairs required to the standpipe system based on leak testing shall be performed under W.I. 26.6 “Allowance – Standpipe Repairs”.

## WI 26.6 ALLOWANCE – STANDPIPE REPAIRS

A. Standpipe Repair Allowance shall be used where repairs to the existing fire suppression system are required as discovered during the pressure test of the system per Alternate W.I. 26.5.

B. All fire suppression Work shall be performed in accordance with Specification Section 211200 “Fire Suppression Standpipes”. Work **ineligible** for this Allowance includes Work covered by or incidental to other Work Items within this Specification or for Work required through Contractor’s negligence.

C. Method of Payment:

1. Fire Suppression Work, as approved in writing by Owner/Engineer prior to implementation, shall be paid for by Contractor. Contractor shall forward actual invoices from subcontractors and General Contractor’s markup to Engineer with each pay request. Contractor shall attach actual invoices to written authorization. At completion of Project, any variation between Mechanical/Electrical Allowance and actual payment receipts (including markup) will be reflected in an adjustment of Allowance amount.
2. Contractor shall not perform any work to be billed under this Allowance without prior written approval from Owner.
3. Contractor shall submit proposal for Owner approval for all work to be performed under this Allowance. Provide detailed breakdown of proposed work and costs for Owner approval.
4. Any unused allowance amount will be credited back to Owner at end of project.

## WI 40.3 RE-WELD SHEAR CONNECTOR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, shoring and jacking, supervision and incidentals necessary to re-weld existing tee-to-tee shear connector as indicated on the Drawings.

2. Payment for this Work Item shall be per each shear connector re-welded.

B. Materials

1. Welds shall be made using E70XX electrodes.
2. If not galvanized, provide corrosion inhibiting coating for shear connector:

   a. “Sikadur 32 Hi-Mod," by Sika Corporation, Lyndhurst, NJ.
   b. “MasterEmaco ADH 326,” by BASF Building Systems, Shakopee, MN.
   c. “Armatec 110,” Sika Corporation, Lyndhurst NJ.
   d. “Euco 452,” The Euclid Chemical Company, Cleveland, OH.

C. Execution

1. Contractor shall locate and mark broken shear connectors exposed by concrete excavation, by visual inspection or by testing for movement under wheel loading.
2. Contractor shall verify locations with Engineer/Architect prior to starting Work.
3. Contractor shall sandblast shear connector to bare metal prior to welding. Confirm in field with Engineer.
4. Following welding, Contractor shall apply corrosion inhibitor coating on exposed connector steel in accordance with Division 02 Section "Surface Preparation for Patching and Overlay.", or touchup with cold-galvanizing product.

## WI 40.4 SUPPLEMENTAL SHEAR CONNECTOR

A. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install supplemental shear connectors. Refer to Detail 40.4 for specific requirements.

B. This Work Item shall be payable per each supplemental shear connector installed.

## WI 41.1 STAIRS – REPLACE TREAD PAN/CONCRETE (ALTERNATE)

A. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove and replace concrete infill at metal pan stair treads. Refer to W.I. 3.0 for similar material and procedural requirements. Locate work in field with Engineer.

B. This Work Item shall be payable per each tread.

C. This Work includes removal/replacement of tread concrete infill and tread pan. Match existing pan thickness. See detail 41.1 for additional requirements.

D. Perform removals in manner to not damage stair steel.

E. Provide WWR in new concrete tread infill at mid-depth. New concrete tread surface shall be flat or slightly sloped towards front of tread. Do not exceed 1% slope. Install cove sealant around perimeter of new concrete tread infill (incidental).

## WI 41.2 STAIRS - REPLACE LANDING PAN / CONCRETE (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate the work area, install temporary shoring/bracing, remove landing concrete, remove steel landing corrugated pan (and adjacent bottom/top tread/riser plates as needed), install new galvanized steel corrugated landing pan and tread/riser plates, install #3 reinforcements, pour new concrete infill, and install cove sealants and coating (incidental). Provide shop drawings for Engineer review prior to ordering materials and hold a pre-installation meeting on-site with Engineer prior to beginning work.
2. This Work Item is payable per square foot of work actually performed.

B. Materials

1. Concrete materials shall be as specified in Section “Cast-in-Place Concrete Restoration” and on Drawings.
2. Reinforcement shall be #3 epoxy-coated rebar.
3. New steel landing corrugated pan, tread/riser plates, and any support steel shall be hot-dipped galvanized, with dimensions and minimum thickness to match existing. Contractor shall be responsible to verify size, length, and thickness prior to submitting bid. Submit shop drawings for Engineer approval prior to fabrication.
4. Hot-dipped galvanized steel shall be air-quenched as required to provide suitable substrate for painting.
5. Weld electrodes shall be E70XX. All welding materials and procedures shall be per AWS D1.1, latest edition.
6. Sealants shall be as specified in Division 07 Section “Concrete Joint Sealants”.

C. Execution

1. Completely close stair tower to pedestrians on all levels prior to start of work. Provide signage and barriers as necessary to inform public and provide barrier between pedestrians and work area. Refer to W.I. 1.5 for specific requirements.
2. Provide and maintain temporary shoring/bracing as necessary to maintain stability to existing stair sections at all times during repairs (incidental).
3. This work shall be performed with caution to not damage existing elements to remain including, but not limited to: existing structural steel stringers and landings, existing railing system, concrete and CMU walls, windows and frames, lights, doors and frames, and existing concrete infill to remain at landings and treads.
4. Contractor shall remove existing concrete landing, corrugated steel landing pan , (and bottom/top stair tread/riser plates as needed). All other existing elements shall remain.
5. Install new hot-dipped galvanized corrugated landing pan and tread/riser plate to match existing size, layout, and configuration. Verify layout and dimensions in field prior to fabrication.

6. New corrugated landing pan and tread/riser plate shall be welded into position with periodic 2” long ¼” fillet welds on all abutting edges. Layout and quantity of new welds shall match existing, at a minimum. Verify in field with Engineer.
7. After installation and welding is performed, touchup all hot-dipped galvanized elements with approved cold-galvanizing product at all welded locations and other scratches/nicks due to installation.
8. Install welded-wire reinforcement on new concrete landing as directed by Engineer. Welded-wire reinforcement shall be installed within 1-½” of perimeter of repair areas at slab mid-depth. Verify in field with Engineer.
9. Provide concrete infill per requirements of Section “Cast-in-Place Concrete Restoration”.
10. Concrete surfaces shall be finished to match existing elevations. Provide 1% slope to provide positive drainage (typical). Ponding on new concrete surfaces shall be repaired by Contractor at no additional cost to Owner. Provide light broom finish perpendicular to path of pedestrian travel.
11. Install cove sealants and coating per requirements of W.I. Series 11.0 and 16.0 (incidental to this Work).

## WI 45.1 PAINT TRAFFIC MARKINGS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, layout and paint parking stall stripes, traffic arrows, crosswalks, accessible stall access aisles, curbs, symbols, stop bars and all other existing pavement markings upon completion of all repairs.
2. Payment for this Work Item shall be lump sum to perform traffic marking installation as described below.
3. Traffic markings shall match all existing markings and be provided at same locations. Contractor shall be responsible for verifying and recording existing traffic marking layout prior to start of Work.
4. Work scope includes restriping all traffic markings throughout the entire structure prior to placement of traffic coating.
    a. Also includes providing contrasting stripes (minimum 1”, maximum 2” wide) at the leading edge of all stair treads. Submit proposed size/color for Owner review and approval.
5. Perform this work to comply with parking space closure requirements as specified on Drawings. New traffic markings shall be installed in all work areas prior to re-opening for normal use.
6. Remove existing stripes in those locations where they conflict with new striping layout.

B. Materials

1. Traffic marking materials shall be as specified in Section "Pavement Marking".

C. Execution

1. Contractor shall prepare drawing of existing parking and traffic marking layout in repair areas prior to starting with repairs. Contractor shall note stall width, angle of parking, directional traffic arrows and all other existing pavement markings.
2. Contractor shall submit striping plan for Owner/Engineer's approval.
3. Contractor shall match existing traffic marking layout, except as directed otherwise by Owner/Engineer.
4. Where existing pavement markings conflict with new striping layout, remove conflicting pavement markings as indicated in Division 9 Section “Pavement Marking.”
5. Engineer shall inspect all layout and surface preparation for conditions in accordance with Section "Pavement Marking."
6. All procedures shall be in accordance with Section “Pavement Marking”.

## WI 45.2 PAINT STANDPIPES (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, layout and paint existing standpipe systems.
2. Payment shall be lump sum to paint all existing standpipes in structure, including horizontal and verticals stacks. System descriptions and approximate lineal footage are included below. This is provided as an aid to bidders; Contractor shall confirm system layout and footages prior to submitting bid. No extras allowed.
    a. Approximate lineal footage: 700 LF.

B. Materials

1. Alkyd System MPI EXT 5.1D:
    a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.
        1) Benjamin Moore; Super Spec HP – Alkyd Metal Primer.
        2) Sherwin-Williams; Protective & Marine - Kem Kromik Universal Primer.
        3) Engineer-approved equivalent.
    b. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), MPI #9.
        1) Benjamin Moore; Corotech - Alkyd Gloss Enamel.
        2) Sherwin-Williams; Protective & Marine - Seaguard 1000 Marine.
        3) Engineer-approved equivalent.

C. Execution

1. Contractor shall locate and confirm Work areas in field with Engineer.
2. Contractor shall prepare surface to be painted in accordance with manufacturer's recommendations.
3. Submit samples for Owner approval of color. Install mockups for approval prior to proceeding with full scale operations.
4. Elevator tower protection required during surface preparation and painting (incidental).

## WI 45.4 CLEAN / PAINT REBAR AT WALL OPENINGS (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, layout and paint rebar at wall openings.
2. Payment for this Work Item shall be lump sum. There are (12) #7 rebar at each wall opening, and there are 120 wall openings throughout the structure.

B. Materials

1. Paint materials shall be as specified in Division 09 Section “Exterior Painting.”

C. Execution

1. Contractor shall locate and confirm Work areas in field with Engineer.
2. Contractor shall prepare surface to be painted in accordance with Division 09 Section "Exterior Painting" and manufacturer's recommendations.
3. Submit samples for Owner approval of color. Install mockups for approval prior to proceeding with full scale operations.

## WI 45.4A REPLACE DAMAGED REBAR AT WALL OPENINGS (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, supervision, and incidentals necessary to locate, layout, and replace damaged rebar at wall openings. See detail 45.4A for additional requirements.
2. This Work Item is payable per each damaged rebar replaced.

## WI 45.5 CLEAN / PAINT EXPOSED STEEL AT COLUMN BASES (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, layout and paint exposed steel at base of columns.
2. This Work Item is payable per each column base painted.

B. Materials

1. Paint materials shall be as specified in Division 09 Section “Exterior Painting.”

C. Execution

1. Contractor shall locate and confirm Work areas in field with Engineer.
2. Contractor shall prepare surface to be painted in accordance with Division 09 Section "Exterior Painting" and manufacturer's recommendations.
3. Submit samples for Owner approval of color. Install mockups for approval prior to proceeding with full scale operations.

## WI 45.6 CLEAN/PAINT S.O.G. TRANSITION ANGLES (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, layout, clean, and paint S.O.G. transition angles.

2. This Work Item is payable per each transition angle cleaned and painted.

B. Materials

1. Paint materials shall be as specified in Division 09 Section “Exterior Painting.”

C. Execution

1. Contractor shall locate and confirm Work areas in field with Engineer.
2. Contractor shall prepare surface to be painted in accordance with Division 09 Section "Exterior Painting" and manufacturer's recommendations.
3. Submit samples for Owner approval of color. Install mockups for approval prior to proceeding with full scale operations.

**WI 45.6A REPLACE S.O.G. TRANSITION ANGLES (ALTERNATE)**

A. Scope of Work

1. Work consists of furnishing all labor, materials, supervision, and incidentals necessary to locate, layout, and replace S.O.G. transition angles.
2. This Work Item is payable per each transition angle replaced. See detail 45.6A for additional requirements.

**WI 51.1 GUARDS AT WALL OPENINGS (ALTERNATE)**

A. Scope of Work

1. Work consists of furnishing all labor, materials, supervision, and incidentals necessary to install guards at all interior wall openings.
2. This Work Item is payable as a lumpsum item to install guards at every opening on the supported levels. There are 140 locations to install guards throughout the deck. See detail 51.1 for additional requirements.

**WI 51.2 STAIR RAILING INFILL (ALTERNATE)**

A. Scope of Work

1. Work consists of furnishing all labor, materials, supervision, and incidentals necessary to install HSS 3x2x3/16" shall be hot-dipped galvanized ASTM A500 GR. C infill.
2. This work Item is payable per each railing infill installed. See detail 51.2 for additional requirements.

**END OF SECTION 020010**

# SECTION 02 51 30 - GENERAL CONCRETE SURFACE PREPARATION

## PART 1 - GENERAL

### 1.1 DEFINITIONS

A. **DELAMINATIONS**: Fracture planes, "internal cracks," within concrete. Typically these fractures are parallel to the member face and vary in depth.

B. **NEAR-VERTICAL CHIPPED EDGES:** Provide an edge dressed to within 20$^{o}$ of perpendicular of finished surface.

C. **SPALLS:** Potholes, cavities or voids in concrete. Usually result of delamination migrating to face of concrete member. When fracture finally reaches surface, concrete encompassed by delamination breaks away, resulting in spall.

D. **UNSOUND CONCRETE:** Concrete exhibiting one or more of:

1. Incipient fractures present beneath existing delaminated or spalled surfaces.
2. Honeycombing.
3. Friable or punky areas.
4. Deterioration from freeze-thaw action.

E. **SCALING:** Deterioration which attacks mortar fraction (paste) of concrete mix. First appears as minor flaking and disintegration of concrete surface. Scaling eventually progresses deeper into concrete, exposing aggregate which breaks away.

F. **SHOTBLASTING:** Scarification of concrete surfaces using an abraded metal shot-rebound. See ICRI Guideline 03732 “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.”

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION (NOT APPLICABLE)

## END OF SECTION 02 51 30

# SECTION 02 51 40 - SURFACE PREPARATION FOR PATCHING AND OVERLAY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the provision of all labor, materials, equipment, supervision and incidentals necessary to locate and remove all delaminated and unsound concrete, all existing failed patches, all existing surface spalls and potholes, and preparation of cavities created by removal to receive concrete patching material.

### 1.3 REFERENCES

A. "Specifications for Structural Concrete for Buildings" (ACI 301) by American Concrete Institute, herein referred to as ACI 301, is included in total as specification for this structure except as otherwise specified herein.

B. Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown on Drawings or specified herein:

1. ”Concrete Repair Guide” (ACI 546R-04)

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Floor Slabs:

1. Floor slab delaminations: locate by sounding surface with hammer, rod, or chain drag.
2. When delaminated area is struck, distinct hollow sound is heard.
3. Contractor: sound all designated floors for delaminations.
4. Certain structural systems that contain thin slab thicknesses with Welded Wire Reinforcement or other small diameter reinforcing, such as waffle slab or precast tees, may have significant deterioration without evidence of delaminations.

These structural systems require qualified personnel to provide additional inspections, primarily visual in nature, to define the extent of deterioration.

5. Contractor: Visually inspect thin slab thicknesses with small diameter reinforcing for deterioration.

B. Vertical and Overhead Surfaces:

1. Vertical and overhead surface delaminations: locate by sounding appropriate member with hammer or rod.
2. Cracks, usually horizontal in orientation along beam faces, and vertical in orientation near column corners are indicators of delaminated concrete.
3. Contractor: sound only vertical and overhead surfaces that show evidence of cracking and/or salt and water staining.

C. Delaminated areas, once located by Contractor, shall be further sounded to define limits. Mark limits with chalk or paint.

D. Contractor: locate spalls by visual inspection and mark boundaries with chalk or paint after sounding surface.

E. Engineer/Architect will define and mark additional unsound concrete areas for removal, if required.

F. Areas to be removed shall be as straight and rectangular as practical to encompass repair and provide neat patch.

G. Contractor: Locate and determine depth of all embedded REINFORCEMENT, POST-TENSIONING TENDONS, and ELECTRICAL CONDUIT in repair area and mark these locations for reference during concrete removal. Do **NOT** nick or cut any embeds unless approved by Engineer/Architect.

H. For overlay installation, boundaries of overlay areas will be as defined in project drawings and verified by Engineer/Architect.

## 3.2 PREPARATION

A. **Temporary shoring may be required at concrete floor repair areas exceeding 5 sq ft and at any beam, joist, or column repair. Contractor: Review all marked removal and preparation areas and request clarification by Engineer/Architect of shoring requirements in questionable areas. Shores shall be in place prior to concrete removal and cavity preparation in any area requiring shores**.

B. Delaminated, spalled and unsound concrete floor areas: mark boundaries. All concrete shall be removed from within marked boundary to minimum depth of 0.75 in. using 15 to 30 lb chipping hammers equipped with chisel point bits. When directed by Engineer/Architect, chipping hammers less than 15 lb shall be used to minimize damage to sound concrete. Near vertical chipped edge shall be provided along perimeter of repair area where shown on drawings. Areas to be removed shall encompass repair and provide uniform cavity surface. If delaminations exist beyond

minimum removal depth, chipping shall continue until all unsound and delaminated concrete has been removed from cavity.

1. All work shall comply with OSHA Crystalline Silica Requirements.

C. Where embedded reinforcement or electrical conduit is exposed by concrete removal, exercise extra caution to avoid damaging it during removal of unsound concrete. If bond between exposed embedded reinforcement and adjacent concrete is impaired by Contractor's removal operations, Contractor shall perform additional removal around and beyond perimeter of reinforcement for minimum of 0.75 in. along entire length affected at no cost to Owner.

D. If rust is present on embedded reinforcement where it enters sound concrete, additional removal of concrete along and beneath reinforcement required. Additional removal shall continue until non-rusted reinforcement is exposed, or may be terminated as Engineer/Architect directs.

E. Sawcut patch and overlay boundaries to depth of 0.75 in. into floor slab, unless otherwise noted. No sawcutting required at overlay boundaries abutting existing vertical surface (wall, beam, curb, etc.). For vertical and overhead surfaces marked boundary may be sawcut, ground or chipped to depth of 0.5 in. to 0.625 in. into existing concrete, measured from original surface. All edges shall be straight and patch areas square or rectangular-shaped. Diamond blade saw or grinder with abrasive disk suitable for cutting concrete is acceptable for performing work. Edge cut at boundary shall be dressed perpendicular to member face. It shall also be of uniform depth, for entire length of cut. Exercise extra caution during sawcutting to avoid damaging existing reinforcement (ESPECIALLY POST-TENSIONING TENDONS AND SHEATHING) and electrical conduit and any other embedded items near surface of concrete. Any damage to existing reinforcement, post-tensioning tendons or sheathing during removals shall be repaired by Contractor with Engineer/Architect-approved methods at no additional cost to Owner.

F. All sound surfaces (surfaces not requiring spall or delamination repair as previously discussed in this section) to receive overlay shall be heavy abrasive blasted or heavy shotblasted prior to overlay placement, to produce a final concrete surface profile matching ICRI CSP.

## 3.3 INSPECTION OF REPAIR PREPARATION

A. After removals are complete, but prior to final cleaning, exposed concrete surfaces and exposed reinforcement shall be inspected by Contractor and verified by Engineer/Architect for compliance with requirements of this Section. Where Engineer/Architect finds unsatisfactory surface or cavity preparation, Engineer/ Architect shall direct Contractor to perform additional removals. Engineer/Architect shall verify areas after additional removals.

B. Contractor shall inspect embedded reinforcement and conduits exposed within cavity for defects due to corrosion or damage resulting from removal operations. Contractor shall notify Engineer/Architect of all defective and damaged reinforcement or conduits.

Replacement of damaged or defective reinforcement or conduits shall be performed according to this Section and as directed by Engineer/Architect.

C. After inspections of exposed surfaces and reinforcement are complete, Engineer/ Architect and Contractor shall measure and document removal and replacement quantities for payment, as required.

## 3.4 REINFORCEMENT AND EMBEDDED MATERIALS IN REPAIR AREAS

A. All embedded reinforcement exposed during surface preparation that has lost more than **15**% (**10**% if 2 or more consecutive parallel bars and/or tendons are affected) of original cross-section due to corrosion shall be considered DEFECTIVE. All non-defective exposed reinforcement that has lost section to extent specified above as direct result of Contractor's removal operations shall be considered DAMAGED.

B. **Embedded materials** including, but not limited to, electrical conduit, corrosion protection systems and snow/ice melting equipment **shall be protected by Contractor** during removal operations. **Damage due to removal operations shall be repaired by Contractor in accordance with national code requirements at no cost to Owner.** Embedded materials which are defective due to pre-existing conditions may be repaired or replaced by Contractor or abandoned at Owner's option and cost.

C. Supplement defective or damaged embedded reinforcement by addition of reinforcement of equal diameter with Class "B" minimum splice per ACI 318 beyond damaged portion of reinforcement. Secure new reinforcement to existing reinforcement with wire ties and/or approved anchors. Supplemental reinforcement shall be ASTM A615 Grade 60 steel installed in accordance with Division 03 specification Sections. Tendon supplement or repair materials, when applicable, shall be as required by Section "Work Items."

D. Loose and supplemental reinforcement exposed during surface preparation shall be securely anchored prior to concrete placement. Loose reinforcement shall be adequately secured by wire ties to bonded reinforcement or shall have drilled-in anchors installed to original concrete substrate. Drilled-in anchors shall be Powers “Tie-Wire Lok-Bolt” anchors, ITW Ramset/Red Head “TW-1400” anchor, or approved equivalent. Supplemental reinforcing needed to be held off substrate shall be adequately secured by drilled-in anchors installed to original concrete substrate with Powers “Tie-Wire Spike”, ITW Ramset/Red Head Redi-Drive “TD4-112” anchors, or approved equivalent. Engineer/Architect will determine adequacy of wire ties and approve other anchoring devices prior to their use. Securing loose and supplemental reinforcement is incidental to surface preparation and no extras will be allowed for this Work.

E. Concrete shall be removed to provide minimum of 3/4 in. clearance on all sides of defective or damaged exposed embedded reinforcement that is left in place. Minimum of 1.5-in. concrete cover shall be provided over all new and existing reinforcement. Concrete cover over reinforcement may be reduced to 1 in. with Engineer/Architect's approval if coated with an approved epoxy resin.

F. Supplemental reinforcement and concrete removals required for repairs of defective or damaged reinforcement shall be paid for as follows:

1. Concrete removals and supplemental reinforcement required for repairs of DEFECTIVE reinforcement shall be paid for by Owner at unit price bid.
2. Concrete removals and supplemental reinforcement required for repairs of DAMAGED reinforcement shall be paid for by Contractor.

## 3.5 CLEANING OF REINFORCEMENT WITH DELAMINATION AND SPALL CAVITIES

A. All exposed steel shall be cleaned of rust to bare metal by sandblasting. Cleaning shall be completed immediately before concrete placement to insure that base metal is not exposed to elements and further rusting for extended periods of time. Entire bar diameter is to be cleaned.

B. After all sandblasting operations and cleanup are completed, paint all exposed steel with an approved epoxy. Protect prepared surfaces from damage prior to and during concrete placement.

## 3.6 PREPARATION OF CAVITY FOR PATCH PLACEMENT

A. Floor slab and cavity surfaces will be examined prior to commencement of concrete placement operations. Sounding surface shall be part of examination. Any delamination noted during sounding shall be removed as specified in this Section.

B. Cavities prepared by chipping or other impact methods shall be sandblasted to remove material that may impair concrete bonding. Sound concrete surfaces shall be prepared by shotblasting as previously specified in this section. Airblasting is required as final step to remove all debris including sand and dust. All debris shall be removed from site prior to commencement of concrete placement, bonding agent preparation, etc. as specified in Division 03 Sections.

**END OF SECTION 02 51 40**

# SECTION 03 30 21 - CAST-IN-PLACE CONCRETE RESTORATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

### 1.4 SUBMITTALS

A. General: In addition to the following, comply with submittal requirements in ACI 301.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete mix. Use form at end of this Section.

D. Testing Agency: Promptly report all field concrete test results to Engineer, Contractor and Concrete Supplier.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
2. Formwork and form accessories.
3. Steel reinforcement and supports.
4. Concrete mixtures.
5. Handling, placing, and constructing concrete.

E. Testing Agency Qualifications:

1. Independent agency, acceptable to authorities having jurisdiction, and acceptable to engineer, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

F. Testing Agency is responsible for conducting, monitoring and reporting results of all tests required under this Section. Testing Agency shall immediately report test results showing properties that do not conform to Project Specification requirements to Contractor's authorized on-site representative and to Owner's authorized on-site representative.

G. Testing Agency: Submit following Field Test information for Project Concrete unless modified in writing by Engineer:

1. Project name and location.
2. Contractor's name.
3. Testing Agency's name, address, and phone number.
4. Concrete supplier.
5. Date of report.
6. Testing Agency technician's name (sampling and testing).
7. Placement location within structure.
8. Time of batching.
9. Time of testing.
10. Elapsed time from batching at plant to discharge from truck at site.
11. Concrete mixture identification number.
12. Weather data:

    a. Air temperatures.
    b. Weather.

13. Field test data:

    a. Date, time and place of test.
    b. Slump.
    c. Concrete Temperature.
    d. Slump flow (for SCC).
    e. Air content.

14. Compressive test data:

a. Cylinder number.
b. Age of concrete when tested.
c. Date and time of cylinder test.
d. Curing time (field and lab).
e. Cross-sectional area of cylinder.
f. Compressive strength.
g. Type of failure (at break).

H. Mockups: Before casting concrete, build mockups to verify typical joints, surface finish, texture, tolerances, and standard of workmanship. See Paragraphs “Finishing Formed Surfaces” and “Finishing Floors and Slabs” within this Section for criteria. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Obtain Engineer's acceptance of mockups before casting concrete with specified finishes.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials.”
2. ACI 214R, “Evaluation of Strength Test Results of Concrete.”
3. ACI 301, “Specifications for Structural Concrete.”
4. ACI 302.1R, “Guide for Concrete Floor and Slab Construction.”
5. ACI 305R, “Hot Weather Concreting.”
6. ACI 306.1, “Cold Weather Concreting.”
7. ACI 308R, “Guide to Curing Concrete.”
8. ACI 308.1, “Standard Specifications for Curing Concrete.”
9. ACI 318, “Building Code Requirements for Structural Concrete & Commentary.”
10. ACI 347, “Guide to Formwork for Concrete.”
11. ACI 347.2 “Guide to Shoring/Reshoring of Concrete Multistory Buildings.”

B. American Society for Testing and Materials (ASTM):

1. ASTM A 36, “Standard Specification for Carbon Structural Steel.”
2. ASTM A 615, “Standard Specification for Deformed and Plain Carbon -Steel Bars for Concrete Reinforcement.”
3. ASTM A 706, “Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.”
4. ASTM A 775, “Standard Specification for Epoxy-Coated Steel Reinforcing Bars.”
5. ASTM A 884, “Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement for Reinforcement.”
6. ASTM A1064, “Standard Specification for Carbon-Steel Wire and Welded Wire Steel Reinforcement, Plain and Deformed, for concrete.”

7. ASTM C 31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field.”
8. ASTM C 33, “Standard Specification for Concrete Aggregates.”
9. ASTM C 39, “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.”
10. ASTM C 94, “Standard Specification for Ready-Mixed Concrete.”
11. ASTM C 138, “Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.”
12. ASTM C 143, “Standard Test Method for Slump of Hydraulic Cement Concrete.”
13. ASTM C 150, “Standard Specification for Portland Cement.”
14. ASTM C 171, “Standard Specification for Sheet Materials for Curing Concrete.”
15. ASTM C 172, “Standard Practice for Sampling Freshly Mixed Concrete.”
16. ASTM C 173, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.”
17. ASTM C 231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.”
18. ASTM C 260, “Standard Specification for Air-Entraining Admixtures for Concrete.”
19. ASTM C 309, “Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.”
20. ASTM C 494, “Standard Specifications for Chemical Admixtures for Concrete.”
21. ASTM C 567, “Standard Test Method for Determining the Density of Structural Lightweight Concrete.”
22. ASTM C 618, “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.”
23. ASTM C 989, “Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.”
24. ASTM C 1218, “Standard Test Method for Water Soluble Chloride Ion in Mortar and Concrete.”
25. ASTM C 1315, “Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.”
26. ASTM C 1611/C 1611M, “Standard Test Method for Slump Flow of Self-Consolidating Concrete.”

## PART 2 - PRODUCTS

### 2.1 FORMWORK

A. Furnish formwork and form accessories according to ACI 301, ACI 347, and ACI 347.2.

### 2.2 STEEL REINFORCEMENT

A. Epoxy-coated Reinforcing Bars: ASTM A775

B. Plain-Steel Welded Wire Fabric: ASTM A 1064, fabricated from as-drawn steel wire into flat sheets, mats only. Roll stock prohibited.

C. Epoxy-Coated Welded Wire Fabric: ASTM A884, fabricated from as-drawn steel wire into flat sheets, mats only. Roll stock prohibited.

D. Provide bar supports according to CRSI's "Manual of Standard Practice." Use all-plastic bar supports when in contact with exposed concrete surface.

## 2.3 CONCRETE MATERIALS

A. Ready Mixed Concrete: Obtain concrete from plant with current certification from:

1. Concrete Materials Engineering Council.
2. Michigan Department of Transportation.
3. National Ready Mixed Concrete Association.
4. Prestressed Concrete Institute.

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

C. Fly Ash: ASTM C618, Class F. Class C fly ash prohibited.

D. Ground-Granulated Blast Furnace Slag: ASTM C989, Gr. 100 or higher.

E. Silica Fume: ASTM C1240.

F. Normal-Weight Coarse Aggregate: ASTM C 33, Crushed and graded limestone or approved equivalent, Class 5S uniformly graded, nominal size not exceeding ½ inch for partial depth patching or 3/4 inch for full depth patching. No cherts, opaline or crushed hydraulic-cement concrete is permitted.

1. Combine Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer that No. 50.

G. Normal-Weight Fine Aggregate: Natural sand conforming to ASTM C 33 and having preferred grading shown for normal weight aggregate in ACI 302.1R, Table 5.1.

H. Water: Potable and complying with ASTM C 1602.

## 2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.

B. General: Admixtures certified by manufacturer that all admixtures used are mutually compatible.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, fiber reinforced concrete, and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.45.
4. Use non-corrosive accelerator for all concrete, less than 8 inches thick, placed at air temperatures below 50 degrees Fahrenheit.
5. Use high range water reducing admixture and viscosity modifying admixture, where required, in Self-Consolidating Concrete (SCC).
6. Use corrosion-inhibiting admixture in parking structure slabs and other areas noted on drawings.
7. Use shrinkage reducing/shrinkage compensating admixture where indicated on drawings to keep shrinkage below **<<insert number>>.**
8. Use alkali-silica reactivity inhibitor unless ready mix company confirms that the aggregates to be used on the job are non-reactive.

D. Normal Water-Reducing Admixture: ASTM C 494, Type A.

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

   a. “Eucon Series,” Euclid Chemical Co.
   b. “WRDA Series,” W.R. Grace & Co.
   c. “Master Pozzolith Series,” or “Master PolyHeed Series,” Master Builders Solutions.
   d. “Plastocrete Series”, Sika Corporation.
   e. “OptiFlo Series” or “EcoFlo Series,” Premiere Concrete Admixtures.
   f. “Polychem Series” or “KB Series,” General Resource Technology.
   g. “LC-400 Series” or “LC-500 Series,” Russ Tech Admixtures, Inc.

E. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A.

1. Subject to compliance with requirements, provide one of following:

   a. “Eucon MR” or “Eucon X-15 and X-20,” Euclid Chemical Co.
   b. “Daracem Series” or “MIRA Series,” W.R. Grace & Co.
   c. “Master Polyheed Series,” Master Builders Solutions.
   d. “Sikaplast Series” or “Plastocrete Series”, Sika Corporation.
   e. “Polychem 1000” or “KB Series,” General Resource Technology.
   f. “Finishease-NC,” Russ Tech Admixtures, Inc.
   g. “OptiFlo Series” or “EcoFlo Series,” Premiere Concrete Admixtures.

F. High-Range, Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F.

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

   a. “Eucon 37” or “Eucon SP-Series” or “Plastol Series,” Euclid Chemical Co.
   b. “Daracem Series” or “ADVA Series,” W.R. Grace & Co.

c. “Master Rheobuild 1000”, “PS 1466” or “Master Glenium Series,” Master Builders Solutions.
d. “Sikament Series” or “Sika ViscoCrete Series,” Sika Corporation.
e. “Melchem Series,” General Resource Technology.
f. “Superflo 443” or “Superflo 2000 Series,” Russ Tech Admixtures, Inc.
g. “EcoFlo Series” or “UltraFlo Series,” Premiere Concrete Admixtures.

G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B or D.

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

a. “Eucon Retarder-75”, “Eucon DS” or “Eucon Stasis.” Euclid Chemical Co.
b. “Daratard-17” or “Recover,” W.R. Grace & Co.
c. “MasterSet R Series” or “MasterSet Delvo Series,” Master Builders Solutions.
d. “Sikatard Series,” or “Plastiment Series” or “Plastocrete Series,” Sika Corporation.
e. “Polychem R,” General Resource Technology.
f. “LC-400 Series” or “LC-500 Series,” Russ Tech Admixtures, Inc.
g. “OptiFlo Series,” Premiere Concrete Admixtures.

H. Air Entraining Admixture: ASTM C260.

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

a. “Air-Mix,” “Eucon Air-Series” or “AEA-92,” Euclid Chemical Co.
b. “Daravair Series” or “Darex Series,” W.R. Grace & Co.
c. “Master Air AE90”, or Master Air AE 200”, or “Master Air VR10,” Master Builders Solutions.
d. “Sika AEA Series,” or “Sika AIR Series,” Sika Corporation.
e. “ConAir Series,” Premiere Concrete Admixtures.
f. Polychem “VR” or “VRC” or “Polychem AE,” General Resource Technology.
g. “RSA-10,” Russ Tech Admixtures, Inc.

I. Non-Chloride, Non-Corrosive Water-Reducing, Accelerating Admixture: ASTM C 494, Type C or E.

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

a. “Eucon AcN-Series,” “Accelguard 80,” “Accelguard NCA,” or “Accelguard 90,” by Euclid Chemical Company.
b. “DCI,” “PolaraSet,” “Lubricon NCA,” “Daraset” or “Gilco,” by W.R. Grace & Co.
c. “MasterSet FP 20” or “MasterSet AC 534,” by Master Builders Solutions.
d. “Sika Set NC,” “Plastocrete 161FL”, or “Sika Rapid-1,” by Sika Corporation.
e. “Catexol 2000 RHE,” by Axim Concrete Technologies.
f. “Polychem NCA” or “Polychem Super Set,” General Resource Technology.
g. “LCNC-166,” Russ Tech Admixtures, Inc.

J. Corrosion Inhibiting Admixture shall be capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

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

    a. “Eucon CIA” or “Eucon BCN,” Euclid Chemical Company.
    b. “DCI” or “DCI-S,” W.R. Grace.
    c. “MasterLife CI 30,” Master Builders Solutions.
    d. “Sika CNI,” Sika Corporation.
    e. “Catexol 1000 CN-CI,” Axim Concrete Technologies.
    f. “Polychem CI,” General Resource Technology.
    g. “Russ Tech RCI,” Russ Tech Admixtures, Inc.

2. Add at rate of 3 gal/cu yd. of concrete, which shall inhibit corrosion to 9.9 lb of chloride ions per cu. yd. of concrete. Calcium Nitrite based corrosion inhibitor shall have a concentration of 30 percent, plus or minus 2 percent of solids content.

K. Shrinkage Compensating Admixture:

1. Design requires using materials with combined drying shrinkage characteristic of 0.04 percent maximum at 28 days. Proposed concrete mixture(s), using actual aggregates, admixtures and cement of the proposed mix for Project as detailed herein and in Drawings, shall meet criteria. Submit ASTM C 157 (may be modified by curing period duration) results for at least 3 specimens. Test takes 28 days minimum. Begin tests as soon as possible so final test results available for submittal to Engineer.
2. Provide powdered admixture used for the compensation and reduction of shrinkage in Portland Cement concrete. Its functional mechanism shall be based on the formation of an expansive Type G component, which produces a calcium hydroxide platelet crystal system based on calcium aluminate/calcium hydroxide, as specified in ACI 223.
3. Acceptable Product:

    a. Conex by The Euclid Chemical Company.
    b. “Eclipse Plus,” W.R. Grace & Co.
    c. “MasterLife SRA 20,” Master Builders Solutions.
    d. “Sika Control 40,” Sika Corporation.
    e. “SRA-157,“ Russ Tech Admixtures, Inc.

## 2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Evaporation Retarder:

    a. AquaFilm J74 by Dayton Superior Corporation, Miamisburg, OH
    b. Eucobar; Euclid Chemical Co.
    c. E-Con; L&M Construction Chemicals, Inc.
    d. MasterKure ER 50; Master Builders Solutions.
    e. SikaFilm; Sika Corporation.

f. Sure-Film (J-74); Dayton Superior Corporation.
g. “EVRT”, Russ Tech Admixtures, Inc.
h. “Barrier,” Premiere Concrete Solutions.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry. Materials must be free of harmful substances, such as sugar or fertilizer, or substances that may discolor the concrete. To remove soluble substances, burlap should be thoroughly rinsed in water before placing it on the concrete.

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

D. Water: Potable.

## 2.6 CONCRETE MIXTURES

A. Proportion mixtures determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
3. Provide different mixtures as the season warrants, as well as each type and strength of concrete or for different placing methods.

B. Use a qualified independent testing agency for preparing and reporting proposed Mixture Proportions for the laboratory trial mix basis.

C. Requirements for normal-weight concrete mix are shown on Drawings:

1. Compressive strength
2. Slump
3. Water-cementitious materials ratio
4. Air content

D. Supplementary cementitious materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials according to ACI 318 requirements.

E. Air Entrainment:

1. See General Notes on Drawings for total average air content (percent by volume).
2. Average air content shall exceed value stated in General Notes on Drawings.
3. Permissible variation for any one test result from specified average total air content: plus or minus 1.5 percent unless noted otherwise on General Notes on Drawings.
4. Hardened concrete shall have an air void spacing factor of 0.0080 in. maximum. Specific surface (surface area of air voids) shall be 600 $in^2$ per cu in. of air-void volume, or greater. Concrete mixes not meeting these values as determined by ASTM C 457 may require adjustments unless accepted in writing by Engineer.”

F. Chloride Ion Content of Mixture:

1. Water soluble chloride ion content of concrete shall not exceed 0.06 percent by weight of cement for pre-stressed concrete and 0.15 percent for reinforced concrete. (ACI 318 Chapter 4 Table 4.4.1“Maximum Chloride Ion Content for Corrosion Protection of Reinforcement”) Testing procedure to determine chloride ion content shall conform to ASTM C 1218.
2. Concrete chloride ion content shall be determined by Testing Agency prior to placement. Cast samples from current production of concrete mix proposed for superstructure.
3. Concrete not meeting the requirements of paragraph “Water soluble chloride ion content of concrete…” above, shall contain appropriate amount of calcium nitrite. Concrete supplier shall provide laboratory test results showing the amount of excess chloride ion content in the concrete mixture contributed by the aggregates. For each pound of chloride ion in excess of the amount allowed, mix shall contain calcium nitrite (30 percent, plus or minus 2 percent, solids content) on one-to-one basis (one gallon of calcium nitrite for one lb. of excess chloride ion). Calcium nitrite used to offset chloride ions is in addition to calcium nitrite used as a corrosion inhibitor. Maximum of 1.5 lb. of chloride ion per cubic yard may be offset in this manner.

G. Alkali-Aggregate Reactivity Resistance: Provide one of the following:

1. Total equivalent alkali content of mixture less than 5 lb. /cu. yd.
2. ASTM C1293: Expansion less than 0.04 % after 1 year for each of the aggregates (both coarse and fine) in the proposed concrete mixture. This data shall be less than 1 year old.
3. ASTM C1260 or AASHTO T303: Expansion less than 0.1 % after 14 days for each of the aggregates (both coarse and fine) in the proposed concrete mixture.
4. ASTM C1567: Expansion less than 0.1 % after 14 days with each of the aggregates (both coarse and fine) and the supplementary cementing materials (both source and quantity) of the proposed concrete mixture design. Alternatively, if satisfactory ASTM C1260 or AASHTO T303 test results can be provided for one of the aggregates that are being used, ASTM C1567 testing does not need to be provided for that aggregate.
5. CE CRD-C662: Expansion less than 0.1 % after 28 days with the each of the aggregates (both coarse and fine), the supplementary cementing materials (both source and quantity) of the proposed concrete mixture design and the lithium admixture source and dosage level of the proposed mixture design. Alternatively, if satisfactory ASTM C1260 or AASHTO T303 test results can be provided for one of the aggregates that are being used, CRD-C662 testing does not need to be provided for that aggregate.

H. Admixtures: Use admixtures according to manufacturer’s written instructions.

1. Consider using water-reducing admixture or high-range water-reducing admixture (Superplasticizers), OR admixtures that achieve self-consolidating concrete, as required, for placement, workability, finishing and when required, increased flowability.

2. Consider using water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less. Use normal or mid-range water reducing admixture for concrete with water-cementitious materials ratio greater than 0.45.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

I. When concrete mixture contains calcium nitrite admixture, (or other ionic salts that affect the chloride permeability test), perform rapid chloride permeability test for submitted mixture and for control sample. Control sample shall have the same mixture and water-cementitious materials ratio as submitted mixture, except calcium nitrite admixture shall not be used.

J. Slump (ACI 301, Part 4 header “Slump”):

1. Maximum slump for concrete is indicated on Drawings. Where field conditions require slump to exceed that shown, increased slump shall be obtained by use of high range water reducers (superplasticizers) only, and Contractor shall obtain written acceptance from Engineer who may require an adjustment to mix.
2. All concrete containing high-range water-reducing admixture (superplasticizer) shall have a verified initial slump of 2– 3 in. Final slump after the addition of the superplasticizer shall be 6–9 in. as required by the contractor to properly place the concrete. Before permission for plant addition of superplasticizer to be granted by Engineer, fulfill following requirements:

    a. Submit letter from testing laboratory which developed original mixture proportions, for each super plasticized mixture, certifying volume of mix water which will produce specified slump and water/cement ratio, taking into account aggregate moisture content.
    b. Submit plant computer printout of mixture ingredients for each truckload of super plasticized concrete with delivery of that truckload. Mix water volume greater than that certified shall be cause for concrete rejection.
    c. Over-retarding or crusting of flatwork surface: cause for concrete rejection.
    d. Segregation or rapid slump loss (superplasticizer life) due to incompatibility or under-dosing: cause for concrete rejection.

K. Shrinkage (Length Change):

1. Determine length change of hardened concrete test specimens in accordance with ASTM C 157, except as noted in paragraph below. Existing test data from previous project with same materials may be acceptable.
2. Test specimens shall be moist cured, including period in molds for 7 days. Then store specimens in air for period of 28 days.
3. Utilize concrete materials and mix proportions submitted, for use in floor slab beam, in accordance with Part 1 Article “Submittals”.
4. Report length change of specimens after periods of air drying after curing of 4, 7, 14, 21, and 28 days.

5. Average length change after 28 days shall be limited to 0.04%, unless otherwise accepted by Engineer. Values exceeding 0.04% shall be rejected.

L. Engineer's acceptance of mixture proportions shall not relieve Contractor from responsibility for any variation from requirements of Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at time of submission and Engineer has given written approval of each such variation.

M. Adjustment to Concrete Mixtures: Adjustments to mixture proportions may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mixture and strength results shall be submitted to and accepted by Engineer before using in work.

## 2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch plant-printed ticket information at delivery to site.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Provide plant-printed batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mixture identification number, date, time of batching, mixing time, quantity and details of materials, amount of water introduced and water permitted by plant to be added, if any.

C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## 2.8 MATERIAL ACCESSORIES

A. Extended Open Time Epoxy Bonding Agent: Three component, water based, epoxy modified portland cement bonding agent and corrosion inhibitor coating providing the recommended Manufacturer's open time in which to apply repair mortar. Product shall be capable of achieving bond strength of 2,700 psi per ASTM C 882.

1. Acceptable materials for this Work are:

    a. “Duralprep A.C.” by The Euclid Chemical Company, Cleveland, OH.
    b. “Sika Armatec 110 EpoCem”, by Sika Corporation, Lyndhurst, NJ.

B. Epoxy Adhesive: 2 or 3 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces. Product shall be capable of achieving bond strength of 1,800 psi per ASTM C 882.

1. Acceptable materials for this Work are:

    a. “MasterEmaco P 124” or “MasterEmaco ADH 326,” by Master Builders Solutions.
    b. “Kemko 001 or 008”, by ChemCo Systems, Inc., Redwood City, CA.
    c. “Dural #452 and Dural Series”, by The Euclid Chemical Company, Cleveland, OH.
    d. Sikadur 32 Hi-Mod LPL”, by Sika Corporation, Lyndhurst, NJ.

C. Epoxy Coating for Existing Exposed Non-prestressed Steel Reinforcement or Welded Wire Reinforcement:

1. Provide one of following epoxy coatings:

    a. “Sikadur 32 Hi-Mod,” Sika Chemical Corp.
    b. “MasterEmaco ADH 326,” Master Builders Solutions.
    c. “Scotchkote 413 PC,” 3M Company.
    d. “Dural 452 MV,” The Euclid Chemical Company.
    e. “Resi-Bond (J-58),” Dayton Superior Corporation.

D. For mechanical tension splices of reinforcement:

1. All splices to develop 125 percent of specified yield strength of bars, or of smaller bar in transition splices. Acceptable products:

    a. Bar-Lock Rebar Coupler, by Dayton Superior.
    b. Bar-Grip or Grip-Twist, by Barsplice Products, Inc.
    c. Extender HRC 500 Series Coupler, by Headed Reinforcement Corp.
    d. Splice Sleeve, by NMB.
    e. LENTON Splices, by Erico.

E. Compression splices: Mechanically coupled splices in accordance with ACI 318, Chapter 12.

F. Joint Fillers

1. Joint filler in slabs and curbs per ASTM D1751 Asphalt impregnated fiber board; as shown on Drawings. Acceptable products as follows:

    a. “Flexcell,” Knight-Celotex Corp.
    b. “Fibre Expansion Joint,” W.R. Meadows, Inc.

2. Joint filler used vertically to isolate walls from columns or other walls: White molded polystyrene bead board type.

3. Joint cover used to bridge gap between columns and grade walls, retaining walls, or basement walls: Minimum width: Gap width plus 4 in. For gaps over 3 in. wide, protect cover with protection board sized to span gap satisfactorily. Acceptable products:

   a. “Sealtight Premoulded Membrane Vapor Seal,” W.R. Meadows, Inc., Elgin, Illinois.
   b. “Sealtight Melgard,” W.R. Meadows, Inc., Elgin, Illinois and shall be applied according to manufacturer’s instructions.

## 2.9 TOOLS

A. Slab Jointing

1. Concrete groovers: For tooled joints in concrete:

   a. For concrete not exceeding 4 in. thickness, use groover with 1 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.
   b. For concrete exceeding 4 in. thickness, use groover with 1.5 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.

2. Saw Cut Joints:

   a. Prohibited. Joints shall be tooled in plastic concrete.

B. All joints subject to acceptance by sealant installer. Concrete contractor to rework rejected joints until acceptable to sealant installer.

# PART 3 - EXECUTION

## 3.1 PRECONSTRUCTION MEETING

A. Conduct a preconstruction meeting addressing the concrete preparation, installation, protection, quality control, and acceptance of Work.

## 3.2 FORMWORK

A. Design, construct, erect, shore, brace, and maintain formwork according to ACI 301 and ACI 347.

## 3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

## 3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Engineer.

C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint filler full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

## 3.5 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Do not add water to concrete during delivery, at Project site, or during placement.

C. Consolidate concrete with mechanical vibrating equipment.

D. Cold Weather Placement: Comply with ACI 306.1.

E. Hot Weather Placement: Comply with ACI 305 R.

## 3.6 FINISHING FORMED SURFACE.

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

1. Apply to concrete surfaces not exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

## 3.7 FINISHING FLOORS AND SLABS

A. Flatwork in Horizontal Areas (BROOM Finish, ACI 301, Section 5 header “Broom or Belt Finish”:

1. Bullfloat immediately after screeding. Complete before any excess moisture or bleed water is present on surface (ACI 302.1R, Article 8.3.3). The use of power trowels is discouraged; however, if they are used the following applies:

    a. Use minimal passes so as to not overwork the concrete.
    b. At the contractor’s expense a petrographic analysis will be required in each area where a power trowel is used to verify the air content at the slab surface is within specified limits.

2. After excess moisture or bleed water has disappeared and concrete has stiffened sufficiently to allow operation, give slab surfaces coarse transverse scored texture by drawing broom across surface. Texture shall be as accepted by Engineer from sample panels.
3. Finish tolerance: ACI 301, Paragraph 5.3.4.2 and ACI 117, paragraph 4.5.7: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 0.5 in. In addition, floor surface shall not vary more than plus or minus 0.75 in. from elevation noted on Drawings anywhere on floor surface.
4. Finish all concrete slabs to proper elevations to ensure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear cost of any corrections to provide for positive drainage.

B. Flatwork subject to pedestrian traffic:

1. Concrete surfaces at all walking areas subject to pedestrian traffic shall provide a smooth, slip resistant walking surface for pedestrians with these minimum requirements:

    a. Shall provide walking surfaces in accordance with ASTM – F 1637 Standard Practice for Safe Walking Surfaces and “2010 ADA Standards for Accessible Design” and ICC A117.1.
    b. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:

        1) Changes in level of less than ¼ inch in height may be without edge treatment as shown in ADA Figure 303.2 and on the Drawings.
        2) Changes in Level between ¼ inch and ½ inch height shall be beveled with a slope no greater than 1:2 as shown in ADA Figure 303.3 and on the Drawings.
        3) Changes in level greater than ½ inch in height are not permitted unless they can be transitioned by means of a ramp with minimum requirements shown on the Drawings.
        4) Openings in floor or ground surfaces shall not allow passage of a sphere more than ½ inch diameter except as allowed for elevators and platform lifts as shown in ADA Figure 302.3 and on the Drawings.

    c. Walkway surfaces shall provide a slip resistant surface.

1) Concrete surfaces shall be toweled and finished to provide a slip resistant finish.
2) Contractor shall provide sample area with slip resistant surface finish.
3) Static coefficient of friction for walking surfaces shall be measured on a dry surface by the NBS – Brungraber machine using a silastic sensor shoe and shall be 0.6 or larger for a level surface and 0.8 or larger for ramps.

## 3.8 TOLERANCES

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

## 3.9 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during placement. Keep concrete continually moist prior to final curing by evaporation retarder, misting, sprinkling, or using absorptive mat or fabric covering kept continually moist.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.1 lb/sq. ft. x h before and during finishing operations. Apply material according to manufacturer's written instructions one or more times after placement, screeding and bull floating concrete, but prior to float finishing. Repeated applications are prohibited after float finishing has begun.

1. Acceptable evaporation retarder materials for this Work are:

a. "Cimfilm", by Axim Concrete Technologies.
b. "MasterKure ER 50," by Master Builders Solutions.
c. "Aquafilm", by Conspec Marketing & Manufacturing Co., Inc.
d. "Sure-Film (J-74)', by Dayton Superior Corporation.
e. "Eucobar", or "Tamms Surface Retarder", by The Euclid Chemical Company, Cleveland, OH.
f. "E-Con", by L&M Construction Chemicals, Inc.
g. "EVRT", by Russ Tech Admixtures, Inc.
h. "SikaFilm", by Sika Corporation, Lyndhurst, NJ.

C. Immediate upon conclusion of finishing operation cure concrete in accordance with ACI 308 for duration of at least seven days by moisture curing or moisture retaining covering. Provide additional curing immediately following initial curing and before concrete has dried.

1. Continue method used in initial curing.
2. Material conforming to ASTM C171.
3. Other moisture retaining covering as approved by Engineer/Architect.

4. During initial and final curing periods maintain concrete above 50°.
5. Prevent rapid drying at end of curing period.

D. Concrete surfaces to receive slab coatings or penetrating sealers shall be cured with moisture curing or moisture-retaining cover**.**

E. Curing Methods: Cure formed and non-formed concrete moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

## 3.10 FIELD QUALITY CONTROL

A. Testing Agency**:** Owner shall engage a qualified independent testing and inspecting agency acceptable to the Engineer to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. Perform tests according to ACI 301.

B. Sample concrete in accordance with ASTM C 172.

C. Epoxy Coated Material:

1. Perform field inspection of installed epoxy coated material under provisions of Division 01 Section “Quality Control.”
2. Repair all epoxy coating damage due to fabrication and handling, using a mirror to find any damage on undersides.
3. Repair all damaged areas using manufacturer’s recommended patching material and method.
4. No damaged area shall be left uncorrected.
5. Epoxy coated welded wire reinforcement with consistent visible holes in epoxy coating (particularly at mesh intersections): unacceptable. Remove from project.

D. Temperature:

1. Test temperature of concrete in accordance with ASTM C 1064/C 1064M and ACI 301 each time cylinders are taken or as directed by the Engineer.

E. Slump Test:

1. Conduct one slump test in accordance with ASTM C 143/C 143M per truck load of ready-mixed concrete delivered to Project at truck for superstructure concrete.
2. Conduct slump test in accordance with ASTM C143/C 143M and ACI 301 for foundation concrete.
3. When high-range water-reducing admixture (superplasticizer) is used, initial slump must be verified by Testing Agency.

F. Water Content:

1. Water content or water-cementitious materials ratio shall be verified by use of the Microwave Test in accordance with AASHTO T 318.
2. Conduct test each time test cylinders are taken and as directed by Engineer.

G. Air Content:

1. General Contractor: Coordinate all parties involved to produce conforming concrete.
2. Sample freshly-mixed concrete at point of final placement in accordance with ASTM C 172 and conduct one air content test in accordance with ASTM C 231 or ASTM C 173 for each truck of ready-mix, air entrained concrete delivered to Project.

H. Concrete Compressive Strength:

1. Make test cylinders in accordance with ASTM C 31 and test in accordance with ASTM C 39 as follows:

    a. Take minimum of three sets of cylinders for each 100 cu yds. or fraction thereof, of each Mixture of concrete placed in any one day.
    b. A set of cylinders shall be comprised of two 6 inch by 12 inch cylinders or three 4 inch by 8 inch cylinders.
    c. At Contractor’s option and cost, cylinders may be taken to verify concrete strength prior to form removal.
    d. Testing Agency: Provide and maintain site cure box for cylinders.

2. Sample plastic concrete for testing at point of final placement, in accordance with ASTM C 172. Engineer will select sampling locations which may include points where plastic concrete has already been screeded and floated. Sample concrete for test cylinders to be used to verify concrete compressive strength for post-tensioning as near as possible to actual tendon anchorages.
3. Cover specimens properly, immediately after finishing. Protect outside surfaces of cardboard molds, if used, from contact with sources of water for first 24 hours after molding.
4. Cure test cylinders per ASTM C 31 as follows:

    a. To verify compressive strength prior to form removal or for additional test cylinders required due to cold weather concreting conditions:

1) Store test specimens on structure as near to point of sampling as possible and protect from elements in same manner as that given to portion of structure as specimen represents.
2) Transport to test laboratory no more than 4 hours before testing. Remove molds from specimens immediately before testing.

b. To verify 28-day compressive strength:

1) During first 24 hours after molding, store test specimens under conditions that maintain temperature immediately adjacent to specimens in range of 60 to 80 degrees F. and prevent loss of moisture from specimens.
2) Remove test specimens from molds at end of 20 +/- 4 hours and store in moist condition at 73.4 +/- 3 degrees F. until moment of test. Laboratory moist rooms shall meet requirements of ASTM C 511.

5. Compression test for non-prestressed concrete:

a. Test one set of cylinders at 7 days.
b. Test one set of cylinders at 28 days.
c. Test one set of cylinders at 56 days for concrete strength requirement of 7000 psi or greater.

6. Hold one set of cylinders in reserve for use as Engineer directs.
7. Unless notified by Engineer, reserve cylinders may be discarded without being tested after 56 days.

I. Report all nonconforming test results to Engineer and others on distribution lists via fax or email. Follow up with colored paper copies to flag the non-conformances.

J. Monthly, submit a graph showing distribution of compressive strength test results and air content test results. Include microwave test results for concretes with a water cementitious ratio less than or equal to 0.40 concrete.

## 3.11 EVALUATION AND ACCEPTANCE OF WORK

A. Acceptance of Repairs (ACI 301):

1. Acceptance of completed concrete Work will be according to provisions of ACI 301.
2. Repair areas shall be sounded by Engineer and Contractor with hammer or rod after curing for 72 hours. Contractor shall repair all hollowness detected by removing and replacing patch or affected area at no extra cost to Owner.
3. If shrinkage cracks appear in repair area when initial curing period is completed, repair shall be considered defective, and it shall be removed and replaced by Contractor at no extra cost.

## 3.12 CONCRETE MIX DESIGN FORM

A. See appendix to this Section for concrete mix design form.

**END OF SECTION 03 30 21**

**APPENDIX: Concrete Mix Design Submittal Form**

| I. GENERAL INFORMATION | |
|---|---|
| Project: | City: |
| General Contractor: | |
| Concrete Supplier: | |
| Mixture Identification No.: | Concrete Grade: |
| Use (Describe)[1]: | |

[1] example: floor slabs, topping, columns, etc.

| II. MIXTURE PROPORTIONING DATA | | |
|---|---|---|
| Proportioning Based on (Check only one):<br>Standard Deviation Analysis: _____<br>or Trial Mix Test Data: _____ | | |
| Mixture Characteristics: (see Mixtures in Drawings General Notes) | Density: pcf; | Air: % specified |
| | Slump _____ in. before superplasticizer | Slump ____ in. after superplasticizer<br>Or<br>for SCC: Spread _____ in. |
| | Strength: _____ psi (28 day); | |

WALKER SUBMITTAL STAMP _____

CONTRACTOR SUBMITTAL STAMP _____

| III. MATERIALS | | |
|---|---|---|
| Aggregates: (size; type; source; gradation report; specification) | | |
| Coarse: | | |
| Fine: | | |
| Other Materials: | TYPE | PRODUCT-MANUFACTURER (SOURCE) |
| Cement: | | |
| Flyash, slag, or other pozzolan: | | |
| Silica Fume | | |
| Processed Ultra Fine Fly Ash | | |
| HRM | | |
| Air Entraining Agent: | | |
| Water Reducer | | |
| High Range Water Reducer (HRWR / superplasticizer) | | |
| Non-Corrosive Accelerator | | |
| Retarder | | |
| Fibers | | |
| Other(s): | | |

| IV. MIX PROPORTIONS (2) | | |
|---|---|---|
| | WEIGHT (lbs.) (per $yd^3$) | ABSOLUTE VOL. (cu. ft.) (per $yd^3$) |
| Cement: | | |
| Fine Aggregate: (3) | | |
| Coarse Aggregate: (3) | | |
| Flyash, slag, or other pozzolan: | | |
| Silica Fume | | |
| Processes Ultra-Fine Fly Ash | | |
| HRM | | |
| Water: (.4) (gals. & lbs.) | | |
| Entrained Air: (oz.) | | |
| Fibers: | | |
| (Other) _____: | | |

| TOTALS: | | |
|---|---|---|

NOTES:
(2) Mix proportions indicated shall be based on data used in section VII or IX.
(3) Based on saturated surface dry weights of aggregates.
(4) Includes ALL WATER, including added water and free water contained on aggregates.

| V. RATIOS | | | | VI. SPECIFIC GRAVITIES |
|---|---|---|---|---|
| Water[1] | = | lb. | = | Fine Aggregate: |
| Cementitious Material[2] | | lb. | | Coarse Aggregate: |
| Fine Aggregate | = | lb. | = | |
| Total Aggregate | | lb. | | |

NOTES:
(1) Includes ALL water, including added water and free water contained on aggregates.
(2) Cementitious materials include cement, fly ash, slag, silica fume, HRM, Processed Ultra-Fine Fly Ash or other pozzolan.

| VII. ADMIXTURES | | | | |
|---|---|---|---|---|
| Air Entraining Agent (A.E.A.): | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Superplasticizer | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Water Reducer | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Non-corrosive Accelerator | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Retarder | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Other | _____ oz. | per $yd^3$ | ____ oz. | per 100# cement |
| Lithium Nitrate | _____ gal. | per $yd^3$ | | |

| VIII. STANDARD DEVIATION ANALYSIS: | Yes | N/A |
|---|---|---|
| (Complete this section only if Mixture was developed using standard deviation analysis of previous project test results. If other method was used, check "N/A".) | | |
| Number of Tests Evaluated:<br>(One test is average of two cylinder breaks)<br><br>Attach copy of test data considered: | Standard Deviation:<br>(Single Group)<br><br>Standard Deviation:<br>(Two Groups) | |
| Required average compressive strength: f'cr = f'c + _____ psi | | |

NOTE:
Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'cr equal to or greater than the larger of one of the following equations:

(4.-3) f'cr = f'c + 1.34ks [s= calculated standard deviation]
or
(4-4) f'cr = f'c + 2.33ks – 500
or
(4-5) f'cr = 0.9f'c + 2.33ks (for f'c> 5,000 psi)

(Refer to ACI 301 for required average when data are not available to establish standard deviation. For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.)

| MIXTURE CHARACTERISTICS (As shown on drawings) | |
|---|---|
| Slump = _____ in. | Air Content =_____ % |
| Unit Wet Wt. = _____ pcf | Unit Dry Wt. = _____ pcf |

| MIXTURE CHARACTERISTICS (Based on proportioning data) | |
|---|---|
| Initial Slump = _____ in. | Final Slump _____ in. |
| Unit Wet Wt.= _____ pcf. | Unit Dry Wt. = _____ pcf. |
| Air Content = _____ % | |

| IX. TRIAL MIXTURE TEST DATA: | | Yes | N/A |
|---|---|---|---|
| (Complete this section only if Mixture Proportion is based on data from trial test mixture(s) batched by testing agency or Contractor. If other method was used, check "N/A".) | | | |
| Age (days) | Mix #1 (comp. str.) | Mix #2 (comp. str.) | Mix #3 (comp. str.) |
| 7 | | | |
| 7 | | | |
| 28 | | | |
| 28 | | | |
| 28 | | | |
| 28 day average compressive strength, psi | | | |

NOTE:
Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'cr equal to or greater than the larger of one of the following equations:

(Less than 3000) f'cr = f'c + 1000
or
(3000 to 5000) f'cr = f'c + 1200
or
(Over 5000) f'cr = 1.1f'c + 700

For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.

| MIXTURE CHARACTERISTICS (as shown on drawings) | |
|---|---|
| Slump = _____ in. | Air Content = _____ % |
| Unit Wet Wt. = _____ pcf | Unit Dry Wt. = _____ pcf |

| MIXTURE CHARACTERISTICS (Based on proportioning data) | |
|---|---|
| Initial Slump = _____ in. | Final Slump _____ in. |
| Unit Wet Wt.= _____ pcf. | Unit Dry Wt. = _____ pcf. |
| Air Content = _____ % | |

| X. OTHER TEST DATA | | |
|---|---|---|
| Water Soluble Chloride Ion Content of mix: | _____ %(by weight of cement) | ASTM C 1218 |
| Hardened Air Content (per ASTM C457): | | |
| Air content: _____% | Air void spacing Factor _____in. | Specific surface: ___$in^2/in^3$ |
| Chloride Ion Content of Concrete Mixture: ASTM C 1218 | | |
| Shrinkage (Length Change, Average) per ASTM C157: | | |
| _____% @ 4 days | _____% @ 7 days | _____% @ 14 days |
| _____% @21 days | _____% @28 days | |

| XI. Remarks: |
|---|
| |
| |
| |

| Ready Mix Concrete Supplier Information |
|---|
| Name: |
| Address: |
| |
| Phone Number: |
| Date: |
| Main Plant Location: |
| Miles from Project Site: |
| Secondary or Backup Plant Location: |
| Miles from Project Site: |

My signature below certifies that I have read, understood, and will comply with the requirements of this Section.

Signature _____

Typed or Printed Name _____

| REQUIRED ATTACHMENTS | |
|---|---|
| | Coarse aggregate grading report |
| | Fine aggregate grading report |
| | Concrete compressive strength data used for calculation of required average strength and for calculation of standard deviation |
| | Chloride ion data and related calculations |
| | Admixture compatibility certification letter |
| | Shrinkage information per ASTM C157 |
| | ASTM C 457 |
| | Alkali Content Data and Calculations<br>OR<br>ASTM C1293, ASTM C1260, ASTM C 1567 or CE CRD-C662 Test report for each aggregate |

# SECTION 03 37 13 - SHOTCRETE

## 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

B. This Section includes shotcrete applied by the dry-mix or wet-mix process.

C. This Section includes the provision of all labor, materials, supervision and incidentals necessary to install shotcrete to horizontal, vertical and overhead surfaces to restore original surface condition and integrity.

### 1.3 DEFINITIONS

D. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.

E. Dry-Mix Shotcrete: Shotcrete with most of the water added at nozzle.

F. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

### 1.4 PREINSTALLATION MEETINGS

G. Preinstallation Conference: Conduct conference at project site.

1. Require representatives of each entity directly concerned with shotcrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for shotcrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Shotcrete Installer.

2. Review methods and procedures related to shotcrete, but not limited to, the following:

    a. Qualification data, equipment, and facilities needed to make progress and avoid delays.
    b. Shotcrete finishes and finishing.
    c. Cold- and hot-weather shotcreting procedures.
    d. Curing procedures

e. Construction joints.
f. Forms and form-removal limitations.
g. Reinforcement accessory installation.
h. Shotcrete repair procedures.
i. Protection of shotcrete.

3. Before submitting design mixtures, review each shotcrete design mixture and examine procedures for ensuring quality of shotcrete materials.

## 1.5 SUBMITTALS

A. Product Data: For manufactured materials and products including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.

B. Shop Drawings: For details of fabricating, bending, and placing reinforcement. Include support and anchor details, number and location of splices, and special reinforcement required for openings through shotcrete structures.

C. Samples: Approximately 24 by 24 by 2 inches (600 by 600 by 50 mm), to illustrate quality of finishes, colors, and textures of exposed surfaces of shotcrete.

D. Design Mixes: For each shotcrete mix. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.

E. Material Test Reports: For shotcrete materials.

F. Material Certificates: For each material item, signed by manufacturers.

1. Cementitious materials.
2. Admixtures.
3. Form materials.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds

## 1.6 QUALITY ASSURANCE

G. Installer Qualifications: Shotcrete contractor shall have a minimum of three (3) years experience in the application performed. All Nozzlemen to perform work shall have a current ACI / ASA Nozzlemen Certification. A qualified installer employing nozzle

operators who attain mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests.

H. Testing Agency Qualifications: Independent and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548, and acceptable to authorities having jurisdiction.

I. Comply with provisions of the following, unless more stringent requirements are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 506.2, "Specification for Shotcrete."
3. CRSI's "Manual of Standard Practice."

J. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing and inspections indicated below:

1. Produce test panels before shotcrete placement according to requirements in ACI 506.2 and ASTM C 1140 for each design mix, shooting orientation, and nozzle operator. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 3-1/2 inches (90 mm). From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced. Agency will perform the following:

a. Test each set of unreinforced specimens for compressive strength according to ASTM C 42.
b. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

K. Mockups: Before installing shotcrete, construct mockups for each finish required and for each design mix, shooting orientation, and nozzle operator to demonstrate aesthetic effects and set quality standard for installation.

1. Mockups may be performed at inconspicuous location and if approved, incorporated into the final work.
2. Remove and replace rejected mockups at no additional cost.

## 1.7 PROJECT CONDITIONS

L. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:

1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C).
2. Do not use frozen materials or materials containing ice or snow.

3. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
4. Do not use calcium chloride, salt, and other materials containing antifreeze agents.

M. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 100 deg F (38 deg C) for dry mix or 90 deg F (32 deg C) for wet mix.
2. Decrease temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS

A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practicable sizes to minimize number of joints.

### 2.2 REINFORCING MATERIALS

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

B. Plain-Steel Wire: ASTM A 82, galvanized.

C. Plain-Steel-Welded Wire Reinforcement: ASTM A 1064, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel-Welded Wire Reinforcement: ASTM A 1064, flat sheet.

E. Supports: Bolsters, chairs, spacers, ties, and other devices for spacing, supporting, and fastening reinforcing steel in place according to CRSI's "Manual of Standard Practice" and as follows:

1. For uncoated reinforcement, use all-plastic bar supports.

### 2.3 SHOTCRETE MATERIALS

A. Shotcrete Cement and Blended Cements

1. Portland Cement: ASTM C 150, Type I, I/II, or III. Use only one brand and type of cement for Project. Select supplementary cementing materials from subparagraphs below, if permitted. Blending of fly ash, slag, silica fume with Portland cement is done at ready-mix plant.
2. Fly Ash: ASTM C 618, Class F. Class C fly ash prohibited.
3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

4. Blended Hydraulic Cement: ASTM C 595, Type IS cement.
5. Silica Fume: ASTM C 1240, amorphous silica.

B. Blending is done at cement plant. If Contractor may choose either Portland cement with supplementary materials, verify availability and types of cements to be compatible or use blended shotcrete cement.

C. Acceptable Blended Shotcrete Cement

1. Gun-Rite Cement: JE Tomes, Blue Island, IL

D. Normal-Weight Aggregates: ASTM C 33, from a single source, and as follows:

1. Aggregate Gradation: ACI 506R, Gradation No. 3 with 100 percent passing 3/4-inch (19-mm) sieve.
2. Coarse-Aggregate Class: 3S.

E. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored, water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by Engineer from manufacturer's full range to match color of existing adjacent surfaces.

F. Water: Potable, complying with ASTM C 94, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.

G. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in shotcrete, complying with ASTM C 1116, Type III, not less than 3/4 inch (19 mm) long.

H. Ground Wire: High-strength steel wire, 0.8 to 1 mm in diameter.

## 2.4 CHEMICAL ADMIXTURES

A. General: ASTM C 1141, Class A or B, but limited to the following admixture materials. Provide admixtures for dry-mix or wet-mix shotcrete that contains not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
6. Accelerating Admixture: ASTM C 494, Type C.

B. Blended Admixture

1. Gun-Rite HP, JE Tomes, Blue Island, IL

2. Other types may be used only with Engineer's approval in writing prior to bidding.

## 2.5 SHOTCRETE MIXES, GENERAL

A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties

B. Prepare design mixes for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.

1. Limit use of fly ash, ground granulated blast-furnace slag and silica fume to not exceed, in combination, 25 percent of portland cement by weight.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.

D. Admixtures: When included in shotcrete design mixes, use admixtures and retarding admixtures according to manufacturer's written instructions.

E. Synthetic Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions.

F. Design-Mix Adjustments: Subject to compliance with requirements, shotcrete design-mix adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

## 2.6 NORMAL-WEIGHT SHOTCRETE MIXES

A. Proportion dry mixes by field test data methods and wet mixes according to ACI 211.1 and ACI 301, using materials to be used on Project, to provide normal-weight shotcrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight, wet-mix shotcrete having an air content before pumping of 7 percent with a tolerance of plus or minus 1-1/2 percent.

B. Acceptable pre-packaged fiber reinforced shotcrete mixes:

1. “Eucoshot F”, (Dry or Wet Method) by The Euclid Chemical Company, Cleveland, OH.
2. “Gun-Rite 5000” (Wet Method), by JE Tomes & Associates, Blue Island, IL.
3. “Gun-Rite HP”, (Wet Method), by JE Tomes & Associates, Blue Island, IL.
4. “Gun-Rite DS-1”, (Dry Method) by JE Tomes & Associates, Blue Island, IL.
5. “MS-D1 Shotcrete”, (Dry Method), by King Packaged Materials Company, Burlington, ON.

6. “MasterEmaco S 211 SP”, (Dry or Wet Method), by Master Builders Solutions, Shakopee, MN.
7. “Sikacem 103F”, (Dry or Wet Method) by Sika Corporation, Lyndhurst, NJ.
8. “Sikacem 133F”, (Dry Method) by Sika Corporation, Lyndhurst, NJ.
9. Other types may be used only with Engineer's approval in writing prior to bidding.

## 2.7 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.

1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
2. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.

C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

## 2.8 BATCHING AND MIXING

A. Dry-Mix Process: Measure mix proportions by weight batching according to ASTM C 94 or by volume batching complying with ASTM C 685 requirements.

1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
2. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.

B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information if ready mix is used.

1. Comply with ASTM C 685 when shotcrete ingredients are delivered dry and proportioned and mixed on-site.
2. Prepackaged shotcrete materials may be used at Contractor's option.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Concrete or Masonry: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before shotcreting.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces before shotcreting.

C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding.

D. Steel: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

## 3.2 FORMS

A. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.

1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.

B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.

## 3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.

C. Securely embed reinforcing anchors into existing substrates, located as required.

D. Accurately position, support, and rigidly secure reinforcement against displacement by formwork, construction, or shotcreting. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.

E. Place reinforcement to obtain minimum coverages for shotcrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during shotcreting. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

F. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

## 3.4 JOINTS

A. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints, unless otherwise indicated.

B. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide-by-1/3 slab depth or premolded plastic, hardboard, or fiberboard strip inserts 1/4-inch- (6-mm-) wide-by-1/3 shotcrete depth, unless otherwise indicated.

1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
2. Space joints at 10 feet o.c. horizontally and vertically.
3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.

## 3.5 ALIGNMENT CONTROL

A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

## 3.6 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

## 3.7 APPLICATION

A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.

B. Moisten wood forms immediately before placing shotcrete where form coatings are not used.

C. Apply shotcrete according to ACI 506.2.

D. Apply dry-mix shotcrete materials within 45 minutes after predampening and wet-mix shotcrete materials within 90 minutes after batching.

E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.

1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
2. Remove and dispose of cuttings during the trimming or rodding process to prevent unconsolidated material from falling onto lower reinforcement.

F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray and prevent build-up against front face during shotcreting.

G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.

H. Do not permit shotcrete to sag, slough, or dislodge.

I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.

J. Do not disturb shotcrete surfaces before beginning finishing operations.

K. Remove ground wires or other alignment control devices after shotcrete placement.

L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.

M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117R, increased by a factor of 2.

## 3.8 SURFACE FINISHES

A. Finish Coat: After screeding to natural rod finish, apply shotcrete finish coat, 1/4 to 1 inch (6 to 25 mm) thick, using ACI 506R, No. 1 gradation, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve and apply steel-trowel, smooth, hard finish.

## 3.9 CURING

A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.

B. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing.

C. Curing Exposed Surfaces: Cure shotcrete by the following methods:

1. Moisture Curing: Keep surfaces continuously moist for at least seven days with water, continuous water-fog spray, water-saturated absorptive covers, or moisture-retaining covers. Lap and seal sides and ends of covers.
2. Curing Compound: Apply curing compound uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Apply curing compound to natural- or gun-finished shotcrete at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).

D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

## 3.10 FORM REMOVAL

A. Forms not supporting weight of shotcrete may be removed after curing at not less than 50 deg F (10 deg C) for 24 consecutive hours after gunning, provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.

1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

## 3.11 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.

B. Air Content: ASTM C 173, volumetric method or ASTM C 231, pressure method; 1 test for each compressive-strength test for each mix of air-entrained, wet-mix shotcrete measured before pumping.

C. Shotcrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and 1 test for each set of compressive-strength specimens.

D. In-Place Shotcrete: Take a set of 3 unreinforced cores for each mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement.

E. Strength of shotcrete will be considered satisfactory when mean compressive strength of each set of 3 unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.

1. Mean compressive strength of each set of 3 unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

F. Shotcrete will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

## 3.12 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces and apply new shotcrete.

B. Repair core holes from in-place testing according to repair provisions in ACI 301 and match adjacent finish, texture, and color.

## 3.13 CLEANING

A. Remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

**END OF SECTION 03 37 13**

# SECTION 03 37 60 – PREPACKAGED REPAIR MORTAR

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the provision of all labor, materials, supervision and incidentals necessary to prepare deteriorated or damaged concrete surfaces and install prepackaged concrete repair mortar to formed horizontal, vertical and overhead surfaces to restore original surface condition and integrity.

### 1.3 QUALITY ASSURANCE

A. Work shall conform to requirements of ACI 301 as applicable except where more stringent requirements are shown on Drawings or specified in this Section.

B. Testing Agency:

1. Independent testing laboratory employed by Owner and acceptable to Engineer.
2. Accredited by AASHTO under ASTM C1077. Testing laboratory shall submit documented proof of ability to perform required tests.

C. Sampling and testing of mortar shall be performed by ACI certified Concrete Field Technicians Grade I. Certification shall be no more than three years old.

D. Testing Agency is responsible for conducting, monitoring and reporting results of all tests required under this Section. Testing Agency has authority to reject mortar not meeting Specifications. Testing Agency does not have the authority to accept mortar that does not meet specifications.

E. Testing Agency shall submit the following information for Field Testing of Concrete unless modified in writing by Engineer:

1. Project name and location.
2. Contractor's name.
3. Testing Agency's name, address and phone number.
4. Mortar manufacturer.
5. Date of report.
6. Testing Agency technician's name (sampling and testing).
7. Placement location within structure.
8. Weather data:

a. Air temperatures.
b. Weather.
c. Wind speed.

9. Date, time, and place of test.
10. Compressive test data:

a. Cube or cylinder number.
b. Age of sample when tested.
c. Date and time of test.
d. Compressive strength.

## 1.4 REFERENCES

A. "Standard Specification for Structural Concrete" (ACI 301) by American Concrete Institute, herein referred to as ACI 301, is included in total as specification for this structure except as otherwise specified herein.

B. Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown on Drawings or specified herein:

1. "Building Code Requirements for Structural Concrete" (ACI 318), American Concrete Institute, herein referred to as ACI 318.
2. "Specification for Hot Weather Concreting," ACI 305.1.
3. "Standard Specification for Cold Weather Concreting," ACI 306.1.
4. “Standard Specification for Curing Concrete” (ACI 308.1)

C. Contractor shall have following ACI publications at Project construction site at all times:

1. "Standard Specifications for Structural Concrete (ACI 301) with Selected ACI and ASTM References," ACI Field Reference Manual, SP15.
2. "Specification for Hot Weather Concreting," ACI 305.1.
3. "Standard Specification for Cold Weather Concreting," ACI 306.1.

D. ASTM International (ASTM):

1. ASTM C109, "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)."
2. ASTM C31, “Test Method for Compressive Strength of Cylindrical Concrete Specimens.”
3. ASTM C1583, “Standard Test Method for the Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)”

## 1.5 SUBMITTALS

A. Make submittals in accordance with requirements of Division 01 and as specified in this Section.

B. Contractor: At preconstruction meeting, submit procedures for demolition, surface preparation, material batching, placement, finishing, and curing of application. Provide procedure to protect fresh patches from severe weather conditions.

C. Testing Agency: Promptly report all mortar test results to Engineer and Contractor. Include following information:

1. See Article "Quality Assurance," paragraph "Testing Agency shall submit...."
2. Strength determined in accordance with ASTM C109.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of following, only where specifically named in product category:

1. Master Builders Solutions (MBS), Shakopee, MN
2. Euclid Chemical Corporation (Euclid), Cleveland, OH
3. King Construction Products (King), Burlington, ON
4. Mapei Corporation (MAPEI), Deerfield Beach, FL
5. Sika Corporation (Sika), Lyndhurst, NJ.
6. J.E. Tomes (Tomes), Blue Island, IL

### 2.2 MATERIALS

A. Horizontal Repair and Form and Pour Mortar: Shall be prepackaged cementitious repair mortar capable of horizontal and form and pour partial depth applications**,** achieving a minimum 3,000 psi compressive strength at 7 days and 5,000 psi compressive strength at 28 days per ASTM C39 as certified by manufacturer with maximum lineal shrinkage of 0.10% at 28 days. Extend per manufacturer’s instructions as required for deeper placements.

1. Acceptable cementitious repair materials for this Work are as follows:

a. “MasterEmaco S440/SikaEmaco 440,” by MBS/Sika.
b. “Eucocrete,” by Euclid.
c. “FA-S10 Concrete,” by King.
d. “Planitop 11,” by MAPEI.
e. “Sikacrete 211,” by Sika.
f. Other types may be used only with Engineer's approval in writing prior to bidding.

B. Rapid Strength Repair Mortar: Shall be prepackaged, cementitious repair mortar. Repair mortar shall be capable of application achieving a minimum 3,500 psi compressive strength at 1 day and 5,000 psi compressive strength at 28 days per ASTM C39 as

certified by manufacturer. Extend per manufacturer's instructions as required for deeper placements.

1. Acceptable materials for this Work are as follows:

    a. "MasterEmaco T430/SikaEmaco 430 Arctic," by MBS/Sika .
    b. "Speedcrete 2028," by Euclid.
    c. "HP-S10 Concrete," by King.
    d. "Planitop 18 ES" by MAPEI.
    e. "Sikaquick 1000," by Sika.
    f. "Aprisa P-80," by Tomes.
    g. Other types may be used only with Engineer's approval in writing prior to bidding.

C. Trowel Applied Repair Mortar (not allowed for structural repairs, only allowed for minor repairs of honey-combing, bugholes, etc.): Shall be prepackaged, cementitious repair mortar capable of vertical/overhead application by trowel achieving a minimum 3,000 psi compressive strength at 7 days and 4,500 psi compressive strength at 28 days per ASTM C 109 as certified by manufacturer.

1. Acceptable materials for this Work are as follows:

    a. "MasterEmaco N425/SikaEmaco 425 Gel Patch," by MBS/Sika.
    b. "Verticoat Supreme," by Euclid.
    c. "Super-Top," by King.
    d. "Planitop XS," by MAPEI
    e. "Sikaquick VOH," by Sika.
    f. "CT-40 Do All Mortar," by Tomes.
    g. Other types may be used only with Engineer's approval in writing prior to bidding.

## 2.3 MATERIAL ACCESSORIES

A. Extended Open Time Epoxy Bonding Agent: Three component, water based, epoxy modified portland cement bonding agent and corrosion inhibitor coating providing the recommended Manufacturer's open time in which to apply repair mortar.

1. Acceptable materials for this Work are:

    a. "MasterEmaco P124," by MBS.
    b. "Duralprep A.C.," by Euclid.
    c. "Planibond 3C," by MAPEI.
    d. "Armatec 110 EpoCem", by Sika.
    e. "B-1 Rebar Coating," by Tomes.

B. Bonding Grout: Bonding grout shall consist of prepackage repair material mixed with sufficient water to form stiff slurry to achieve consistency of "pancake batter."

C. Clear, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

D. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Extended Open Time Epoxy Bonding Agent**:**

1. In strict accordance with manufacturer's recommendations, mix and apply epoxy bonding agent to all areas as indicated on Drawings**.**
2. Allow epoxy bonding agent to dry a minimum 2 hours, but no more than the Manufacturer's recommended open time prior to placing repair mortar.

B. Bonding Grout:

1. Mix bonding grout and scrub into SSD repair substrate with a stiff broom to all areas as indicated on Drawings.
2. Place repair material prior to initial set of grout. If grout sets prior to placement of repair material, complete remove grout from surface and re-clean prior to proceeding with new grout placement and repair mortar.

C. Mortar Placement: Mortar materials shall be placed in strict accordance with manufacturer's instructions. Properly proportioned and mixed mortar material shall be placed using tools to consolidate mortar so that no voids exist within new material and continuous contact with base concrete is achieved.

D. Form and Pour Repair Mortar Placement: Mix and apply in strict accordance with manufacturer's written instructions, to achieve a maximum 9" slump. Consolidate mortar so that no voids exist and continuous contact with base concrete is achieved.

E. Vertical and Overhead Repairs: Mortar materials shall be placed in strict accordance with manufacturer's instructions. Properly proportioned and mixed mortar material shall be placed using tools to consolidate mortar so that no voids exist within new material and continuous contact with base concrete is achieved. Supplemental wire mesh shall be required for delamination and spall repairs greater than two inches in depth. Fresh bonding grout is required between successive lifts of patching material.

F. Finishing:

1. Apply a nonslip broom finish to top of floor patches and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Provide a surface finish similar to adjacent surfaces for vertical and overhead partial depth repairs.
3. Finish formed surfaces similar to adjacent surfaces.

## 3.2 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during placement. Keep concrete continually moist prior to final curing by evaporation retarder, misting, sprinkling, or using absorptive mat or fabric covering kept continually moist.

B. Immediate upon conclusion of finishing operation cure concrete in accordance with ACI 308.1 for duration of at least seven days by curing methods listed below. Provide additional curing immediately following initial curing and before concrete has dried.

1. During initial and final curing periods maintain concrete above 50°.
2. Prevent rapid drying at end of curing period.

C. Concrete surfaces to receive slab coatings or penetrating sealers shall be cured with moisture curing or moisture-retaining-cover curing.

D. Curing Methods: Cure formed and non-formed concrete moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing compound: Apply curing compound in accordance with manufacturer’s instructions.

## 3.3 FIELD QUALITY CONTROL

A. Testing Agency**:** Owner shall engage a qualified independent testing and inspecting agency acceptable to the Engineer to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. Perform tests according to ACI 301.

B. Testing Frequency: Perform one set of strength testing and one bond test for each product used for each day's work. Prepare samples in accordance with ASTM C31.

C. Compressive Strength Testing: Determine strength at 7 and 28 days. Each test shall consist of two 6-inch diameter cylinders or three 4-inch diameter cylinders. Testing shall be in accordance with ASTM C39.

D. Bond Testing: Bond testing shall be performed at 7 days in accordance with ASTM C1583.

## 3.4 EVALUATION AND ACCEPTANCE OF WORK

A. Acceptance of Repairs (ACI 301):

1. Acceptance of completed concrete Work will be according to provisions of ACI 301.
2. Repair areas shall be sounded by Engineer and Contractor with hammer or rod after curing for 72 hours. Contractor shall repair all hollowness detected by removing and replacing patch or affected area at no extra cost to Owner.
3. If shrinkage cracks appear in repair area when initial curing period is completed, repair shall be considered defective, and it shall be removed and replaced by Contractor at no extra cost.
4. Patches shall be considered defective if average strength does not meet minimum strength at 28 days or if average bond strength does not meet minimum requirements of 150 psi.

**END OF SECTION 03 37 60**

# SECTION 07 18 00 – TRAFFIC COATINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. A single installer shall be responsible for providing complete waterproofing system, including all products specified in Division 07 Sections.

B. This Section includes traffic coating: Fluid-applied, waterproofing, traffic-bearing elastomeric membrane with integral wearing surface.

C. Materials shall be compatible with other materials or related Work with which the traffic coating will come into contact, and with materials covered by this Section.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Distribute reviewed submittals to all others whose Work is related.

B. Pre-installation Conference: Meet at project site well in advance of time scheduled for Work to proceed to review requirements for Work and conditions that could interfere with successful coating performance. Require every party concerned with coating Work, or required to coordinate with it or protect it thereafter, to attend. Include manufacturer's technical representative and warranty officer.

C. Make submittals in accordance with requirements of Division 01 Sections.

D. Submittals and Resubmittals: Engineer will review each of Contractor’s shop drawings and/or submittal data initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/ corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including cost of Engineer’s services made necessary to review such additional resubmittals. Owner shall in turn reimburse Engineer.

E. Requests For Information

1. Engineer reserves right to reject, unprocessed, any Request for Information (RFI) that Engineer, at its sole discretion, deems frivolous and/or deems already answered in the Contract Documents.
2. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in Contract documents.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each system indicated, submit the following at least 60 days prior to application.

1. Product description, technical data, appropriate applications and limitations.
2. Primer type and application rate
3. Material, and wet mils required to obtain specified dry thickness for each coat.
4. Type, gradation and aggregate loading required within each coat, if applicable.

B. Samples:

1. One stepped sample showing each component for each system indicated. **Obtain Owner/Engineer's approval of finished product sample prior to start of Work**.
2. Install mockups for approval to match approved samples prior to start of full-scale operations.

## 1.5 INFORMATION SUBMITTALS

A. Certificates

1. Certification that products and installation comply with applicable federal, state where project is located, and local EPA, OSHA and VOC requirements regarding health and safety hazards where project is located.
2. Evidence of applicator's being certified by manufacturer. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.
3. Certification from Manufacturer that finishes as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive traffic coating.
4. Certification stating materials have been tested and listed for UL 790 Class "A" rated materials/system by UL for traffic coating application specified on project. Containers shall bear UL labels.
5. Certification from manufacturer confirming compatibility with existing underlying coatings and/or substrate.

B. Manufacturer's Instructions: for each system indicated.

1. Crack treatment and surface preparation method and acceptance criteria.
2. Method of application of each coat.
3. Maximum and minimum application temperatures.
4. Maximum and minimum allowable times between coats.

5. Final cure time before resumption of foot traffic, parking and/or paint striping.
6. Any other special instructions required to ensure proper installation.

C. Field Quality Control:

1. Quality Control Plan as defined in Part 3.
2. Copy of manufacturer's technical representative's log for each visit.
3. Testing agency field reports.

D. Qualification Statements

1. Manufacturer’s qualifications as defined in “Quality Assurance” article.
2. Installer’s qualifications as defined in “Quality Assurance” article.
3. Signed statement from applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

E. Sample Warranty: For each system indicated.

1. Submit manufacturers sample warranty which meets the requirements of the specified warranty terms and conditions.

## 1.6 CLOSEOUT SUBMITTALS

A. Three copies of System Maintenance Manual.

B. Snow removal guidelines for areas covered by Warranty.

C. Final executed Warranty.

## 1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
2. Evidence of financial stability acceptable to Engineer/Architect.
3. Listing of 20 or more projects completed with submitted system, to include:

    a. Name and location of project.
    b. Type of system applied.
    c. On-Site contact with phone number.

B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.

C. Installer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of compliance with Summary article paragraph "A single installer. . ."

2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted system.
3. Listing of 5 or more installations in climate and size similar to this Project performed by installer's superintendent.

D. Testing Agency: Independent testing laboratory employed by Owner and acceptable to Engineer/Architect.

E. Certifications

1. Licensing/certification document from manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state this project is being constructed.
2. Licensing/certification agreement shall include following information:

    a. Applicator's financial responsibility for warranty burden under agreement terms.
    b. Manufacturer's financial responsibility for warranty burden under agreement terms.
    c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    d. Authorized signatures for both Applicator Company and Manufacturer.
    e. Commencement date of agreement and expiration date (if applicable).

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.
2. Name of manufacturer.
3. Date of preparation.
4. Lot or batch number.

B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

C. Distribute materials stored on elevated structures to prevent exceeding structure load limits.

## 1.9 FIELD CONDITIONS

A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather, temperature of concrete substrate, and ambient conditions within the structure will permit work in accordance with manufacturer's recommendations. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5

deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

B. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

C. Do not install traffic coating until items that penetrate membrane have been installed.

## 1.10 WARRANTY

A. System Manufacturer **(New Application and Complete System Recoating)**: Furnish Owner with written 5-year total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements (Joint and Several) commencing with date of acceptance of work. Warranty shall provide that system will be free of defects, water penetration and chemical damage related to system design, workmanship, or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Abrasion or tearing failures from normal traffic use.
3. Excessive aggregate loss (Coefficient of Friction below 0.6).
4. Weathering. Breakdown/degradation of topcoat.
5. Excessive Wear: Base coat showing through top coat.
6. Surface cracking or intercoat delamination.
7. Abrasion or tear failure of membrane resulting from normal traffic use.
8. Failure to bridge cracks less than 0.0625 in. or cracks existing at time of traffic coating installation.

B. System Manufacturer (**Partial System Recoating**): Furnish Owner with written 5-year total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements (Joint and Several). Warranty shall provide that system will be free of defects, chemical damage related to system design, workmanship, or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Abrasion or tearing failures from normal traffic use.
3. Excessive aggregate loss (Coefficient of Friction below 0.6).
4. Weathering. Breakdown/degradation of topcoat.
5. Excessive Wear: Base coat showing through top coat.
6. Surface cracking or intercoat delamination.
7. Abrasion or tear failure of membrane resulting from normal traffic use.
8. Failure to bridge cracks less than 0.0624 in. or cracks existing at time of traffic coating installation.

C. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.

D. Perform any repair under this warranty at no cost to Owner.

E. Address following in terms of Warranty: length of warranty, change in value of warranty – if any – based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.

F. Snowplows, vandalism, studded snow tires, and abnormally abrasive maintenance equipment are not normal traffic use and are exempted from warranty.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:

1. Advanced Polymer Technology (APT), Harmony, PA.
2. GCP Applied Technologies (GCP), Alpharetta, GA.
3. Lymtal International Inc. (Lymtal), Lake Orion, MI.
4. Master Builders Solutions Construction Systems US (Master Builders), Shakopee, MN.
5. Neogard Division of Hemple (Neogard), Dallas, TX.
6. Pacific Polymers, Inc. a Division of ITW (Pacific Polymers), Garden Grove, CA.
7. Pecora Corporation (Pecora), Harleysville, PA.
8. Polycoat Products Division of Amer. Polymers (Polycoat), Santa Fe Springs, CA.
9. R&D Technical Solutions, Ltd. (R&D), Mississauga, ON, Canada.
10. Sika Corporation (Sika), Lyndhurst, NJ.
11. Tremco (Tremco), Cleveland, OH.

### 2.2 MATERIALS, TRAFFIC COATING

A. Acceptable coatings are listed below. Coatings shall be compatible with all other materials in this Section and related work.

1. Heavy Duty:

a. Auto-Gard, Neogard.
b. Elasto-Deck 5000-HT, Pacific Polymers.
c. Iso-Flex 750U-HL HVT/760U-HL HVT Deck Coating System, LymTal.
d. MasterSeal Traffic 1500, Master Builders.
e. Qualideck Heavy Vehicular (152/252/372/582), APT
f. Sikalastic 710/715, Sikalastic 720/745, Sika.
g. Vulkem 350NF/951NF/951NF Deck Coating System, Tremco.
h. Kelmar Merdek (two layer wear course), R&D.
i. Pecora-Deck 8123 HD, Pecora.
j. Poly-I-Gard 246HD, Polycoat.

2. Provide #2 flint aggregate or 12/20 silica material.

B. Recoating [**Complete System**]: Provide complete traffic coating system with all components specified for new, heavy-duty applications, including all waterproofing and wearing courses.

1. System shall provide 200 psi minimum bond strength to existing system.

C. Recoating [**Partial System**]: Provide all wearing course components specified for new heavy-duty applications.

1. System shall provide 200 psi minimum bond strength to existing system.

D. Provide ultraviolet screening for all traffic coating placed on this project.

E. Finish top coat shall be colored gray. Confirm with Owner prior to ordering materials.

F. Substitutions: None for this project. Contact Engineer/Architect for consideration for future projects.

## 2.3 MATERIALS, CRACK SEALER

A. Repair for isolated random horizontal cracks 0.01 in. to 0.03 in. wide. Acceptable products:

1. Iso-Flex 609 Epoxy Crack Sealer, LymTal.
2. MasterSeal 630, Master Builders.
3. Sikadur 55 SLV Epoxy Crack Healer/Sealer, Sika.
4. SikaPronto 19TF, Sika.

## 2.4 ACCESSORY MATERIALS

A. Joint Sealants: As specified in Section 07 92 33 “Concrete Joint Sealants.”

B. Reinforcing Strip: Polymer mesh (polyester or polyethylene) recommended in writing by traffic-coating manufacturer, as required by manufacturer.

## 2.5 SOURCE LIMITATIONS

A. Obtain primary traffic-coating materials, including primers, from single source from single traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.

B. Coordinate and verify that related Work meets following requirements before beginning surface preparation and application:

1. Concrete surfaces are finished as acceptable for system to be installed. Correct all high points, ridges, and other defects in a manner acceptable to Engineer/Architect.
2. Curing compounds used on concrete surfaces are compatible with system to be installed.
3. Concrete surfaces have completed proper curing period for system selected.
4. Joint Sealants are compatible with traffic coatings.

## 3.2 PREPARATION

A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.

B. Concrete substrates: mechanically abrade surface to a uniform profile acceptable to manufacturer, in general conformance with ASTM D4259. Acid etching is prohibited.

C. Remove all laitance and surface contaminants, including oil, grease and dirt as specified by manufacturer's written recommendations.

D. Remove all debonded traffic coatings as determined by site inspection. Remove all laitance and surface contaminants, including oil, grease and dirt, by shot blasting and appropriate degreasers, or as specified by manufacturer's written recommendations to provide warranty.

E. Before applying materials, apply system to small area to assure that it will adhere to substrate and joint sealants and dry properly and to evaluate appearance.

F. All cracks on concrete surface shall be prepared in accordance with manufacturer's recommendations.

1. All random cracks on concrete surface less than 0.03 in. wide and showing no evidence of water and/or salt water staining on ceiling below shall receive detail coat unless more complete treatment required in accordance with manufacturer's recommendations.

a. Rout and seal random cracks, construction joints and control joints prior to installation of primer or base coat. Crack preparation for narrow cracks as specified in Section 2.3 is incidental to traffic coating work. Installation of joint sealant material is payable under W.I. Series 11.0.

G. Mask off adjoining surfaces not to receive traffic coating and mask off drains to prevent spillage and migration of liquid materials outside membrane area. Provide neat/straight lines at termination of traffic coating.

## 3.3 INSTALLATION/APPLICATION

A. Installation should include all of the following steps or in accordance with manufacturer's written instructions and specifications:

1. Surface Preparation: Prepare concrete for system application.
2. Crack/Construction/Control/Cove Joint Sealing: Detail for crack bridging.

    a. If reinforcing mesh is utilized at joints, ensure mesh is installed and fully embedded in base coat without bunching, wrinkles, fish mouths or protrusions above the surface of the base coat in which it is embedded.

3. Primer Coat: Insure proper adhesion of membrane to substrate.
4. Base Coat: Provide crack spanning in conjunction with Crack Detail noted above and provide monolithic coating without pinholes, blisters, or voids in coating,
5. Wear Coat providing skid and wear resistance.

    a. Aggregate: Correct size, shape, hardness and amount necessary to insure proper skid and wear resistance.
    b. Provide monolithic coating without pinholes, blisters, or voids in coating

6. Top Coat: Lock aggregate into place, provide a maintainable surface and provide resistance to ponding water, UV degradation, color loss and chemical intrusion.

    a. Provide monolithic coating without pinholes, blisters, or voids in coating
    b. Not required for approved hybrid wearing course with integral aggregate.

B. A primer coat is required for all systems. No exception. Reprime areas exposed for more time than recommended by manufacturer.

C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

D. Perform all work and apply traffic coating according to ASTM C 1127 and in accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), coverages, mil thicknesses, crack and joint detailing, and texture, and as shown on Drawings. Verify that substrates are visibly dry and free of moisture.

E. Do not apply traffic coating products until moisture content of substrates is acceptable for installation.

1. New construction projects: Do not apply traffic coating material until new concrete has been air dried at temperatures at or above 40ºF for at least 30 days after curing

period specified, or test substrates to determine that the actual moisture content meets traffic coating manufacturer's requirements.

2. Existing construction restoration projects: Do not apply traffic coating material until repair concrete has adequately cured. Test substrates to determine the actual moisture content meets traffic coating manufacturer's requirements.
3. Test for moisture in new concrete slabs, at concrete repair areas, or areas suspect of moisture by one of the following methods:

    a. ASTM F2170 (relative humidity)
    b. Method recommended in writing by traffic-coating manufacturer, including but not limited to:

        1) ASTM D4263 (plastic mat test)
        2) Measuring with an electronic impedance moisture meter, per ASTM F2659
        3) ASTM F1869 (calcium chloride test; not acceptable for lightweight concrete)

F. Do not apply traffic coating membranes products until concrete has attained compressive strength to resist primer tensile adhesion values as per manufacturer's written instructions and specifications.

G. Cease material installation under adverse weather conditions, when temperatures of work area or substrate are below 40º F, or outside manufacturer's recommended limitations for installation.

H. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to manufacturer's written instructions.

I. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

J. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

K. All adjacent vertical surfaces shall be coated with traffic coating 4 in. above coated horizontal surface. Requirement includes, but is not limited to pipes, columns, walls, curbs (full height of vertical faces of all curbs) and islands.

L. Mask off adjoining surfaces not to receive traffic coating and mask off drains to prevent spillage and migration of liquid materials outside membrane area. Provide neat/straight lines at termination of traffic coating.

M. Complete all Work under this Section before painting line stripes.

N. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.

## 3.4 FIELD QUALITY CONTROL

A. Develop a quality control plan for assured specified uniform membrane thickness that utilizes grid system of sufficiently small size to designate coverage area of not more than 5 gallons at specified thickness. In addition, employ wet mil gauge to continuously monitor thickness during application. Average specified wet mil thickness shall be maintained within grid during application with minimum thickness of not less than 80% of average acceptable thickness. Immediately apply more material to any area not maintaining these standards.

1. Testing Agency: employ wet mil gauge to periodically monitor thickness during application.

B. Mock-Up: Install 1 trial section of coating system for each duty grade and/or recoat system specified. Do not proceed with further coating application until trial sections accepted in writing by Engineer/Architect. Remove and replace rejected trial sections with acceptable application. Size: 200 sq. ft. (18.5 sq. m) of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Trial section shall also be tested for:

1. Wet mil thickness application.
2. Overall dry mil thickness.
3. Adhesion to concrete substrate and/or existing coating(s).

    a. Perform three (3) adhesion pull -off tests in accordance with ASTM D7234, Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Portable Adhesion Testers.

        1) The average of the tests shall be 200 psi or greater with no intercoat delamination within the new system.
        2) Areas not meeting minimum pull-off strength requirements shall have additional testing required at areas selected by Architect/Engineer.
        3) Areas not meeting minimum pull-off strength will be considered rejected and will be replaced at no cost to the Owner.

4. Reinforcing Mesh: If reinforcing mesh is required, install sample section of reinforcing mesh in accordance with Installation/Application requirements.

D. Use trial sections to determine adequacy of pre-application surface cleaning. Obtain Owner, Engineer/Architect and manufacturer acceptance of:

1. Cleaning before proceeding with traffic coating application.
2. Visual appearance of finished coating application.
3. Static coefficient of friction of 0.6, as advised in the Appendix to ADAAG
4. Pull-off test to quantify traffic coating adhesion to concrete and existing traffic coating.

E. Determine overall coating system mil thickness:

1. Contractor shall provide 6 in. by 6 in. bond breaker (coating coupon) on concrete surface for each 25,000 sq ft, or fraction thereof, of coating to be placed as directed by Engineer/Architect and manufacturer. Dimensionally locate coupon for easy removal.
2. Contractor shall assist Testing Agency in removing coating coupons from concrete surface at completion of manufacturer-specified cure period. Contractor shall repair coupon area per coating manufacturer's instructions.
3. Testing Agency shall determine dry mil thickness of completed Traffic Coating System, including bond breaker. Take 9 readings (minimum), 3 by 3 pattern at 2 in. on center. No reading shall be taken closer than 1 in. from coupon edge. Report individual readings and overall coating system average to Engineer/Architect. Readings shall be made with micrometer or optical comparator.

F. Adhesion Testing (ongoing testing during installation):

1. Perform three (3) adhesion pull -off tests in accordance with ASTM D7234, Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Portable Adhesion Testers.

    a. Perform testing for every [25,000 sf, 40,000 sf, Other].
    b. The average of the tests shall be 200 psi or greater with no intercoat delamination within the new system.
    c. Areas not meeting minimum pull-off strength requirements shall have additional testing required at areas selected by Architect/Engineer.
    d. Areas not meeting minimum pull-off strength will be considered rejected and will be replaced at no cost to the Owner.

## 3.5 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION 07 18 00**

# SECTION 071810 - EPOXY BROADCAST OVERLAY SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This work consists of furnishing and placing an overlay system comprised of a two-component epoxy resin system with broadcast aggregate for the purpose of improving skid resistance and sealing the concrete surface. The surface of the concrete shall be prepared and two applications of the epoxy-aggregate system shall be made in accordance with these specifications. The Contractor shall install an aggregate wearing course that is provided through a single manufacturer. The topcoat shall be the approved manufacturer's compatible polyurethane topcoat.

B. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.

### 1.3 QUALITY ASSURANCE

A. Submit following information for field testing of epoxy broadcast overlay installation unless modified in writing by Engineer.

1. Project name and location.
2. Contractor's name.
3. Epoxy material supplier.
4. Date of report.
5. Placement location within structure.
6. Epoxy material data:

    a. Epoxy type.
    b. Application rate (gals/sf)
    c. Aggregate rate (lbs/sf)
    d. Area applied (sf)

7. Weather data:

    a. Air temperatures.
    b. Weather.
    c. Wind speed.

8. Written acceptance of surface preparation from manufacturer representative.

9. Written acceptance of installation/application of epoxy from manufacturer representative.

## 1.4 REFERENCES

A. "Standard Specifications for Structural Concrete," (ACI 301) by American Concrete Institute, herein referred to as ACI 301, is included in total as specification for this structure except as otherwise specified herein.

B. Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown on Drawings or specified herein:

1. "Building Code Requirements for Reinforced Concrete," (ACI 318), American Concrete Institute, herein referred to as ACI 318.
2. "Causes, Evaluation, and Repair of Cracks in Concrete Structures" (ACI 224.112), American Concrete Institute.
3. "State-of-the-Art Report on Parking Structures" (ACI 326), American Concrete Institute.
4. "Use of Epoxy Compounds with Concrete" (ACI 503), American Concrete Institute.
5. "Standard Specification for Bonding Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive" (ACI 503.1), American Concrete Institute.
6. “Specification for Producing a Skid-Resistant Surface on Concrete by the Use of Epoxy and Aggregate” (ACI 503.3), American Concrete Institute
7. "Guide for Repair of Concrete Bridge Superstructures" Reported by ACI Committee 546 (ACI 546.1).

C. Contractor shall have following ACI publications at Project construction site at all times:

1. "Use of Epoxy Compounds with Concrete" (ACI 503), American Concrete Institute.
2. "Standard Specification for Bonding Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive" (ACI 503.1), American Concrete Institute.
3. “Specification for Producing a Skid-Resistant Surface on Concrete by the Use of Epoxy and Aggregate” (ACI 503.3), American Concrete Institute.

## 1.5 SUBMITTALS

A. Make submittals in accordance with requirements of the contract and as specified in this Section.

B. Contractor: Submit manufacturer's product data sheets, technical sheets, surface preparation procedures and equipment, recommended application procedures and information on epoxy broadcast system.

C. The Contractor shall submit documentation that confirms his having a minimum of five years of experience in the use and application of similar specified materials or the Contractor shall retain the services of a manufacturer's representative with said experience.

## 1.6 CLOSEOUT SUBMITTALS

A. Three copies of System Maintenance Manual.

B. Five copies of snow removal guidelines for areas covered by Warranty.

C. Final executed Warranty.

## 1.7 WARRANTY

A. System manufacturer and Contractor shall furnish Owner a written single source performance warranty that the epoxy overlay system will be free of defects related to design, workmanship, or material deficiency for 5-year period from date of acceptance of Work required under this Section against leakage, bond failure, and excessive aggregate loss:

B. Any repair under this warranty shall be done at no cost to Owner. Warranty shall be provided by Contractor and manufacturer of system.

## 1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
2. Evidence of financial stability acceptable to Engineer/Architect.
3. Listing of 10 or more projects completed with submitted system, to include:

    a. Name and location of project.
    b. Type of system applied.
    c. On-Site contact with phone number.

B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.

C. Installer's Qualifications: Owner retains right to reject any installer.

1. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 2 verifiable years of installations similar to those involved in this Contract, and minimum 5 projects with submitted system.
2. Listing of 3 or more installations in climate and size similar to this Project performed by installer's superintendent.

D. Testing Agency: Independent testing laboratory employed by Owner and acceptable to Engineer/Architect.

E. Certifications:

1. Licensing/certification document from system manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Michigan.
2. Licensing/certification agreement shall include following information:

a. Applicator's financial responsibility for warranty burden under agreement terms.
b. Manufacturer's financial responsibility for warranty burden under agreement terms.
c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
d. Authorized signatures for both Applicator Company and Manufacturer.
e. Commencement date of agreement and expiration date (if applicable).

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.
2. Name of manufacturer.
3. Date of manufacture.
4. Lot or batch number.
5. Manufacturer's instructions for mixing.
6. Warning for handling and toxicity.
7. Expiration date.

B. Store materials under cover and protect from weather at temperatures between 40-100 deg F. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

C. At no time shall weight of stored material being placed on slab area exceed total design load of slab area. Provide temporary shoring as needed to support construction loads (incidental).

## 1.10 FIELD CONDITIONS

A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

B. Dispose of unused materials in accordance with MSDS.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

A. Epoxy Resin System. The epoxy resin system shall be a two-component, 100% solids (Zero VOC), low-modulus, flexible, high-elongation, moisture-insensitive and fuels resistant system. It shall be in accordance with the following requirements:

1. Properties of the mixed epoxy resin:
    a. Pot Life, 1 qt., (AASHTO T-237): 15-35 minutes at 73°F
2. Properties of the cured epoxy resin shall meet material requirements of ASTM C881, Type III, and as follows:
    a. Compressive Properties (ASTM D-695):
        1) Compressive Strength at 7 days: 4,000-7,000 psi
    b. Compressive Properties (ASTM C-109):
        1) Compressive Strength at 4 hours: 1,400 psi
        2) Compressive Strength at 7 days: 7,000 psi
    c. Tensile Properties (ASTM D-638) at 7 days:
        1) Tensile Strength: 2,200 psi
        2) Elongation at Break: 30 percent minimum
    d. Water Absorption, 24 hr. %, (ASTM D570): <0.5
    e. Thermal Compatibility, (ASTM C-884): Passing
    f. Effective Shrinkage, (ASTM C-883): Passing
    g. Adhesion to Concrete, (ACI Method 503R-30): Concrete Failure

B. Fine Aggregate: An aggregate wearing surface shall be broadcast into a liquid binder according to the manufacturer's specifications. The fine coarse aggregates shall be those typically used for high performance surfaces. Aggregates shall consist of clean, hard, durable, non-staining and non-corroding fragments such as flint, chert, emery, or basaltic sand that are primarily angular or sub-angular in shape and have been crushed. Particle material, size, shape and surface texture shall be optimized for the binder. Aggregates shall have a proven record of durability in this type of application. The aggregate's origin shall not be from ocean or salt water sources unless it has been washed and certified as chloride-free. All aggregate shall be stored in a dry, moisture-free atmosphere. The aggregate shall be fully protected from any contaminants on the job site and shall be stored so as not to be exposed to rain or other moisture sources. Alternate aggregates may be used as approved by the Engineer. The aggregate used shall contain at least 10 percent aluminum oxide and conforming to Table 1 on following page.

**TABLE 1**

**FINE AGGREGATE GRADATION**

| | Bridge Deck | Parking Deck or Pedestrian Walkway |
|---|---|---|
| **Sieve Size** | **Percent Passing** | |
| #4 | 100 | 100 |
| #8 | 30~75 | 51-75 |
| #16 | 5(max) | 14-50 |
| #30 | 1 | 0-25 |
| #200 | 0.2 | 0-2 |

C. The aggregate shall conform to the properties listed in Table 2 below:

**TABLE 2**

**FINE AGGREGATE PROPERTIES**

| TESTS | Method | Limit |
|---|---|---|
| Los Angeles Abrasion (after 500 revolutions) | AASHTO T 96 | 40% max |
| MOHS Scale of Hardness | MOHS | 7 min |
| Moisture Content ASTM C566 | By Weight | <= 0.2% |

D. Polyurethane Topcoat: Manufacturer's compatible high-performance high-solids urethane waterproofing membrane for exterior applications.

E. Equipment: All equipment for cleaning the existing concrete surface and mixing and applying the epoxy-aggregate system shall be in accordance with the epoxy manufacturer's recommendations as approved by the Engineer prior to commencement of any work.

## 2.2 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products from the following manufacturers.

1. Unitex Chemical Co., a division of Dayton Superior
2. Sika Corporation
3. BASF Construction Chemicals - Building Systems
4. LymTal International, Inc.
5. ChemCo Systems
6. The Euclid Chemical Company
7. IPA Systems, Inc.

B. Acceptable epoxy broadcast overlay systems are listed below. Epoxy broadcast system shall meet the above requirements and specifications.

1. Unitex Total Overlay System – Dayton Superior, Miamisburg, OH.
2. Sikadur Epoxy Broadcast Overlay System – Sika Corp, Lyndhurst, NJ
3. MasterSeal 350 – BASF Construction Chemicals – Building Systems, Shakopee, MN.
4. Iso-Flex 200 Epoxy Overlay System - LymTal International, Lake Orion, MI
5. Kemko 128 FlexDek Binder - ChemCo Systems, Inc., Redwood City, CA
6. Flexolith – The Euclid Chemical Company, Cleveland, OH
7. Ipanol E-Flex – IPA Systems, Inc.

C. Substitutions: **None** for this project. Contact Engineer/Architect for consideration for future projects.

## PART 3 - EXECUTION

### 3.1 PROJECT CONDITIONS

A. Weather and Substrate Conditions for Epoxy: Do not proceed with application (except with written recommendation of manufacturer) under any of the following conditions:

1. Ambient temperature is less than 50 deg F.
2. Substrate surfaces have cured for less than 1 month.
3. Rain or temperatures below 50 deg F predicted for a period of 24 hours.
4. Earlier than 24 hours after surfaces became wet.
5. Substrate is frozen, or surface temperature is less than 50 deg F.

B. Weather and Substrate Conditions for Other Materials: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

### 3.2 PREPARATION

A. The overlay system shall be applied in accordance with these specifications at the locations indicated on the plans. Exact quantities and rates shall be as recommended by the manufacturer and approved by the engineer, based on existing surface scaling conditions. See Detail 16.9 for typical thickness requirements of the epoxy overlay system.

1. Trial Application. Prior to constructing the overlay, one or more trial overlays shall be placed to determine the initial set time and to demonstrate the effectiveness of the mixing, placing, and finishing equipment proposed. Each overlay shall be 4 ft wide, at least 6 feet long and the same thickness as the overlay to be constructed. Conditions during the construction of the trial overlays and equipment used shall be similar to the expected and those to be used for construction of the multilayer

epoxy-overlay (includes scarification and shot-blasting). The location of the trial overlays shall be approved by the Engineer.

2. Surface Preparation: The surface of the concrete deck shall be prepared for application of the overlay by first repairing the concrete deck and then shotblast, abrasive blasting, hydro-blasting, or cleaning in any way acceptable to the Epoxy Manufacturer and the Engineer so as to remove all laitance, curing compounds, sealers, grease, oils, paint, dirt, or any other contaminants that could interfere with the proper adhesion of the epoxy overlay system in accordance with the following requirements:

    a. The existing deck shall be rehabilitated prior to the epoxy overlay as shown in the plans. Spalled and delaminated areas of the deck shall be repaired back to sound concrete as directed by the Engineer per other Work Items. The area shall be scarified and shot-blasted and loose particles of shot shall be removed prior to material installation. The surface to be patched shall be completely dry prior to priming and patching in accordance with the following requirements:
    b. Areas with nominal depth of 1 inch or more- The surface shall be prepared in accordance with paragraph a. above; however a rapid set cementitious or epoxy based patching material compatible with the overlay system shall be used. Finishing, curing and patching material shall be in accordance with manufacturer's recommendations.

3. After concrete patching repairs, all remaining loose/delaminated existing concrete shall be removed by scarifying up to ½" amplitude.

4. Shotblast Cleaning: The preferred method of cleaning is shotblasting. This cleaning shall not commence until all work involving the repair of the concrete deck surface has been completed. Additionally, surface preparation shall not commence until all epoxy mortar repairs and/or concrete mortar repairs are sufficiently cured. Following completion of shotblast cleaning, any loose shot or other particles shall be removed from the deck prior to the application of the overlay. The shotblast cleaning or other approved method will not be measured and paid for separately, but shall be included in the work.

5. Sand-blasting and/or Water-blasting: After shot-blasting, sand-blasting and/or water-blasting shall then be performed to remove all dust/debris/laitance. Additional surface preparation and/or cleaning shall be performed as needed in strict accordance with manufacturer's recommendations.

6. Product manufacturer shall provide written approval of surface preparation prior to start of installation.

7. Surface preparation methods will not be measured and paid for separately, but shall be included in the work.

## 3.3 INSPECTION

A. Inspect surfaces to receive Work and report immediately in writing to Engineer any deficiencies in surface which render it unsuitable for proper execution of Work.

## 3.4 INSTALLATION

A. Do all Work in strict accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), coverages, thicknesses, texture and curing.

B. Manufacturer's technical representative, acceptable to Engineer, shall be on site during surface preparation and installation.

1. Application of Epoxy-Aggregate Overlay. Application of the overlay shall not be performed unless the ambient temperature is a minimum of 50 deg F and rising, and the concrete deck temperature is at least 50 deg F. At cooler temperatures, the material should be conditioned at 75 deg F at least 24 hours prior to use. Additionally, application shall not begin until the concrete deck is completely surface dry. Values shown in this specification are typical of general installations. Actual values and application rates shall be per Manufacturer’s recommendations.
2. Mixing of Epoxy Components: Components A and B shall each be thoroughly stirred in its own container prior to mixing in order to disperse any settlement which may have occurred. Components A and B shall be proportioned in strict accordance with the instructions of the manufacturer and then thoroughly blended together with a mechanical mixing device for at least 2 minutes. Hand mixing is not acceptable. No diluent, thinner, or other foreign material shall be added to either the individual components or the mixed epoxy.
3. Applying the Overlay: Application of the mixed epoxy to the concrete surface shall be squeegee, roller, or spray, or combinations thereof as approved by the Engineer following the trial application. The application method used shall apply the material smoothly, uniformly, and continuously. The epoxy shall not be allowed to puddle or accumulate in holes or depressions in the deck. The Contractor shall provide suitable coverings, such as heavy-duty drop cloths and the like, to protect all exposed areas not to be overlayed with epoxy, such as curbs, sidewalks, railings, parapets, joints, etc. All damage or defacement resulting from this application shall be cleaned or repaired at the Contractor's expense, to the satisfaction of the Owner.

    a. First Coat: The epoxy shall be applied to the concrete deck at the rate of **35-40 square feet per gallon**, unless otherwise recommended by the manufacturer. While the epoxy is still wet broadcast the aggregate until no wet spots are visible. In broadcasting, the aggregate shall be sprinkled or dropped vertically in such a manner so as not to violently disturb the wet epoxy film. When this first coat has cured sufficiently to sustain working traffic, any excess aggregate remaining shall be removed by sweeping or vacuum.

b. Second Coat: The second coat shall be applied in a manner identical to the application of the first coat, except that the coverage of the epoxy shall be **20-25 square feet per gallon** and the aggregate shall be broadcast until no wet spots are visible. When the second coat has cured sufficiently to sustain working traffic, all excess aggregate remaining shall be removed by sweeping or vacuum.

c. Topcoat: Manufacturer's compatible polyurethane topcoat, installed at thickness as recommended by manufacturer.

C. Curing. The Contractor shall allow the materials to cure sufficiently before subjecting it to loads or traffic of any nature that may cause damage. Cure time depends upon the ambient and deck temperatures. The field cure, if approved by the Engineer, can be determined as follows:

1. The overlay shall be considered cured to a firm, hard state when no movement of the overlay can be detected when pressure is applied. Actual degree of cure and suitability for traffic shall be determined by the manufacturer, acceptable to the Engineer, on the actual epoxy concrete overlay.

## 3.5 FIELD QUALITY CONTROL

A. Develop a quality control plan for assured specified uniform overlay thickness that utilizes grid system of sufficiently small size to designate coverage area of not more than 5 gallons at specified thickness. In addition, employ wet mil gauge to continuously monitor thickness during application. Average specified wet mil thickness shall be maintained within grid during application with minimum thickness of not less than 80% of average acceptable thickness. Immediately apply more material to any area not maintaining these standards.

B. Testing Agency employ wet mil gauge to periodically monitor thickness during application.

## 3.6 ACCEPTANCE

A. Repair of Surface Defects. The repair method for surface defects in the overlay shall be identical to that used for the application of the overlay. All surface defects shall be repaired to the satisfaction of the Engineer before acceptance of the work is made.

**B. An additional cleaning of the overlay area is required to remove all loose or excess aggregate by sweeping or vacuum. Repeat as needed to Owner's satisfaction.**

C. The manufacturer shall furnish certification to the Engineer that the material supplied is in accordance with all requirements specified and stating that the material supplied is the same system and is identically formulated to the material tested for manufacturer and brand name approval.

**END OF SECTION 071810**

# SECTION 07 92 33 – CONCRETE JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. A single installer shall be responsible for providing complete water proofing system including all products specified in Division 07 Sections.

B. This Section includes the following:

1. Polyurethane sealants for exterior joints in horizontal traffic-bearing and non-traffic-bearing surfaces.

2. See Section 020010 for approved silicone sealants for vertical/façade applications.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.
2. Distribute reviewed submittals to all others whose Work is related.

B. Make submittals in accordance with requirements of Division 01 Sections.

C. Submittals and Resubmittals: Engineer will review each of Contractor's shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including the cost of Engineer's services made necessary to review such additional resubmittals. Owner shall in turn reimburse Engineer.

D. Requests For Information

1. Engineer reserves the right to reject, unprocessed, any Request for Information (RFI) that the Engineer, at its sole discretion, deems frivolous.

2. Engineer reserves the right to reject, unprocessed, any RFI that the Engineer, at its sole discretion, deems already answered in the Contract Documents.
3. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in the contract documents.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each system indicated at least 30 days prior to application.

1. Product description, technical data, appropriate applications and limitations.
2. Primer type and application rate

B. Samples:

1. One for each system indicated.

C. Sample Warranty: For each system indicated.

## 1.5 INFORMATION SUBMITTALS

A. Certificates:

1. Evidence of installer's being certified by manufacturer. Evidence shall include complete copy of manufacturer’s licensing/certification document, spelling out repair responsibility for warranty claims.
2. Certification from the Manufacturer that joint details as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive joint sealant.

B. Field Quality Control:

1. Two copies each of manufacturer's technical representative's log for each visit.
2. Testing agency field and test reports.

C. Qualification Statements:

1. Manufacturer’s qualifications as defined in the “Quality Assurance” article.
2. Installer’s qualifications as defined in the “Quality Assurance” article.
3. Signed statement from this Section applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

## 1.6 CLOSEOUT SUBMITTALS

A. Final executed Warranty.

## 1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
2. Evidence of financial stability acceptable to Engineer/Architect.
3. Listing of 20 or more projects completed with submitted sealant, to include:

    a. Name and location of project.
    b. Type of sealant applied.
    c. On-Site contact with phone number.

B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.

C. Installer’s Qualifications: Owner retains right to reject any installer or subcontractor.

1. Installer shall be legally licensed to perform work in the state of Michigan. Evidence of compliance with Summary article paragraph "A single installer. . ."
2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted sealant.
3. Listing of 5 or more installations in climate and size similar to this Project performed by installer’s superintendent.

D. Testing Agency: Independent testing laboratory employed by Owner and acceptable to Engineer/Architect.

E. Certifications:

1. Licensing/certification document from system manufacturer that confirms sealant installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Michigan.
2. Licensing/certification agreement shall include following information:

    a. Applicator’s financial responsibility for warranty burden under agreement terms.
    b. Manufacturer’s financial responsibility for warranty burden under agreement terms.
    c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    d. Authorized signatures for both Applicator Company and Manufacturer.
    e. Commencement date of agreement and expiration date (if applicable).

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.

2. Name of manufacturer.
3. Date of preparation.
4. Lot or batch number.

B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

C. Do not store material on slabs to be post-tensioned before final post-tensioning of slabs is accomplished. At no time shall weight of stored material being placed on slab area, after post-tensioning is completed and concrete has reached specified 28 day strength, exceed total design load of slab area. Between time final post-tensioning is accomplished and time concrete has reached specified 28 day strength, weight of stored material placed on slab area shall not exceed half total design load of slab area.

## 1.9 FIELD CONDITIONS

A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

## 1.10 WARRANTY

A. Manufacturer: Furnish Owner with written total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and installer with regard to warranty requirements (Joint and Several). The warranty shall provide that sealant will be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Weathering.
3. Abrasion or tear failure resulting from normal traffic use.

B. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.

C. Warranty period shall be a 5 year Joint and Several Warranty commencing with date of acceptance of work.

D. Perform any repair under this warranty at no cost to Owner.

E. Address the following in the terms of the Warranty: length of warranty, change in value of warranty – if any- based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.

F. Snowplows, vandalism, and abnormally abrasive maintenance equipment are not normal traffic use and are exempted from warranty.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:

1. Master Builders Solutions (MBS), Shakopee, MN.
2. Dow Corning Corp. (Dow Corning), Midland, MI.
3. Lymtal International Inc. (Lymtal), Lake Orion, MI.
4. Pecora Corporation (Pecora), Harleysville, PA.
5. Sika Corporation (Sika), Lyndhurst, NJ.
6. Tremco (Tremco), Cleveland, OH.

### 2.2 MATERIALS, JOINT SEALANT SYSTEM

A. Provide complete system of compatible materials designed by manufacturer to produce waterproof, traffic-bearing control joints as detailed on Drawings.

B. Compounds used for sealants shall not stain masonry or concrete. Aluminum pigmented compounds not acceptable.

C. Color of sealants shall match adjacent surfaces.

D. Closed cell or reticulated backer rods: Acceptable products:

1. “Sof Rod,” Nomaco Inc., 501 NMC Drive, Zebulon, NC 27597. (800) 345-7279 ext. 341.
2. “ITP Soft Type Backer Rod,” Industrial Thermo Polymers Limited, 2316 Delaware Ave., Suite 216, Buffalo, NY 14216. (800) 387-3847.
3. “MasterSeal 921 Backer Rod,” MBS.

E. Bond breakers and fillers: as recommended by system manufacturer.

F. Primers: as recommended by sealant manufacturer.

G. Acceptable sealants are listed below. Sealants shall be compatible with all other materials in this Section and related work.

H. Acceptable polyurethane control joint sealants (traffic bearing):

1. MasterSeal SL-2 or MasterSeal SL-2 SG, MBS.
2. Iso-flex 880 GB or Iso-flex 881, Lymtal.
3. Dynatrol II-SG or Urexpan NR 200, Pecora.
4. Sikaflex-2c SL or Sikaflex-2c NS TG, Sika.
5. THC-901, Vulkem 45SSL, Dymeric 240 FC or Dymonic 100, Tremco.

I. Acceptable polyurethane vertical and cove joints sealants (non-traffic bearing):

1. Sikaflex-2c NS EZ, Sika.
2. MasterSeal NP-2, MBS.
3. Dymeric 240FC, Dymonic 100 or THC 901 (cove only), Tremco.
4. Dynatred, Pecora.
5. Iso-flex 881, Lymtal.

J. Proposed Substitutions: None for this project. Contact Engineer/Architect for consideration for future projects.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.
B. Coordinate and verify that related Work meets following requirements before beginning installation

1. Concrete surfaces are finished as acceptable for system to be installed.
2. Curing compounds used on concrete surfaces are compatible with system to be installed.
3. Concrete surfaces have completed proper curing period for system selected.

### 3.2 PREPARATION

A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.

B. Correct unsatisfactory conditions before installing sealant system.

C. Acid etching is prohibited.

D. Grind joint edges smooth and straight with beveled grinding wheel before sealing. All surfaces to receive sealant shall be dry and thoroughly cleaned of all loose particles, laitance, dirt, dust, oil, grease or other foreign matter. Obtain written approval of method from system manufacturer before beginning cleaning.

E. Final preparation of joints shall be a sandblast with medium that removes dust and ground material from surfaces to receive sealant.

F. Check preparation of substrate for adhesion of sealant.

G. Prime and seal joints and protect as required until sealant is fully cured. A primer coat is required for all systems.

## 3.3 INSTALLATION/APPLICATION

A. Do all Work in strict accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), thicknesses and texture, and as shown on Drawings.

B. Completely fill joint without sagging or smearing onto adjacent surfaces.

C. Self-Leveling Sealants: Fill horizontal joints slightly recessed to avoid direct contact with wheel traffic.

D. Non-Sag Sealants: Tool joints concave: Wet tooling not permitted.

E. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.

F. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation, or when temperature of work area or substrate are below 40ºF.

## 3.4 FIELD QUALITY CONTROL

A. Contractor, at Engineer/Architect's direction, shall install 3 trial joint sections of 20 ft each. Contractor shall cut out joint sections, as selected by Engineer/Architect, for Engineer/Architect and Manufacturer's Representative inspection. Additional isolated/random removals may be required where sealant appears deficient. Total cut out sealant shall not exceed lesser of 1% of total lineal footage placed or total of 100 lineal ft of joint sealant at isolated/random locations (varying from in. to ft of material) for Engineer/Architect and Manufacturer's Representative inspection of sealant profile.

B. Repair all random joint sealant "cut out" sections at no cost to Owner.

C. Testing Agency:

1. Check shore hardness per ASTM standard specified in sealant manufacturer's printed data.

**END OF SECTION 07 92 33**

# SECTION 07 92 36 – ARCHITECTURAL 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 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project Site.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. 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.

**C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants, for owner’s review and approval.**

### 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 a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. 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. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

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

G. 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 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 (5 deg C).
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.

## 1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees 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: Five years from date of Substantial Completion.

B. 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. Colors of Exposed Joint Sealants: As selected by Owner from manufacturer's full range, to match colors of existing construction to Owner’s satisfaction.

### 2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, non-sag, plus 50 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Pecora Corporation.
d. Sika Corporation.

### 2.3 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation-Construction Systems.

b. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 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: Non-staining, 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. Masonry.

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. Glass.

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 Non-sag 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.

## 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 1 test for the first 500 FT of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

   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 vertical surfaces.

1. Joint Locations:
    a. Control and expansion joints in unit masonry.
2. Joint Sealant: **Silicone, Non-staining, S, NS, 50, NT**.

**END OF SECTION 079236**

# SECTION 07 95 00 – EXPANSION JOINT ASSEMBLIES

## 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. A single installer shall be responsible for providing complete water proofing system including all products specified in Division 07 Sections.

B. This Section includes the following: Standard expansion joint systems:

a. W.I. 10.6: Expanding Foam Sealants with field-applied silicone.

### 1.3 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width. Movement capability is to include anticipated movements from concrete shrinkage, concrete shortening and creep from post-tensioning or prestressing, cyclic thermal movements, and seismic movements.

D. Nominal Joint Width: Width of linear opening specified in practice and in which joint system is installed.

E. Nominal Form Width: Linear gap in joint system at time of forming or erection of structural elements bounding the expansion joint.

F. Service Load Level: Defined level of load under which joint assembly remains elastic and fully functional.

G. Fatigue Load Level: Defined level of load under which joint assembly remains elastic and fully functional, including all noise mitigation components, for the stated number of cycles.

H. Collapse Load Level: Defined level of load under which joint assembly remains capable of bridging the gap, although plates may yield and components may break.

## 1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General:

a. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
b. Coordinate requirements for transitions, tolerances, levelness, and plumbness to ensure the installed expansion joint system can perform with expected movement capabilities.
c. Coordinate and assign responsibility for preparation of concrete surfaces adjacent to expansion joints.
d. Expansion joint surface areas each side of joint gap shall have a vertical differential less than ¼" and meet requirements of expansion joint manufacturer.
e. Minor surface defects shall be repaired according to manufacturer's recommendations. Repair materials shall be compatible with intended system materials and shall be approved by the Engineer prior to surface preparation and installation.
f. Submit for approval repair products and procedures for all major defects. Repair description shall indicate materials, manufacturer's requirements, expected service life, and maintenance requirements. Take all precautions necessary to avoid damaging adjacent surfaces and embedded reinforcement or post tensioned anchors and tendons. Contractor is responsible for any damages. Concrete repairs shall be of rectangular configuration, with no feather-edged surfaces. Final surface preparation of all repairs shall be sandblasting, or approved equivalent.
g. Coordinate layout of joint system and approval of methods for providing joints.

2. Joint Opening Width:

a. Use temperature adjustment table to properly size joint gap at time of concrete pour and show that proposed joint system is capable of equal individual and combined movements in each direction when installed at designated temperature shown on drawings.
b. Where installation temperature is other than specified temperature, perform calculations showing joint is capable of movement within design temperature range (Criteria on Drawings) for "other" temperature, and that design and installation follow manufacturer's recommendations.
c. Expansion joint movement capability and the actual joint gap movement may not coincide. Construct actual joint gap in accordance with expansion design criteria.

3. Blockouts:

    a. Float expansion joint blockouts to remove all air pockets, voids and spalls caused by form work.
    b. Blockouts shall be plumb with maximum tolerance per Manufacturer or not more than 0.125 inches deviation in 12 inches. Noncompliant blockouts shall be considered major defects.
    c. Blockouts shall be straight and true with maximum tolerance per Manufacturer or not more than 0.250 inches deviation in 10 lineal feet. Noncompliant blockouts shall be considered major defects.

B. Preinstallation Meetings: Meet at project site well in advance of time scheduled for Work to proceed to review requirements for Work and conditions that could interfere with successful expansion joint system performance. Require every party concerned with concrete formwork, blockout, concrete placement, or others required to coordinate or protect the Work thereafter, to attend. Include Engineer of Record and manufacturer's technical representative and warranty officer.

C. Make submittals in accordance with requirements of Division 01 Sections.

D. Submittals and Resubmittals: Engineer will review each of Contractor’s shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including the cost of Engineer’s services made necessary to review such additional resubmittals. Owner shall in turn reimburse Engineer.

E. Requests For Information

1. Engineer reserves the right to reject, unprocessed, any Request for Information (RFI) that the Engineer, at its sole discretion, deems frivolous.
2. Engineer reserves the right to reject, unprocessed, any RFI that the Engineer, at its sole discretion, deems already answered in the Contract Documents.
3. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in the contract documents.

## 1.5 ACTION SUBMITTALS

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

1. Construction details, material descriptions, dimensions, and finishes.
2. Proposed method of preparation of concrete surface to receive expansion joint systems.
3. Proposed method and details for treatment of cracks, bugholes, or other potential concrete surface defects in areas to receive expansion joint systems.

4. Horizontal spacing between embedded metals and plates to allow for volume change due to thermal conditions.
5. Temperature adjustment table showing formed gap at the time of concrete placement calculated at 10°F increments and a calculation showing joint system is capable of movement within the design temperature range.

B. Shop Drawings: For each type of product indicated:

1. Placement Drawings: Show project conditions including, but not limited to, line diagrams showing plans, elevations, sections, details, splices, blockout requirement, and terminations. Provide isometric or clearly detailed drawings depicting how components interconnect. Include reviewed and approved details from others whose work is related. Other information required to define joint placement or installation.
2. Joint System Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

    a. Manufacturer and model number for each joint system.
    b. Joint system location cross-referenced to Drawings.
    c. Form width.
    d. Nominal joint width.
    e. Movement capability.
    f. Minimum and maximum joint width.
    g. Classification as thermal or seismic.
    h. Materials, colors, and finishes.
    i. Product options.
    j. Fire-resistance ratings.

3. Components and systems required to be designed by a professional engineer, shall bear such professional’s written approval when submitted.

C. Samples:Samples for each type of joint system indicated.

    a. Submit 1 sample for each type. Full width by 6 inches (150 mm) long, for each system required.
    b. Field samples of premolded joint sealant. Width, thickness and durometer hardness of sealant shall be checked by Testing Agency. Upward buckling caused by joint gap closure shall be limited to a maximum of ¼ inch per ADA Guidelines.

2. Develop mockups of concrete surface preparation for review and to establish a control for the application. Approved mockups may be incorporated into the final work. Perform additional surface preparation as needed to obtain approval.

D. Delegated Design Submittals:

1. Analysis indicating expansion joint system complies with expansion joint performance and design criteria of this specification and is suitable for use in conditions of this project. Provide a summary of design criteria used in design.

E. Test and Evaluation Reports:

1. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for current products.

## 1.6 INFORMATIONAL SUBMITTALS

A. Certificates

1. Certification that products and installation comply with applicable federal, state of [State], and local EPA, OSHA and VOC requirements regarding health and safety hazards.
2. ADA Certification: Prior to installation, submit written certification from manufacturer indicating that expansion joints conform to Americans with Disabilities Accessibility Guidelines for Buildings and Facilities, as published by U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, N.W., Suite 1000, Washington, DC 20004-1111. 1-800-872-2253.

    a. Submit test reports from accredited laboratory attesting to joint systems' movement capability and ADA compliance.
    b. Static coefficient of friction shall meet minimum requirements of Americans with Disabilities Act (ADA).

3. Signed statement from installer/applicator certifying that installer/applicator has read, understood, and shall comply with all requirements of this Section.
4. Signed statement from manufacturer's representative that they have read, understood, and shall comply with all requirements of this section.

B. Field Quality Control

1. Two copies each of manufacturer's technical representative's log for each visit.

C. Qualification Statements

1. Manufacturer's qualifications as defined in the "Quality Assurance" article within 60 days of project award.
2. Installer's qualifications as defined in the "Quality Assurance" article.
3. Evidence of manufacturer's certification of installer/applicator. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.

## 1.7 CLOSEOUT SUBMITTALS

A. Maintenance Contracts: 2 copies of Maintenance Program contracts.

B. Operation and Maintenance Data

1. Maintenance Manual: 3 copies of System Maintenance Manual.

2. Five copies of snow removal guidelines for areas covered by warranty.

C. Warranty Documentation: 2 executed copies of the Warranty including all terms, conditions and maintenance requirements.

## 1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of compliance with Experience Record and Qualifications paragraph below.
2. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
3. Copy of sample warranty that meets the requirements of the “Warranty” article in Section 1.
4. Evidence of financial stability acceptable to Owner or Engineer/Architect.
5. Evidence of compliance with "Single Installer" requirement.

B. Experience Record and Qualifications: Verification of systems shall be established by either System Validation or Design Validation.

1. System Validation: Submitted system for similar applications with minimum five (5) years’ experience and five (5) verified projects completed. Validation submittal shall include:

    a. Sealed design calculations by an engineer licensed in Michigan, including finite element analysis for all structural load carrying elements, using the design criteria listed in Part 2.
    b. Field history as defined below.
    c. Results of seismic load tests defined below for projects with a Seismic Design Category of C or higher.

2. Design Validation: Submitted system for similar application with less than five (5) years’ experience shall include a design validation submittal. Validation submittal shall include:

    a. Sealed design calculations by an engineer licensed in Michigan, including finite element analysis for all structural load carrying elements, using the design criteria listed in Part 2.
    b. Results of cyclic and seismic load tests defined below.

3. Acceptable field history consists of successful performance of five (5) installations in place over the previous five (5) years under similar project loads, traffic frequency, footprints, and joint sizes. Include sketches, photos, and references for each installation. Installations shall have experienced at least moderate levels of traffic.
4. Vertical and horizontal cyclic load tests shall be performed at an independent laboratory, and witnessed by a professional engineer who shall issue a sealed final report of the test results. Tests shall consist of cyclic load testing using the

design criteria in Part 2 and project joint sizes. Tests shall meet the following criteria:

a. Vertical load cycle counts shall be a minimum of 2, 1000, and 1,000,000 cycles for the collapse, service, and fatigue level loads respectively.
b. Horizontal load cycle counts shall be a minimum of 1,000 and 25,000 cycles for the service and fatigue level loads respectively. No horizontal load test is required for the collapse level loads.
c. The vertical service and fatigue load test shall consist of a rolling tire at specified load in order to gauge joint wear. Test specimen shall show no signs of yielding of load carrying elements.
d. Observation and testing results of performance for noise mitigation elements shall be reported.
e. Different specimens may be used for the tests if they are of the same size and design. Conditions adjacent to the joint, e.g. the blockout region, shall be in keeping with the system design. Test joints shall be not less than 4 feet per tire in length, and shall replicate typical field installed geometry.

5. Seismic load tests shall be performed by an independent laboratory and witnessed by a professional engineer who shall issue a sealed final report of the test results. Tests shall consist of harmonic cycle testing at seismic velocities and displacements.

a. Test displacements shall not be less than 85% of the joint's design range, at a frequency not less than 0.5Hz, for not less than 10 cycles.
b. Longitudinal displacements (parallel to the joint) shall be 10% of the transverse displacement (perpendicular to the joint), but not less than 1", for joints where only unidirectional movement is expected, and 50%, but not less than 1", for joints in which bidirectional movement is anticipated. Longitudinal and transverse displacements shall be applied simultaneously with a vertical offset of ½" between opposite sides of the joint.
c. Seismic testing is not required for small movement joints with seismic design displacements of less than 2" (+/-2", 4" total).

C. Installer Qualifications: An employer of workers, including superintendent for this project, trained and approved by manufacturer.

D. Testing Agency: Independent testing laboratory employed by Owner and acceptable to Engineer/Architect.

E. Certifications

1. Provide reports to Owner detailing maintenance activities have been performed in accordance with written maintenance agreement for expansion joints.
2. Materials shall be compatible with materials or related Work with which they come into contact and the related materials sections.
3. Manufacturer/Applicator: Review and approve all details before construction. Confirm in writing to Owner.

## 1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.
2. Name of manufacturer.
3. Date of preparation.
4. Lot or batch number.

B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

## 1.10 WARRANTY

A. Warranty period shall be a [5] year Joint and Several Warranty commencing with date of acceptance of work.

B. Installation Requirements: Include a written plan of construction and coordination requirements, to allow joint system installation to proceed with specified warranty, that specifically addresses the following:

1. Block out acceptance criteria.
2. Surface preparation acceptance criteria.
3. Crack, surface defect, and detailing recommendations.
4. Method of protection of surrounding surfaces.
5. Method of expansion joint system installation description.
6. Primer type and application rate.
7. Method of preparation of all glands and reinforced membranes.
8. Temperature, humidity and other weather constraints. Specify substrate moisture testing criteria, if any.
9. Final cure time before removal of protection, resumption of traffic, and/or paint striping.
10. Any other special instructions required to ensure proper installation.

C. Quality Service Requirements: Show evidence of licensed/approved installer. List of names, addresses and phone numbers, with copies of certification/approval agreement with each, satisfies requirement. Licensing/certification agreement shall include following information:

1. Installer’s financial responsibility for warranty burden under agreement terms.
2. Manufacturer’s financial responsibility for warranty burden under agreement terms.
3. Process for dispute settlement between manufacturer and installer in case of system failures where cause is not evident or cannot be assigned.
4. Authorized signatures for both Installer Company and Manufacturer.
5. Commencement date of agreement and expiration date (if applicable).
6. Provide copy of contractor’s field application quality control procedures.

D. Manufacturer: Furnish Owner with written total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and installer with regard to warranty requirements (Joint and Several). The warranty shall provide that expansion joints will be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of: Warranty shall provide that system shall be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any water leakage through expansion joint system or leaking conditions of reinforced membrane, other waterproofing components, or glands.
2. Any adhesive or cohesive failures of the system.
3. Shifting of plates out of alignment due to system failure.
4. Loose plates, anchor blocks, bolts.
5. Metal to metal vibration causing noises during use.
6. Metal to non-metal vibration causing noises during use.
7. Tears, weathering, or degradation in gland from normal use.
8. Expansion joint glands are considered defective if they buckle upwards beyond the level of the floor surface after installation or downward in excess of ½ inch below the floor surface.

E. If expansion joint systems or components show any of defects listed above, supply labor and material to repair all defects at no cost to Owner.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

A. A single Installer shall be responsible for providing complete expansion joint system. Obtain all joint systems through one source from a single manufacturer.

B. Drawings indicate size, profiles, and dimensional requirements of joint systems and are schematic for systems indicated.

C. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

### 2.2 PERFORMANCE REQUIREMENTS

A. Intent of this section is to insure that installed expansion joints allow pedestrian and vehicular traffic to pass in a smooth, quiet fashion with minimal maintenance required over a period of not less than 10 years. Expansion joints shall not only function as structural bridging elements, but must also accommodate structural expansions/contractions and minimize water leakage.

B. Provide design of expansion joint for preparation of final details for fabrication and construction of all concrete openings, expansion joint elements and required accessories. An integral part of this project is engineering for the following:

1. Include calculations for the size and forming of concrete openings to provide nominal joint width as indicated on drawings. Provide a summary of the design criteria used in the design.
2. Include calculations for the appropriate size of expansion joint elements in accordance with the expansion joint assembly performance criteria. Include installation requirements of expansion joint assembly for specific project conditions and scheduling. Provide a summary of design criteria used in design.

C. Expansion joint design shall meet or exceed all expected movements shown on drawings.

D. Installation temperature range and estimated volume change movements are shown on drawings. Nominal form width shown on the drawings shall be adjusted for the ambient temperature at time of concrete placement and designer shall verify that width of joint at installation shall meet minimum installation requirements.

E. Expansion joint systems shall be capable of resisting a differential vertical movement of ½ inch.

F. Materials shall be supplied in lengths to minimize or eliminate the need to splice waterproofing components.

1. Waterproofing materials directly exposed to vehicular traffic shall be supplied with no joints in vehicle drive aisles.
2. All mitered splices shall be performed at the factory and provide sufficient gland length for butt splicing with field splicing equipment.
3. All Santoprene butt to butt splices shall be heat welded.
4. Butt to butt splices with other materials shall be per manufacturer’s recommendations.

G. Design system for passenger vehicles traveling at speeds normally expected within a parking structure.

H. Fire-Test-Response Characteristics: Where indicated, provide expansion joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

I. Walking Surfaces: Expansion joint assemblies at walking areas subject to pedestrian traffic shall provide a smooth, slip resistant walking surface for pedestrians with these minimum requirements:

1. Shall provide walking surfaces in accordance with ASTM – F 1637 Standard Practice for Safe Walking Surfaces.

2. Shall be designed to comply with “Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)” and ICC A117.1. Americans with Disabilities Accessibility Guidelines for Buildings and Facilities, as published by U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, N.W., Suite 1000, Washington, DC 20004-1111. 1–800-872-2253.
3. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:

    a. Changes in level of less than ¼ inch in height may be without edge treatment as shown in ADA Figure 303.2 and on the Drawings.
    b. Changes in Level between ¼ inch and ½ inch in height shall be beveled with a slope no greater than 1:2 as shown in ADA Figure 303.3 and on the Drawings.
    c. Changes in level greater than ½ inch in height are not permitted unless they can be transitioned by means of a ramp as shown on Drawings.
    d. Openings in floor or ground surfaces shall not allow passage of a sphere more than ½ inch diameter except as allowed for elevators and platform lifts as shown in ADA Figure 302.3 and on the Drawings.

## 2.3 MANUFACTURERS

A. Subject to compliance with requirements, provide products from one of following manufacturers (listed in alphabetical order), only where specifically named in product categories:

1. Balco Inc., Wichita, KS (Balco).
2. Construction Specialties, Inc., Muncy, PA (C/S).
3. Dow Corning Corp., Midland, MI (Dow Corning).
4. Emseal Joint Systems, Westborough, MA (Emseal).
5. Erie Metal Specialties, Inc., Akron, NY (EMS).
6. Inpro Jointmaster, Muskego, WI (Jointmaster)
7. Lymtal International Inc. Lake Orion, MI (Lymtal).
8. MM Systems Corporation, Atlanta, GA (MM).
9. TechStar, Inc., Findlay, OH (TechStar).
10. Tremco, Cleveland, OH (Tremco).
11. Watson Bowman Acme Corporation, a Division of Master Builders Solutions, Amherst, NY (WBA).

## 2.4 PRODUCTS, STANDARD EXPANSION JOINT SYSTEMS

A. W.I. 10.6: Expanding foam sealants:

1. 1200 Series Foam Seal, Jointmaster.
2. ColorJoint Silicone Sealing System, ESS Series, MM.
3. Seismic Colorseal, Emseal.
4. Iso-Flex Precom “C”, LymTal.
5. Wabo Seismic WeatherSeal, WBA.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine surfaces and blockouts where expansion joint systems will be installed for installation tolerances and other conditions affecting performance of Work.

B. Check elevations on each side of expansion joint gap to ensure flush slab-to-slab transition.

C. Check anticipated or actual minimum and maximum joint openings. Compare to manufacturer's movement specifications and make joint sizing recommendations.

D. Coordinate and verify that related Work meets following requirements:

1. Check adhesion to substrates and recommend appropriate preparatory measures.
2. Curing compounds used on concrete surfaces are compatible with Work to be installed.
3. Concrete surfaces have completed proper curing period for system selected.
4. Coordinate expansion joint system with other related Work before installation of expansion joint.
5. Verify expansion joints are compatible with Joint Sealants and traffic toppings.

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

F. Cease installation if expansion joint blockouts and/or openings exhibit cracked edges, voids or spalls. Repair with approved material prior to installation of expansion joint.

G. Correct unsatisfactory conditions in manner acceptable to Manufacturer and Engineer before installing joint system.

### 3.2 PREPARATION

A. Prepare for installation of expansion joint systems in accordance with manufacturer's recommendations

B. Surface Preparation:

1. Acid etching: Prohibited.
2. Prepare substrates according to joint system manufacturer's written instructions.
3. Clean joints thoroughly in accordance with manufacturer's instructions to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion.

### 3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing joint assemblies and materials unless more stringent requirements are indicated.

B. Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

C. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturers recommended limitations for installation, or when temperature of work area or substrate are below 40ºF.

D. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

E. Seal all openings to occupied spaces to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.

F. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturer.

## 3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections: Prior to opening to traffic, test joint seal for leaks by maintaining continuously wet for 12 hours. Repair leaks revealed by examination of seal underside. Repeat test and repairs until all leaks stopped for full 12 hours.

B. Manufacturer Services: Provide qualified manufacturer’s technical representative for periodic inspection of Work at critical time of the installation, including but not limited to pre-concrete formwork and placement site meetings, block out inspection, surface defect repair, surface preparation, metal work, expansion gland installation and waterproofing system installation.

## 3.5 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of Work.

**END OF SECTION 07 95 00**

# SECTION 09 91 13 - EXTERIOR PAINTING

## 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 surface preparation and the application of paint systems on the following exterior substrates:

- **W.I. 45.2 “Paint Standpipes” (Alternate)**
- **W.I. 45.4 “Clean/Paint Rebar at Wall Openings” (Alternate)**
- **W.I. 45.5 “Clean/Paint S.O.G. Transition Angles” (PS#2) (Alternate)**

### 1.3 DEFINITIONS

A. MPI Gloss Level 1 (Matte Finish): Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3 (‘Egg-Shell-Like’ Finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4 (‘Satin-Like’ Finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Provide additional samples at Owner request until Owner approval is obtained (incidental).

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

E. Sample Warranty: For each system indicated.

F. Evidence of applicator's being certified by manufacturer. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims, including:

   a. Applicator's financial responsibility for warranty burden under agreement terms.
   b. Manufacturer's financial responsibility for warranty burden under agreement terms.

## 1.5 EXTRA MATERIALS

A. Furnish extra materials that are described below from the same product run (batch mix) as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Quantity: Furnish an additional 5 gallons of each material and color applied.

## 1.6 QUALITY ASSURANCE

A. Standards:

   1. Preparation and Workmanship: Comply with manufacturer's written instructions and recommendations in "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.
   2. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Owner/Engineer at no added cost to Owner.

B. Pre-construction Testing:

   1. No testing has been performed on any of the existing coatings. There are no existing records for paint type and/or lead/hazardous material content. The age of the existing paint systems is unknown.
   2. Contractor is responsible for cost of pre-construction testing required to comply with all Federal, State, and Local requirements regarding painting preparation and

application work. See section “Scope of Work” under “Part 3 – Execution” in this Section for additional information.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment, and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

## 1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## 1.9 WARRANTY

A. Paint Materials: Furnish Owner with written **5-year** warranty that paint products will not experience the following due to material defects:

1. Check, crack, blister, or delaminate from the substrate.
2. Fade or change color.
3. Weather or exhibit loss of gloss.
4. Chalking.

B. Paint System (Includes Preparation & Installation Procedures): Furnish Owner with written **5-year** Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements. Warranty shall state that Paint system will be free of any defects listed under note 1.9A above related to material deficiency as well as any

deficiencies related to preparation or installation procedures for a period of 5 years from date of Substantial Completion.

C. Perform any repair under this warranty at no cost to Owner.

D. Address and state following in terms of Warranty:

1. Length of warranty.
2. Change in value of warranty – if any – based on length of remaining warranty period.
3. Transferability of warranty.
4. Responsibilities of each party.
5. Notification procedures.
6. Dispute resolution procedures.
7. Limitations of liability for direct and consequential damages.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products listed in the Exterior Painting Schedule at the end of this Section.

### 2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Contractor responsible to verify compatibility of existing coatings with new paint products.

B. Colors: In general, match color of existing adjacent surfaces to Owner’s satisfaction. Provide samples/mockups for Owner selection and approval of colors.

C. See Section 3 “Execution” for schedule of paint systems to be used on this project.

## PART 3 - EXECUTION

## 3.1 GENERAL INFORMATION

A. Preparation and painting is required as described in this Section and noted on the Drawings and in Section 020010.

B. Minor items that are not specifically listed may also require preparation and painting as part of base bid work scope, and are incidental to the project scope of work.

C. Mockups

1. Provide Mockups for each type of paint and substrate combination. Obtain Owner/Engineer approval of surface preparation and finished painting work product for all applicable combinations of substrate, surface preparation procedures, and paint products, colors, and finishes prior to proceeding with Work. Install additional mockups as needed to obtain approval (incidental).

D. Existing Paint Information

1. No testing of existing paint materials to establish type of existing paints has been completed or is available.

E. Metal / Hazardous Material Content Testing Results:

1. No testing of existing paint materials for hazardous materials content has been completed or is available.

## 3.2 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Remove all debonded coatings. Remove all laitance and surface contaminants, including oil, grease, and dirt as specified by manufacturer's written recommendations to provide warranty.

D. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrate surfaces and conditions.

E. **Pre-construction Paint Testing:** Testing of existing paint materials for lead and other hazardous materials content has **not** been conducted. Testing of existing paint for lead content and other hazardous materials content is responsibility of Contractor and is **incidental to this project**.

F. **Preconstruction Adhesion Testing:** Adhesion testing of the generic paint systems specified has **not** been conducted. Coordination of the following preconstruction testing is responsibility of Contractor:

1. Using the specific paint product manufacturer and paint products to be used for painting work, Owner will engage an independent paint materials testing laboratory technician (acceptable to Owner/Engineer) to perform ASTM D4541 - 09e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers. Successful adhesion test results at representative areas (minimum 5 S.F. in area), on each substrate prepared and the new paint system applied according to this specification shall be tested prior to acceptance of a full-scale application of the paint products. Successful adhesion test results shall be demonstrated prior to proceeding with painting work. Test locations include, but are not limited to:

   a. All applicable combinations of substrates, locations, and paint products to be utilized.

   b. Obtain paint manufacturer's written approval of adhesion testing methods and results.

G. **Ongoing Adhesion Testing:** In addition to the pre-construction adhesion testing outlined above, the Owner reserves the right to perform adhesion testing throughout the project for verification as painting work progresses. Ongoing adhesion testing is to be performed after all specified preparation work is completed.

H. **Paint Thickness Testing:** Owner will engage an independent testing agency to document (time, location, and result) wet film thickness testing. Contractor in conjunction with paint manufacturer shall develop a project standard that correlates minimum wet film thickness readings required to achieve the required dry-film thicknesses (DFT).

1. Contractor shall also utilize wet film thickness testing at the beginning of work on any new substrate, in order to assist with developing the final application technique.

I. **Paint Manufacturer's Technical representative:** Contractor is responsible to ensure a technical representative of the paint manufacturer to be used for this project is present on site during representative and critical examination tasks, including pre-construction and ongoing adhesion testing operations.

## 3.3 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Provide mockups of surface preparation procedures for Owner/Engineer approval.

C. See section 3.2 "Examination" for additional tasks required prior to preparation and painting work, including testing to be performed and demonstrated prior to proceeding with paint preparation and painting.

D. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

E. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, bird droppings, failed existing coatings, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.

F. Perform surface preparation to all surfaces/substrates as outlined elsewhere in this specification document. Containment, collection, and disposal of all preparation debris shall be responsibility of Contractor. Submit plan to Owner/Engineer prior to start of Work. Minimum requirements include:

1. Provide containment and collection procedures to not affect nearby vehicles, patrons, or other operational areas.
2. Contain and/or collect preparation debris and dispose of in manner acceptable to Owner/Engineer. Preparation debris shall not be allowed into existing drainage system. Disconnect and/or protect existing drainage system.

G. Perform additional mechanical preparation to remove unsound coatings, corrosion, etc. down to bare metal as outlined elsewhere in this specification document.

H. Transitions between different layers of substrates/coatings shall be mechanically feathered together to provide a sound and tight transition for over-coating.

I. **All Painting Work Items**: All surfaces shall receive a 2,000-psi power wash with a paint manufacturer-approved and Owner-approved bio-degradable detergent to remove all “chalking”, dirt, grease, bird droppings, and material that could inhibit bond of new paint materials. Contractor to confirm power-washing procedure does not damage existing construction prior to proceeding with full-scale operation. After power-washing, all surfaces shall be thoroughly rinsed to remove all remaining detergent residue and contaminants.

1. Do not use high-pressured power washers that may cause damage. Confirm that 2,000 psi washing will not damage surfaces, and adjust accordingly as necessary.
2. Power washing shall not be used near elevator towers as it may damage operation of the elevator. Solvent cleaning and power tool cleaning/abrading shall be utilized in lieu of power washing in these areas. Protect elevator towers from dust/debris and water entering into shaft.

J. **Steel Substrates:** Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer. All existing painted surfaces shall be

cleaned and prepared according to SSPC-SP3 “Hand / Power Tool Cleaning” to provide a mechanically abraded / profiled surface to promote a mechanical bond.

1. Corroded and/or exposed steel shall be prepared by the following, prior to spot priming:
    a. SSPC-SP11 “Power Tool Cleaning to Bare Metal”.
2. Proper containment, collection, and disposal of preparation debris shall be the responsibility of the Contractor.

K. **All Painting Work Items**: After mechanically preparing all areas, **all** surfaces shall be thoroughly rinsed to remove all remaining laitance to provide suitable final substrate for painting. Comply with manufacturer’s written requirements.

L. Boundaries between different layers of existing coatings and between existing coatings and bare steel shall be feathered together prior to application of primer paint materials.

M. Provide barriers and containment as required by applicable regulations to contain all airborne debris.

N. **Paint Manufacturer’s Technical representative:** A technical representative of the paint manufacturer to be used for this project shall be present on site during representative and critical preparation tasks, and shall view and approve representative results of surface preparation work prior to paint application operations. Perform additional surface preparation procedures as required by the paint manufacturer.

## 3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated. Application by roller, brush, or spray shall be pre-approved by manufacturer and Engineer.
2. Paint surfaces behind movable items same as similar exposed surfaces.

B. If undercoats or other conditions show through topcoats, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

## 3.5 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner may engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## 3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.7 EXTERIOR PAINTING SCHEDULE

A. Minimum dry-film thicknesses (DFT) shall be verified with manufacturer's recommendations for each system.

B. Submit color samples to Owner for final approval of paint color and finish.
a)

C. **W.I. 45.2 "PAINT STANDPIPES" (PS#4) (Alternate)**

1. Alkyd System MPI EXT 5.1D:

   a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.

      1) Benjamin Moore; Super Spec HP – Alkyd Metal Primer.
      2) Sherwin-Williams; Protective & Marine - Kem Kromik Universal Primer.
      3) Equivalent products by other manufacturers and approved by Architect/Engineer.

   b. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), MPI #9.

1) Benjamin Moore; Corotech - Alkyd Gloss Enamel.
2) Sherwin-Williams; Protective & Marine - Seaguard 1000 Marine.
3) Equivalent products by other manufacturers and approved by Architect/Engineer.

D. **W.I. 45.4 "CLEAN / PAINT REBAR AT WALL OPENINGS" (Alternate)**

**W.I. 45.6 "CLEAN / PAINT COLUMN BASE PLATE" (Alternate)**

1. Carboline:

   a. Base Coat: Carbomastic 615.
   b. Topcoat (2 coats): Carbothane 133 LH.

2. PPG:

   a. Base Coat: Pittguard 97-145.
   b. Topcoat (2 coats): Pitthane 95-812.

3. Tnemec:

   a. Base Coat: Series 135 Chembuild.
   b. Series 73 EnduraShield.

4. Engineer-approved equivalent.

5. Confirm color with Owner prior to ordering materials. Provide samples for Owner selection and install mockup for approval.

**END OF SECTION 09 91 13**

# SECTION 09 91 21 - PAVEMENT MARKING - RESTORATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Contract 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. This Section includes surface preparation and application of high build paint systems to replace existing for the items of types, patterns, sizes, and colors described in this article.

B. Provide the following systems as shown on Drawings:

1. Parking Stall Stripes.
2. Traffic Arrows, crosswalks, accessible stall access aisles, walkways, symbols, stop bars, words and other markings.
3. International Symbol of Accessibility.

C. Provide painting of curbs and curb ramps as described in the following paragraphs:

1. Paint vertical surface and the first 6 in. of the abutting horizontal surface at the top of all curbs and islands (including PARCS equipment islands) within parking facility to match existing, unless otherwise noted on the Drawings.
2. Paint color for curbs and curb ramps shall be yellow.

D. Proportion International Symbol of Accessibility in accordance with ICC A117.1-2009 Accessible and Usable Buildings or 2010 ADA Standards for Accessible Design.

E. Related Work:

1. Pavement Marking Contractor shall verify compatibility with sealers, joint sealants, caulking and all other surface treatments as specified in Division 07.

### 1.3 SUBMITTALS

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

B. Provide product data as follows:

1. Manufacturer’s certification that the material complies with standards referenced within this Section.
2. Intended paint use.
3. Pigment type and content.

4. Vehicle type and content.

C. Submit list of similar projects (minimum of 5) where pavement-marking paint has been in use for a period of not less than 2 yrs.

D. See requirements of Division 01 Sections for submittal and RFI requirements.

## 1.4 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

## 1.5 QUALITY ASSURANCE

A. Provide written 1 year warranty to Owner that pavement markings will be free of defects due to workmanship, inadequate surface preparation, and materials including, but not limited to, fading and/or loss of markings due to abrasion, peeling, bubbling and/or delamination. Excessive delamination, peeling, bubbling or abrasion loss shall be defined as more than 15% loss of marking material within one year of substantial completion and/or occupancy of the parking area. With no additional cost to Owner, repair and/or recoat all pavement marking where defects develop or appear during warranty period and all damage to other Work due to such defects.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Pavement marking materials shall meet Federal, State and Local environmental standards.

B. Paint shall be manufactured and formulated from first grade raw materials and shall be free from defects or imperfections that might adversely affect product serviceability.

C. Paints shall comply with the National Organic Compound Emission Standards for Architectural Coatings, Environmental Protection Agency, 40 CFR Part 59.

D. The product shall not contain mercury, lead, hexavalent chromium, or halogenated solvents.

## 2.2 PAVEMENT MARKING PAINTS:

A. Low VOC - Solvent based paint may be employed for white and yellow pavement markings and shall meet the requirements of MPI #32

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

a. Chlorinated Rubber Traffic & Zone Marking Paint, 7493/7494, by RAE Products & Chemicals Corporation
b. Setfast Low VOC Acrylic Marking Paint, TM 5626/5627 by Sherwin Williams Company

B. 100% acrylic waterborne - paint shall be used for white and yellow pavement markings and shall meet requirements of MPI #70.

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

a. Hi-Build Latex “Liquid Thermoplastic” Traffic & Zone Marking Paint, 5430/5431, by RAE Products & Chemicals Corporation
b. Setfast Acrylic Waterborne Marking Paint, TM 226/227 by Sherwin Williams Company

2. 100% acrylic waterborne paint for special color pavement markings (blue, green, red, black) shall meet requirements of Federal Specification TT-P-1952E. Special color marking materials shall be compatible with the white and yellow pavement markings where they are layered.

C. All products shall have performance requirements of Type I and II of Federal Standard TT-P-1952E.

## 2.3 COLOR OF PAINT

A. Color of paint shall match existing, unless noted otherwise on Contract Drawings:

1. White: Match federal color chip 37925 and daylight directional reflectance (without glass beads) shall not be less than 84% (relative to magnesium oxide) when tested in accordance with Federal Test Method Standard 141, Method 6121.
2. Yellow: Match federal color chip No. 33538. Color shall have daylight directional reflectance (without glass beads) of not less than 50% (relative to magnesium oxide) when tested in accordance with Federal Test Method Standard 141, Method 6121.
3. Blue: Match federal color chip No. 35180. Color shall have daylight directional reflectance (without glass beads) of not less than 52% (relative to magnesium oxide) when tested in accordance with Federal Test Method Standard 141, Method 6121.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Document the location of existing striping and traffic marking, and colors utilized prior to removal of traffic lines and markings for surface preparation.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

E. Striping shall not be placed until full cure of concrete repairs, sealers or coatings. Sealers (other than silane) generally require 14 days @ 70°F or higher. Silane sealers require 24 hrs @ 70°F or higher. Bituminous surfaces generally require 30 days @ 45° F or higher. Coatings shall be fully cured

## 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Do not paint or finish any surface that is wet or damp.

C. Clean substrates of substances that could impair bond of paints, including dirt, dust, oil, grease, release agents, curing compounds, efflorescence, chalk, and incompatible paints and encapsulants.

D. Concrete Substrates: Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Lay out all striping on each tier, using existing layout, dimensions and details unless otherwise noted on Contract Drawings.

F. Report any discrepancies, interferences or changes in striping due to field conditions to Engineer/Architect prior to painting. Pavement Marking Contractor shall be required to remove paint, repair surface treatment and repaint stripes not applied in strict accordance with Contract Drawings.

G. Where existing painted pavement markings and/or stripes conflict with new striping layout or must be removed due to installation which does not conform to contract

requirements, remove existing paint markings, using care to avoid scarring substrate surface.

1. Concrete and asphalt surfaces: Material shall be removed by methods acceptable to Engineer/Architect and cause as little damage as possible to surface texture of pavement. Methods, that can provide acceptable results, are grinding and air or shot blasting. Use of chemicals to remove pavement markings prohibited. Collect residue generated by removal of pavement markings and dispose of as required by all applicable laws and regulations. If grinding is used, lightly grind floor surface using wheel mounted floor grinder or similar equipment with positive elevation control of grinder head. For all removal techniques: On test area, demonstrate to Owner acceptable removal of paint material and control of paint removal equipment to prevent substrate scarring.
2. Traffic Topping/Membrane surfaces: Remove existing pavement markings by solvent washing or high-pressure water washing. Submit letter from traffic topping/membrane manufacturer certifying that solvents and/or water pressures are acceptable for this use and will not damage material. On test area, demonstrate to Owner acceptable removal of paint material and control of paint removal equipment to prevent substrate scarring.
3. Contractor shall not use paint, bituminous bond coat or other methods of covering markings to obliterate existing pavement markings.
4. Material deposited on pavement as a result of removal shall be removed as work progresses. Accumulation of material, that might interfere with drainage or might constitute a hazard to traffic, prohibited.
5. Curing compounds on new concrete surfaces (less than 1 yr old) shall be removed per existing pavement marking removal requirements prior to installation of new pavement markings.

H. Work Areas:

1. Store, mix and prepare paints only in areas designated by Contractor for that purpose.
2. Provide clean cans and buckets required for mixing paints and for receiving rags and other waste materials associated with painting. Clean buckets regularly. At close of each day's Work, remove used rags and other waste materials associated with painting.
3. Take precautions to prevent fire in or around painting materials. Provide and maintain appropriate hand fire extinguisher near paint storage and mixing area.

I. Mixing:

1. Do not intermix materials of different character or different manufacturer.
2. Do not thin material except as recommended by manufacturer.

J. Disposal:

1. Contractor shall properly dispose of unused materials and containers in compliance with Federal Resource Conservation Recovery Act (RCRA) of 1976 as amended, and all other applicable laws and regulations.

## 3.3 APPLICATION

A. Apply painting and finishing materials in accordance with manufacturer's directions. Use applications and techniques best suited for material and surfaces to which applied. Minimum air shall be used to prevent overspray. Temperature during application shall be minimum of 40º F and rising, unless manufacturer requires higher minimum temperature. Maximum relative humidity shall be as required by manufacturer.

1. Total wet mil thickness of 0.015 in (minimum).
2. Total dry film thickness of 0.008 in (minimum).

B. All lines shall be straight, true, and sharp without fuzzy edges, overspray or non-uniform application. Corners shall be at right angles, unless shown otherwise, with no overlaps. Line width shall be uniform (-0%, +5% from specified width). No excessive humping (more material in middle than at edges or vice versa).

C. All lines shall be 4-inches wide unless otherwise noted.

**END OF SECTION 09 91 21**

# SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

## 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. This Section specifies Fire Protection Systems for buildings and structures.

### 1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI/AWWA C104/A21.4, "Specification for Ductile Iron Pipe Lining".
2. ANSI/AWWA C11/A21.11, "Specification for Ductile Iron Pipe Joints".
3. ANSI/AWWA C151/A21.51, "Specification for Ductile Iron Pipe".
4. ANSI/AWWA C153/A21.53, "Specification for Ductile Iron Pipe Fittings".

B. Factory Mutual Research Corp. (FM):

C. National Fire Protection Association (NFPA):

1. NFPA 14, "Standard for the Installation of Standpipe and Hose Systems".
2. NFPA 24, "Standard for the Installation of Private Service Mains and Their Appurtenances."

D. Underwriters' Laboratories, Inc. (UL):

E. International Code Council, Inc. (IBC)

1. The International Building Code.
2. The International Fire Code.

### 1.4 DEFINITIONS

A. Pipe sizes used in this Section are nominal pipe size (NPS) specified in inches. Tube sizes are standard tube size specified in inches.

B. Other definitions for fire protection systems are included in referenced NFPA standards.

## 1.5 SYSTEM DESCRIPTIONS

A. Manual Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Does not have permanent water supply. Piping is dry. Water must be pumped into standpipes to satisfy demand.

## 1.6 PERFORMANCE REQUIREMENTS

A. Minimum Pipe Sizes: Match existing.

B. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.

1. Standpipe and Hose Systems: 200 psig

## 1.7 SUBMITTALS

A. General: Submit information specified in the submittals Section of "Basic Mechanical Requirements" in accordance with conditions of Contract and Division 01 "Specifications" Section.

B. See requirements of Division 01 Sections for submittals and RFI’s.

## 1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.

B. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.

C. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections, and testing.

D. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following: (See Section 15010 Section 3.4 for additional testing requirements.)

1. NFPA 14 "Standard for the Installation of Standpipe and Hose Systems".
2. NFPA 24 "Standard for the Installation of Private Service Mains and Their Appurtenances."

# PART 2 - PRODUCTS

## 2.1 STANDPIPE SYSTEM

A. All components are to be UL listed and FM approved.

B. Pipe: Pipe shall be designed to withstand a system working pressure of not less than 200 psi.

1. Above ground: Schedule 40, black steel pipe:

a. ASTM A53, Grade A, "Welded & Seamless Steel Pipe".
b. ASTM A795, "Spec. for Black & Hot-Dipped Zinc Coated (Galvanized) Welded & Seamless Steel Pipe for Fire Protection Use".

C. Fittings: ANSI B16.4, 250 psi hot dipped galvanized malleable or cast-iron screwed.

D. Hose Valves: 300 psi 2.5 in. (63.5mm) size complete with adapters, cap and chain, and local city Fire Department standard hose threads. Similar to Elkhart U-25-2.5.

E. Siamese Fittings: Inlet fittings with internal clappers, hose caps and chains as noted on Drawings. Hose threads according to local city Fire Department standards.

F. Check Valves: 200 psi iron body, bronze mounted, synthetic rubber disc, bolted cap, flanged ends with ball drip.

G. Drain Valve: 200 psi, bronzed globe, integral seats, renewable seat with threaded ends.

H. Provide base threads for fittings complying with standards of local Fire Department.

I. Standpipe isolation valves shall be indicating type OS & Y gate valves with solid wedge disc and flanged ends.

J. Provide a 0 to 300 psi 3.5-inch diameter pressure gauge at the top of each standpipe riser.

K. Double Check Detector Assembly, 8 in. Shall meet AWWA and USC Foundation for Cross Control and Hydraulic Research Requirements.

L. Water Flow Detector: Grinnell No. VSR-F.

M. Vertical Indicator Posts: Grinnell No. F750 with tamper switch.

N. All clamps, rods and other supporting material shall be hot dipped galvanized or stainless steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

## 3.2 PIPING INSTALLATION

A. Install in accordance with NFPA 14:
   1. Paint above ground portions of standpipe system to match existing system.
   2. All clamps, rods and other supporting material shall be hot dipped galvanized or stainless steel.
   3. All piping shall be adequately pitched to drain all sections of pipe.
   4. Provide minimum hand clearance between valves and wall and columns to allow operation of valve.

## 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

## 3.4 COMMISSIONING

A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:

   1. Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.
   2. Verify that specified tests of piping are complete.

## 3.5 DEMONSTRATION

A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.

B. Schedule demonstration with at least 7 days' advance notice.

**END OF SECTION 211200**