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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 (PS#2, PS#5)
   WI 1.5 – Temporary Signage & Barriers (PS#2, PS#5)

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 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 to obtain all permits required to perform work as specified, per all authorities having jurisdiction.

3. This Work Item applies to Parking Structures #2 and #5.

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B. Materials

1. N/A

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 at each structure to install all required signage, barriers, and dust control, maintain throughout entire project at all work areas, and remove upon completion of work.
3. This Work Item applies to Parking Structures #2 and #5.

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, 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, 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 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 supplemental reinforcement and patching material to restore floor slab to original condition and appearance. Refer to Detail Series 3.0 for specific requirements.

2. This Work applies to Parking Structures #2 and #5.

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".

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". Remove all unsound concrete within marked boundary prior to saw-cutting and preparation of patch edges.

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 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 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.
WI 3.1  FLOOR REPAIR - PARTIAL DEPTH

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

B. This Work Item applies to Parking Structures #2, and #5.

C. Sound floors to locate deterioration and verify in field with Engineer prior to starting removals.

D. Payment for this Work Item shall be per square foot of repair performed.

WI 3.2  FLOOR REPAIR – SLAB-ON-GRADE (ALTERNATE)

A. Refer to Work Item "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 Alternate Work Item shall be per square foot of repair performed.

C. This Work Item applies to Parking Structures #2 and #5.

WI 3.3  FLOOR REPAIR - FULL DEPTH

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 supplemental reinforcement, and install patching material to restore floor to original integrity and appearance. Refer to Detail 3.3 for specific requirements.

2. Installation of supplemental reinforcement required on Detail 3.3 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. This Work Item applies to Parking Structures #2 and #5. Payment shall be per square foot of repair performed.

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. All concrete shall be removed from within marked boundaries until sound concrete is reached on all sides.
3. 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".
4. Do not cut or damage any existing reinforcement, including WWR.
5. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching", Article "Inspection of Repair Preparation".
6. 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".
7. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
8. 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 3.4 FLOOR REPAIR – FULL DEPTH AT EJ (ALTERNATE)

A. Refer to Work Item 3.3 for similar scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 3.4 for specific requirements.

B. This Work Item applies to Parking Structure #5.

WI 3.5 FLOOR REPAIR – CURBS

A. Refer to Work Item "Concrete Floor Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 3.5 for specific requirements.

B. Payment for this Work Item shall be per square foot of repair performed.

C. This Work Item applies to Parking Structure #2.
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WI 3.6 REBUILD S.O.G. TRANSITION JOINTS (ALTERNATE)

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing asphalt, prepare and compact existing fill (and add fill material as needed), install reinforcement and prepare concrete repair surfaces, place concrete, and tool and seal control joints. See Detail 3.6 for specific requirements.

B. Materials

1. Concrete repair materials and epoxy-coated steel reinforcement shall be as specified on Drawing R-001 and 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", Article "Inspection".
2. Procedure for removals shall be as specified in Section "Surface Preparation for Patching", Article "Preparation". Verify requirements in field with Engineer. Protect existing construction to remain. Work also includes full-depth sawcut at termination of asphalt removals. Locate embedded conduit/wiring (if present) prior to saw-cutting.
3. Do not cut or damage any existing reinforcement embedded in elements to remain without prior approval from Engineer.
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 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 Restoration".
6. Save existing fill/base material and compact to 95% Standard Proctor. Add suitable engineered fill material as needed (incidental).
7. Install reinforcement as shown on Detail 3.6. Prepare existing concrete surfaces to ¼" amplitude (minimum CSP 8).
8. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching", Article "Preparation of Cavity for Patch Placement".
9. Repair materials and associated reference specifications are listed in Article "Materials" above. Installation procedures shall be in accordance with referenced specifications for selected material.
10. Slope repair surfaces to match existing conditions, and to maintain existing drainage layout. No ponding allowed. Submit plan to Engineer for approval prior to concrete placement.
11. Tool and seal control joints in new slab-on-grade concrete, located at 5-ft. on center perpendicular to joint. Locate joints with Engineer in field prior to concrete pour.
12. Seal joint between new concrete and existing asphalt as shown on Detail.

**WI 3.10  SUPPLEMENTAL REINFORCING DOWELS**

A. Work scope is to install additional reinforcing dowels in concrete repairs per Engineer’s direction. This work item is for the installation of additional dowels/reinforcing steel beyond that already required in other details. Install supplemental dowels as directed by Engineer; no payment for dowel installation without Engineer’s direction.

B. Payment shall be per each supplemental dowel installed (each dowel shall be 4’-0” long, epoxy-coated #4 bar, epoxy-anchored with Hilti HIT HY200 Safe Set with 8” minimum embedment.

**WI 4.9  REMOVE LOOSE OVERHEAD CONCRETE**

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.

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.

3. Contractor shall verify overhead removal heights and general scope of removal requirements prior to submitting bid.

4. This Work Item applies to Parking Structures #2 and #5.

5. At Parking Structure #2, removals are required on the exterior façade, all levels. Provide manlift as needed to complete Work (incidental).

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 of PS#2.

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 5.0  CONCRETE BEAM 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, install supplemental reinforcement, and install patching materials to restore concrete beams to original condition and appearance. Refer to Detail Series 5.0 for specific requirements.

2. Installation of supplemental reinforcement and temporary shoring requirements on Detail Series 5.0 shall be incidental to this Work and NOT separate pay items.

B. Materials

1. Repair materials shall be as specified in Sections “Cast-in-Place Concrete Restoration”, “Prepackaged Repair Mortar”, and/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". Engineer shall verify critical repair area identification prior to start of repairs.

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. Shoring support shall be provided as necessary and in accordance with Detail Series 5.0 and Section “Cast-in-Place Concrete Restoration”.

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7. 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 Section "Shotcrete" is used. Area adjacent to repair shall be cleaned to Owner's satisfaction prior to leaving site.

WI 5.1 BEAM REPAIR - PARTIAL DEPTH (LEDGE)

A. Refer to Work Item "Concrete Beam Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 5.1 for supplemental reinforcement and other specific requirements.

B. At all locations where this Work occurs, Contractor shall provide 25-kip minimum capacity shoring (2 levels below) at both stems of double tees in repair area prior to start of concrete removals (incidental).

C. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per lineal foot of repair performed.

WI 5.2 BEAM REPAIR - PARTIAL DEPTH (SIDE)

A. Refer to Work Item "Concrete Beam Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 5.2 for specific requirements.

B. This Work may require concrete to be placed from the topside concurrent with full-depth floor repairs, based on field conditions. Verify in field.

C. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per square foot of repair performed.

D. Temporary Shoring required to perform this Work shall be payable under W.I. 18.1. Verify shoring requirements in field with Engineer.

WI 5.3 BEAM REPAIR - PARTIAL DEPTH (UNDERSIDE)

A. Refer to Work Item "Concrete Beam Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 5.3 for specific requirements.

B. This Work Item applies to Parking Structure #2. Payment for this Work Item shall be per square foot of repair performed.

C. Temporary Shoring required to perform this Work shall be payable under W.I. 18.1. Verify shoring requirements in field with Engineer.
WI 5.4 BEAM REPAIR – LEDGER BEAMS

A. Refer to Work Item "Concrete Beam Repair" for scope of Work, materials, and procedure associated with this Work Item. Refer to Detail 5.4 for specific requirements.

B. This Work Item applies to Parking Structure #2. Payment for this Work Item shall be per square foot of repair performed.

C. Temporary Shoring required to perform this Work shall be payable under W.I. 5.4A. Verify shoring requirements in field with Engineer.

WI 5.4A BEAM REPAIR – SHORING AT LEDGER BEAMS

A. Work Item is to install shoring, where required, for Work Item 5.4. Verify required shoring in field with Engineer. Refer to Detail 5.4A for specific requirements.

B. This Work Item applies to Parking Structure #2. Payment for this Work Item shall be per each location shored.

WI 6.0 CONCRETE COLUMN 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 install patching materials to restore concrete columns to original condition and appearance. Refer to Detail Series 6.0 for specific requirements.

2. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per square foot of repair performed.

B. Materials

1. Repair materials shall be as specified in Sections "Cast-in-Place Concrete Restoration", "Prepackaged Repair Mortar", and/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. Review repair area with Engineer prior to start of removals to determine if temporary shoring is required.

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".

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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 Restoration".

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

**WI 6.2 COLUMN HAUNCH – PATCHING REPAIR**

A. Work is to remove encasement concrete at cracked/delaminated haunches, prepare and paint exposed steel surfaces, and install reinforcement and patch material. Refer to Detail 6.2 for additional requirements. Refer to W.I. 6.0 for similar concrete patching requirements.

B. This Work Item applies to Parking Structure #2, and is payable per each location. Verify locations in field with Engineer prior to start of work.

C. Materials

1. Paint materials shall be as specified on Detail 6.2.
2. Repair materials shall be as specified in Sections "Cast-in-Place Concrete Restoration", "Prepackaged Repair Mortar", and/or "Shotcrete".
3. Trowel applied repair materials not allowed.

D. Execution

1. Contractor shall locate and layout Work areas as indicated on Drawings. Verify in field with Engineer.
2. Perform concrete removals in manner to not damage existing construction to remain.
3. Temporary shoring may be required per other Work Items if conditions of pack rust or steel section loss are encountered. Confirm with Engineer.
4. Contractor shall prepare surface to be painted in accordance with manufacturer's recommendations and Section “Exterior Painting”.
5. Apply self-priming epoxy immediately after surface preparation.
6. Install reinforcement as noted on Detail.
7. Install formwork and place repair material to restore concrete encasement to original condition. Match existing dimensions and configuration and provide chamfered edges.

**WI 6.3 COLUMN HAUNCH – REMOVE LOOSE CONC. & PAINT**

**A. Scope**

1. Work is to remove loose concrete/previous patch material at expansion joint slide bearing, clean/prepare and paint the existing steel. Refer to Detail 6.3 for additional requirements.
2. This Work Item applies to Parking Structure #2, and is payable per each connection painted.
3. Loose concrete/previous patch material not shown on Detail 6.3. Intent is to remove existing loose concrete/previous patch material to the condition shown on Detail 6.3. Confirm in field with Engineer.

**B. Materials**

1. Carboline:
   a. Base Coat: Carboline 615.
   b. Topcoat (2 coats): Carbothane 133 LH.
2. PPG:
   a. Base Coat: Pittguard 97-145.
3. Tnemec:
   b. Series 73 EnduraShield.
4. Confirm color with Owner prior to ordering materials. Provide samples for Owner selection and install mockup for approval.

**C. Execution**

1. Contractor shall locate and layout Work areas as indicated on Drawings.
2. Contractor shall verify requirements in field prior to submitting Bid. Intent is to remove existing patch material and loose concrete, clean/prepare and paint all existing exposed steel at the expansion joint slide bearing haunches.
3. Contractor shall prepare surface to be painted in accordance with manufacturer's recommendations and Section “Exterior Painting”.

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WI 6.4 COLUMN/BEAM REPAIR @ CONNECTION (ALTERNATE)

A. Work is to locate and repair concrete as needed at the beam-column connections exposed to the sky prior to cleaning/repainting per W.I. 45.6. Refer to Detail 6.4 for specific requirements.

B. This alternate Work Item, if accepted, applies to Parking Structure #2. Payment shall be per Square Foot of repair performed.

C. Refer to W.I. 6.0 for similar concrete patching requirements.

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.

2. This Work Item applies to Parking Structures #2 and #5.

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 "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 repair performed.

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.

2. This Work applies to Parking Structures #2 and #5.

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".
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 "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. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per lineal foot of repair performed as directed by Engineer.

WI 8.2 TEE STEM TEST OPENING

A. Refer to Work Item "Precast Tee Stem Repair" for scope of Work, materials and procedure associated with this Work Item. Refer to Detail 8.2 for specific requirements.

B. This work shall be performed at locations noted on plans at start of project. Confirm specific locations in field with Engineer prior to start of removals.

C. Remove all live loads from floor above. Perform removals to not damage any embedded reinforcement or pre-stressing strands (including WWR). Allow Engineer to observe cavities and exposed pre-stressing strands prior to proceeding. Engineer will direct Contractor to complete tee stem repairs as needed per W.I. series 8.0 as applicable.

WI 8.3 TEE STEM REPAIR – PARTIALLY ENCASED STEM

A. Refer to Detail Series 8.3 for scope of Work, materials and procedure associated with this Work Item.

B. Work occurs as needed at Parking Structures #2 and #5, based on findings at test openings per W.I. 8.2. Verify requirements in field with Engineer prior to start of Work.

C. Payment shall be per each location (24'-0" total repair length). See W.I. 8.3A if longer repair length is required due to amount of deterioration to pre-stressing strands. See notes on Detail 8.3.
D. Do not apply tension to the Dywidag bars unless Engineer is present onsite. Calibrated equipment shall be utilized for tensioning to document amount of tension applied to bars. Coordinate with DSI. Contractor responsible to procure tensioning equipment suitable for the repairs as detailed.

E. See Drawing R-506 for Detail Series 8.3 for PS#2, and Drawing R-507 for Detail Series 8.3 for PS#5.

**WI 8.3A TEE STEM REPAIR – PARTIALLY ENCASED STEM (ADDITIONAL LENGTH)**

A. Work Item 8.3A applies where longer repair length is required for W.I. 8.3 due to amount of deterioration to pre-stressing strands.

B. Payment shall be per linear foot of repairs performed beyond the 24’-0” repair length required per W.I. 8.3, only as directed by Engineer. See notes on Detail 8.3.

**WI 8.4 TEE STEM REPAIR – END ENCASEMENT**

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate extensively cracked or spalled and delaminated tee stems, install temporary shoring, remove loose or deteriorated concrete, prepare cavity and install reinforced concrete tee stem encasement. Refer to Detail Series 8.4 for specific requirements.

2. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per each location of repair performed (required length of repair shown on Detail).

B. Materials/ Equipment

1. Repair materials shall be as specified in Sections "Cast-in-Place Concrete Restoration" and/or "Prepackaged Repair Mortar".

2. Epoxy-coated steel reinforcing shall be as specified in Section "Cast-in-Place Concrete Restoration".

3. Chipping hammers shall be 15 lb or less as directed by Engineer. Only sections of loose concrete shall be removed; do not remove sound concrete or expose embedded reinforcement without prior direction from Engineer.

4. Temporary Shoring: Adjustable-type, rated for 6,000 lbs at required extension.

C. Execution

1. Contractor shall locate and mark Work areas. General locations of tee stems requiring encasement repairs are shown on Drawings. Engineer shall verify Work areas with Contractor prior to start of repairs.
2. Remove live loads from floors above and below repair area. Both stems of double tee being repaired shall be shored as required on Detail Series 8.4 and in accordance with Section "Cast-in-Place Concrete Restoration".
   a. Install 25-kip minimum capacity temporary shoring (2 levels below) beneath both stems of affected double tee prior to start of concrete removals (incidental).

3. Existing location of pre-stressing strands shall be determined before Work commences.

4. Tee flange concrete shall be removed as needed to place repairs from above (incidental).

5. Cracked tee stem concrete shall remain in place. Do not completely remove concrete from around reinforcement. Verify concrete removal requirements with Engineer prior to start of Work.

6. Following necessary concrete removals, concrete stem surface shall be roughened to 0.25 in. amplitude.

7. Drill holes in stem for #4 bent bars. Exercise caution to avoid damage to pre-stressing strand and other reinforcement.

8. Install epoxy-coated steel reinforcing in accordance with Section "Cast-in-Place Concrete Restoration" and Drawings.

9. Install formwork as required to conform to dimensions as shown on Details.

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.

11. Shop drawings for Work shall be submitted and approved by Engineer prior to start of Work.

**WI 8.5 TEE STEM – CABLE REPAIR “GRABB-IT”**

A. Scope of Work

1. Work consists of all labor, materials, equipment, supervision and incidentals necessary to repair broken pre-stressing strands/tendons with "Grabb-It" PT cable splice or engineered approved equivalent. Reference detail 8.5 for additional information.

B. Materials

1. "Grabb-It" Barrier Cable Splice, Precision Post Tension, LP, Dallas, TX (972 – 287-2390) or engineered approved equivalent.

2. Prestressing tendons, ASTEM A416, Grade 270, uncoated, seven-wire low-relaxation strand with minimum ultimate strength of 270 ksi. Manufactured by one source and conform to ACI 423.7.

C. Execution

1. Coordinate with other Work Item Series 8.0 work items.

2. Contractor and Engineer shall locate (for repair) all broken prestressing strands after test openings per W.I. 8.2.
3. When directed by Engineer, this Work includes providing “Grabb-It" splice hardware necessary to connect two undamaged sections of prestressing strands. Incidental to this is 20'-0" of new prestressing strands and Grabb-it splice required to splice on a replacement section of cable.

4. “Grabb-It” cable splices shall be seated on sound unrusted / undeteriorated sections of prestressing cables.

5. Concrete removal/replacement work as needed to facilitate this repair item shall be payable under other W.I. Series 8.0 Work Items.

WI 9.1  EXPANSION JOINT – NEW BLOCKOUT (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate the Work area, remove sound and unsound floor slab concrete as required, install reinforcement and place repair material to prepare cavity to receive new expansion joint systems. Refer to Detail 9.1 for specific requirements and installation conditions. This Work shall be coordinated with Work Item 10.3.

2. This Work Item applies to Parking Structure #2 and #5.

B. Materials

1. Cast-in-place concrete repair materials shall be as specified in Section "Cast-in-Place Concrete Restoration" and/or “Prepackaged Repair Mortar" and Drawings.

2. Trowel applied patching materials not allowed.

C. Execution

1. Contractor shall remove existing expansion joint materials in manner that minimizes damage to adjacent concrete (incidental).

2. Contractor shall locate and mark all expansion joint installation areas requiring new blockout as located on Drawings.

3. All concrete requiring removal shall be square sawcut and chipped to limits/dimensions detailed. Caution shall be exercised during saw-cutting operations to avoid damaging existing reinforcement near surface of concrete.

4. Spalls and delaminations located beyond removal limits shown on Detail shall be repaired under W.I. 3.1.

5. Contractor shall allow for Engineer inspection of all cavities for condition as specified.

6. Final surface preparation, concrete placement, finishing and curing shall be performed as specified in concrete repair material specification. Manufacturer specifications/requirements for these issues shall also be followed in the event proprietary bag mix repair materials are used.

7. Condition and finish of repaired blockout surfaces shall be per expansion joint manufacturer’s requirements to receive new expansion joint system. Repair bugholes or other imperfections to satisfaction of manufacturer and Engineer (incidental). Expansion joint manufacturer shall review, approve, and provide
written confirmation of blockout surfaces (new and existing) prior to installing expansion joints.

WI 10.0 EXPANSION JOINT REPAIR AND REPLACEMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to remove existing expansion joints, prepare adjacent concrete and furnish and install new expansion joint system. Refer to Detail Series 10.0 for specific requirements.

B. Materials

1. Expansion joint system materials shall be as specified in Section "Expansion Joint Assemblies," installed in strict accordance with manufacturer's recommendations.
2. Cast-in-place concrete repair materials shall be as specified in Section "Cast-in-Place Concrete Restoration" and/or "Prepackaged Repair Mortar" and Drawings.
3. Trowel applied patching materials not allowed.

C. Execution

1. Contractor shall remove existing expansion materials in manner that minimizes damage to adjacent concrete.
2. Alterations to existing expansion joint blockout required for installation of new expansion joint system shall be performed in accordance with other Work Items. Expansion joint manufacturer shall review, approve, and provide written confirmation of blockout surfaces (new and existing) prior to installing expansion joints.
3. Joint installation procedures shall be in accordance with referenced specifications and manufacturer's recommendations.
4. In-place testing: Prior to opening to traffic, test joint seal for leaks. Repair leaks revealed by examination of seal underside. Repeat test and repairs until all leaks stopped.

WI 10.3 EXPANSION JOINT – ELASTOMERIC CONCRETE EDGED (ALTERNATE)

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 10.3 for specific requirements.

B. This Work Item applies to Parking Structure #2 and #5.

C. Payment for this work item shall be per linear foot. See drawings for locations of joints to be replaced.

D. Expansion joints shall be installed into wall openings at ends and turned up to promote positive drainage. (incidental).
E. Submit shop drawings for approval, detailing all pertinent information including condition around interior columns and condition at exterior walls/columns. Utilize manufacturer's standard horizontal-to-vertical termination/installation procedures as applicable.

**WI 10.6 REPLACE STAIR TOWER ISOLATION JOINT (ALTERNATE)**

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. This Work Item applies to Parking Structures #2 and #5.

C. Payment for this Work shall be per lineal foot of repair performed. Contractor required to provide and install aluminum non-slip plates at doorways within repair areas (or remove and re-install existing plates as applicable) incidental to this Work Item. Verify requirements in field prior to submitting Bid.

D. New aluminum non-slip cover plates shall be 3/16”, Grade 2, with center crown and beveled edges from SlipNOT, or Engineer-approved equivalent. Length and width shall be customized to span joint and fit within existing door openings. Contractor required to verify dimensions in field. Secure to stair/elevator tower side of joint with countersunk stainless steel anchors. Installation shall be ADA-compliant.

E. Submit shop drawings of new aluminum non-slip cover plates for Engineer approval prior to ordering/fabricating.

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

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

**WI 10.7 REPLACE EXTERIOR VERTICAL SEALANT AT E.J. (ALTERNATE)**

A. Scope of Work

   1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to replace existing failed vertical joint sealant.
   2. Work Item applies to Parking Structure #2. Payment for this Work Item shall be per lineal foot of repair performed (manlift or other means of access incidental)

B. Materials

   1. Approved materials for use in this Work are specified in Section “Expansion Joint Assemblies.”
C. Execution

1. Contractor shall remove all existing vertical joint sealant, prepare concrete surfaces per manufacturer's direction, and install new pre-compressed vertical silicone sealant per manufacturer’s direction. Verify joint width in field prior to ordering material. Provide sample and confirm color selection with WSU prior to ordering.

2. Refer to Detail 10.6 for similar joint installation requirements (cover plates not required). Comply with expansion joint manufacturer’s written requirements.

**WI 11.1 SEAL FLOOR CRACKS (ALTERNATE)**

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidental necessary to locate, prepare, and seal random cracks in concrete floors. Refer to Detail 11.1 for specific requirements.

2. This Work Item applies to Parking Structures #2 and #5. Payment for this Work Item shall be per lineal foot of repair performed.

B. Materials

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

C. Execution

1. Contractor shall thoroughly clean and inspect concrete slabs for cracks. Those identified as either greater than 0.03 in. wide or showing evidence of water and/or salt staining on ceiling below shall be sealed. All cracks identified for repair shall be marked with chalk to aid in precision routing. Obtain depths to embedded reinforcement in area of repair by use of a pachometer. Determine depth of electrical conduit (metal or plastic). Do not exceed this depth 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 the 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.

3. Cavities shall be thoroughly cleaned by sandblasting and grinding 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. Traffic topping manufacturer shall specify joint sealant type compatible with traffic topping, as applicable.
WI 11.2  REPLACE JOINT SEALANTS

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 11.2 for
   specific requirements.

2. This Work Item applies to Parking Structures #2 and #5. Payment for this Work
   Item shall be per lineal foot of sealant installed.

B. Materials

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

C. Execution

1. Contractor shall remove existing sealant from joints.

2. When existing joint dimensions do not conform to Detail 11.2, joints shall be routed
   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.

3. Cavities shall be thoroughly cleaned sandblasting and grinding to remove all
   remaining sealant and unsound concrete which may interfere with adhesion.
   Groove shall also be air blasted to remove remaining debris.

4. Install sealants in accordance with sealant manufacturer’s instructions and
   Section “Concrete Joint Sealants”.

5. Traffic topping manufacturer shall specify joint sealant type compatible with traffic
   topping, as applicable.

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

A. Scope of Work

1. Work consists of providing all labor, materials, equipment, supervision, and
   incidentals necessary to provide sealed control joints in concrete repair areas as
   shown on Drawings. Refer to Detail 11.4 for specific requirements.

2. This Work is incidental to concrete floor repair items and is NOT a separate pay
   item.

3. This Work Item applies to Parking Structures #2 and #5.

B. Materials

1. Sealant materials shall be as specified in Section "Concrete Joint Sealants".
C. Execution

1. Contractor shall locate and provide control joints in repair areas to maintain existing joint configuration. This work also applies to the perimeter of full-depth floor repairs per W.I. 3.3. Verify in field with Engineer prior to placing repairs.
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. Approved joint materials shall be installed as specified in Article "Materials" above.

WI 11.7 COVE SEALANT (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing cove sealant, prepare surfaces, and install cove sealant between floor and vertical surfaces as shown on Drawings. Refer to Detail 11.7 for specific requirements.

This Alternate Work Item applies to Parking Structures #2 and #5, if accepted. Payment for this Work Item shall be per lineal foot of sealant installed.

B. Materials

1. Joint sealant materials shall be as specified in Section "Concrete Joint Sealants".

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 16.0  TRAFFIC TOPPING

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to prepare existing floor surfaces and install traffic topping. Coating of all vertical surfaces within Work limits shall be incidental to installation of traffic topping. Refer to Detail series 16.0 for specific requirements.

B. Materials

1. Traffic topping materials shall be as specified in Section "Traffic Coatings."

C. Execution

1. 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. Detail coat along cracks and joints as shown on Detail 16.1 is incidental to traffic topping work.
5. Coating system shall be thoroughly cured prior to Work areas being returned to service.

WI 16.1  TRAFFIC TOPPING - STRIPS @ JOINTS (ALTERNATE)

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

B. This Work Item, if accepted, applies to Parking Structures #2 and #5.

C. At Parking Structure #2, payment shall be lineal foot to install 18-inch wide strips of coating centered along all tee-to-tee sealants replaced per W.I. 11.2. This work is directly related to W.I. 11.2.

D. At Parking Structure #5, payment shall be lump sum to install the following on level 2: 18-inch wide strips of coating centered along all tee-to-tee sealants, 6'-0" wide strips centered along all expansion joints, and 6" horizontal by 4" vertical strips along all cove sealants. This work includes the vehicle ramp from level 2 to level 1).

WI 16.3  TRAFFIC TOPPING – REPAIR (FOR REFERENCE ONLY)

A. Refer to Work Item "Traffic Topping" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 16.3 for specific requirements.
B. This Work Item is incidental and applies to Parking Structure #2 and #5, as applicable to repair existing coating system prior to recoat per W.I.’s 16.4 and 16.5. Contractor to verify requirements in field.

C. This work includes the following at localized areas as needed:
   1. Removing loose/delaminated existing coating.
   2. Preparing surfaces per coating manufacturer’s requirements.
   3. Installing primer, base coat, and intermediate coat(s) as needed to build up system to match thickness of adjacent intact coating, prior to recoating per other Work Items.

WI 16.4 TRAFFIC TOPPING – RECOAT BEAM STRIPS (ALTERNATE)

A. Refer to Work Item "Traffic Topping" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 16.4 for specific requirements.

B. This Work Item, if accepted, applies to Parking Structure #2. Intent of work item is to recoat all crossover beams on levels 2 thru 5.

C. This work includes:
   1. Preparing surfaces per coating manufacturers requirements.
   2. Installation of intermediate coat with aggregate and topcoat.

WI 16.5 TRAFFIC TOPPING – RECOAT STAIRS (ALTERNATE)

A. Refer to Work Item "Traffic Topping" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 16.5 for specific requirements.

B. This Work Item, if accepted, applies to Parking Structure #5. Intent of work item is to recoat concrete stairs and landings.

C. This work includes:
   1. Preparing surfaces per coating manufacturers requirements.
   2. Installation of intermediate coat with aggregate and topcoat.
   3. This work also includes painting of contrasting delineation strips on all tread nosings throughout all stair towers (1-½” by width of treads). Confirm color with Owner.

WI 16.9 SCALED SURFACE REPAIR (EPOXY/SAND) (ALTERNATE)

A. Scope of Work
   1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to scarify, shotblast, and prepare surface of concrete
topping and install epoxy/sand overlay on prepared concrete surface. Refer to Detail 16.9 for specific requirements.

2. This Alternate Work Item applies to Parking Structure #2. Payment for this Work Item shall be per square foot of repairs performed.

3. Complete concrete floor repairs per other W.I.’s prior to performing this Work. Replace cove and tee-to-tee sealants per other W.I.’s after installation of epoxy/sand repair material, per manufacturer’s requirements.

B. Materials

1. See Section “Epoxy Broadcast Overlay Systems”.

2. For any selected product:
   a. Submit color sample for Owner approval.
   b. Sand shall be 12-20 size minimum (or equivalent) unless noted otherwise. Submit samples of various sizes and colors for Owner/Engineer approval.
   c. Provide non-sag additive as required to prevent epoxy/sand from sagging. Seed stone until rejection.
   d. For the topcoat, provide manufacturer’s compatible polyurethane topcoat (incidental).

C. Execution

1. Contractor shall locate scaled surface repair areas and verify with Engineer prior to start of Work. See Drawings R-101 and R-102.

2. All loose/delaminated existing concrete shall be removed by scarifying up to ½” amplitude.

3. After scarification, shotblast surface per manufacturer’s recommendations. Sand-blasting and/or water-blasting shall then be performed to remove all dust/debris/laitance. Additional surface preparation shall be performed as needed in strict accordance with manufacturer’s recommendations.

4. Install 10-ft.x10-ft. trial section of epoxy/sand system for Owner/Engineer approval, utilizing scarification, shot-blasting, sand-blasting, water-blasting, and other surface preparation as required. Do not proceed with further material application until trial sections accepted in writing by Owner. Remove and replace rejected trial sections until approval is obtained (incidental).

5. Install the epoxy/sand overlay per manufacturer’s recommendations to minimum depth shown on Detail (in multiple lifts as required).

6. Manufacturer’s technical representative shall be onsite during surface preparation and epoxy/sand installation.

7. Provide 5-year warranty for labor and material for any material and adhesion/bonding failures.

8. Replace joint sealants per other W.I.’s after installation of epoxy/sand material, but prior to installation of polyurethane topcoat. Confirm with material manufacturer.
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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.

F. This Work Item applies to Parking Structure #2.

WI 25.1 MECHANICAL / ELECTRICAL ALLOWANCE

A. Scope of Work

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

2. All utilities removed during Work shall be reinstalled in accordance with latest edition of electrical and mechanical codes in effect. Work ineligible for allowance includes Work covered by or incidental to Work Items within this Specification or for Work required through Contractor's negligence.

3. This Work Item applies to Parking Structures #2 and #5.

B. Method of Payment

1. Mechanical/electrical Work, as approved in writing by Owner 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 allowance and actual payment receipts will be reflected in an adjustment of allowance amount.
2. Contractor shall not perform any Work that is to be billed under this Allowance without prior written approval from Owner.

**WI 25.2 MECHANICAL – REPLACEMENT FLOOR DRAIN**

**A. Scope of Work**

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to remove existing drains and install new drains at locations shown on plans and as directed by Engineer. Work Item 25.3 is directly related to this Work Item. Refer to Detail 25.2 for specific requirements.

2. This Work Item applies to Parking Structures #2 and #5. Payment shall be per each drain replaced.

**B. Materials**

1. Approved materials for this Work are as shown on Detail 25.2.

2. 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. Replacement drains shall be set at same elevation as existing drains (or lower) as necessary to ensure proper drainage. Contractor shall verify proper drainage by ponding or elevation survey. Maintain minimum concrete cover as specified at all drain locations.

3. Perform removals with chipping hammers; no coring allowed. Do not cut or damage existing embedded reinforcement.

4. Concrete removals and surface preparation shall be as shown on Detail 25.2 and per requirements of Section “Surface Preparation for Patching”.

5. Drains shall be installed as shown on Detail 25.2.

6. Installation of sealant around perimeter of drains shall be incidental to this work.

**WI 25.3 MECHANICAL - PIPE AND HANGERS**

**A. Scope of Work**

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to connect replacement drains (W.I. 25.2) to existing floor drain system by installing pipe and hangers, or to remove and replace deteriorated piping as directed by Engineer. Work Item 25.2 is directly related to this Work Item. Refer to Detail 25.3 for specific requirements.

2. This work also includes removing and replacing existing sections of deteriorated piping. Confirm locations in field with Engineer.
3. This Work Item applies to Parking Structures #2 and #5. Payment shall be per lineal foot of piping replaced.

B. Materials

1. Approved materials for this Work are as shown on Detail 25.3.

C. Execution

1. Contractor shall locate and mark all areas where new or replacement floor drain piping is 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.
3. Maintain minimum slope as required for positive drainage, and maintain existing height clearances. Notify Engineer of any discrepancies.
4. Verify route of new piping in field with Engineer prior to start of work.

**WI 25.4 MECHANICAL – REPLACE FLOOR DRAIN COVER**

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to replace floor drain grates where the existing grate is damaged. Locate drains in field with engineer. Contractor to verify drain grate style/dimensions match the existing drain prior to ordering.

B. Materials

1. Existing drain types vary, but are similar to the following:
   a. Covered Level Drains: Smith 2140-C-U-M-B.
   b. Roof Level Drains: Smith 2295-Y-U-FBS

**WI 31.1 RESEAL FLASHING AT NORTH STAIR (ALTERNATE)**

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to reseal the flashing at the roof level of the North Stair with flexible sealant.
2. This Alternate Work, if accepted, occurs at Parking Structure #2. Payment is per lineal foot of sealant replaced.

B. Materials

1. Sealant materials shall be as specified in Section "Concrete Joint Sealants".
C. Execution

1. Remove all existing sealant and prepare surface to be free of dirt, dust, and all other contaminants/debris. Contractor to use caution during surface preparation so as not to damage the adjacent flashing / membrane or other nearby utilities.

2. Install sealants in accordance with sealant manufacturer’s instructions and Section “Concrete Joint Sealants”. Sealant color to match existing wall color.

3. Perform touch up painting to any portions of the wall damaged during surface preparation. Color to match existing.

WI 37.1 REPLACE ROOF LEVEL DOORS AND FRAMES (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to remove existing steel door and frame and install new steel door and frame to match existing. Door and frame shall be completely installed level and plumb, and all surrounding joints sealed and finished. Door shall be provided in galvanized finish, painted to match existing color, including level designations (incidental).

2. This Work Item applies to Parking Structure #5, and applies to both roof level doors. Payment shall be per each location.

B. Materials

1. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel, Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

2. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   3. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model.

4. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

5. Frames of 0.053-inch thick steel.

6. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.

7. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

8. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

9. Provide lever-type door hardware per ADA requirements.

10. Steel Doors and Frames – acceptable manufacturers:
   a. Amweld Building Products, Inc.
b. Benchmark Commercial Doors; a division of General Products Co., Inc.
c. Ceco Door Products; a United Dominion Company.
d. Copco Door Co.
e. Curries Company.
f. Deansteel Manufacturing, Inc.
g. Kewanee Corporation (The).
h. Mesker Door, Inc.
i. Pioneer Industries Inc.
j. Republic Builders Products.
k. Steelcraft; a division of Ingersoll-Rand.

11. Verify existing door and frame dimensions in field prior to ordering/fabrication.

C. Execution

1. Contractor shall coordinate door and door frame replacement work with Owner.
2. Contractor is responsible for securing stair tower work areas during work. Do not allow public access to work area, but keep stair tower open to traffic during work.
3. Contractor shall install and finish door completely, including final painting. Door shall be installed plumb and level, and shall be permanently fixed in door opening with appropriate anchors, shims and necessary hardware.
4. Replacement door hardware to match existing.
5. Submit shop drawings and samples for Owner/Engineer approval of all materials, hardware, anchors, colors, etc. prior to ordering or fabricating.

WI 41.1 STAIR REPAIR – LANDINGS

A. Refer to Work Item “Concrete Floor Repair” for similar scope of Work, materials, and procedures. See Detail 41.1 for specific requirements.

B. This Work Item applies to Parking Structure #2. Verify requirements in field prior to submitting Bid. Payment shall be per square foot of repair performed.

WI 41.2 STAIR REPAIR – TREADS

A. Refer to Work Item “Concrete Floor Repair” for similar scope of Work, materials, and procedures. See Detail 41.2 for specific requirements.

B. This Work Item applies to Parking Structure #2. Verify requirements in field prior to submitting Bid. Payment shall be per each tread repair performed.

WI 41.3 STAIR TOWER – REPAIR CONCRETE AT THRESHOLD (ALTERNATE)

A. Refer to Work Item “Concrete Floor Repair” for similar scope of Work, materials, and procedures. See Detail 41.3 for specific requirements.
B. Contractor is responsible for providing shoring/bracing as necessary to support existing construction during repairs.

C. This Alternate Work Item, if accepted, applies to Parking Structure #5. Payment shall be per square foot of landing concrete repair performed. Confirm requirements in field with Engineer.

D. Install coating on repair surface per requirements of W.I. 16.0 (incidental to this work).

WI 41.4  STAIR TOWER – METAL PAN/CHANNEL REPAIR (ALTERNATE)

A. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to replace the deteriorated channel and clip angles at roof level of the Southwest stair tower in Parking Structure #5. New channel and clip angles shall be HDG and match existing size and configuration.

B. Contractor is responsible for providing shoring/bracing as necessary to support existing construction during repairs. This work also includes removal/replacement of localized CMU masonry units to facilitate work (include 5 replacement units in lump sum pricing).

C. This Alternate Work Item, if accepted, applies to Parking Structures #5. Payment shall be lump sum.

D. Materials


2. Weld connections: Continuous ¼" fillet weld along all abutting edges of clip angles (similar to existing). Weld electrodes shall be E70XX. All welding materials and procedures shall be per AWS D1.1, latest edition.


E. Execution

1. Provide signage and barriers as necessary to inform public and provide barrier between pedestrians and work area to prevent access at all times. Refer to W.I. 1.5 for other minimum requirements.

2. Provide temporary shoring/bracing as necessary to maintain stability to existing construction at all times during repairs.

3. This work shall be performed with caution to not damage existing elements to remain including, but not limited to: existing structural steel tube and plate stringers, steel landings, CMU walls, and existing concrete infill to remain at landings.

4. Contractor shall remove existing channel and existing support clip angles. Do not damage channels/plate to remain. Remove localized CMU masonry units as needed. Confirm in field with Engineer.

5. Install new channel and clip angles and connect to existing channels utilizing similar bolted and welded connections as existing (confirm in field with Engineer).
6. Replace CMU masonry units to match existing construction and paint white to match surrounding construction.

7. Touchup all hot-dipped galvanized elements with approved cold-galvanizing product at all welded locations and other scratches/nicks due to installation. Touchup all existing painted steel surfaces (including adjacent rusted areas).

**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 at PS#2 and PS#5 to perform traffic marking installation in all areas of the structure where existing markings are affected by Project including, but not limited to:
   a. Concrete floor repair locations.
   b. Locations of sealant replacement.
   c. Epoxy/sand repair areas.
   d. Areas of new traffic coating installation.
   e. Areas where dust/debris have accumulated.
   f. Contractor staging/storage/parking areas.
   g. Traffic markings affected by debris removal, cleanup procedures, equipment/material storage, construction traffic, deliveries, etc.

3. This Work Item applies to Parking Structures #2 and #5.

4. 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.

5. Perform this work during off-hours and/or on weekends (incidental) after all other repairs have been completed as necessary to not close additional parking spaces during normal daytime hours. Comply with parking space closure requirements as specified on Drawings.

6. New traffic markings shall be installed in all work areas prior to re-opening for normal use.

7. Remove existing stripes in those locations where they conflict with new striping layout.

8. Any traffic markings required due to Alternate Work, if accepted, shall be incidental and included in the unit price of the Alternate Work Items. No extras allowed.
B. Materials
   1. Traffic marking materials shall be as specified in Section "Pavement Marking - Restoration".

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 traffic marking 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 - Restoration".
   5. Engineer shall inspect all layout and surface preparation for conditions in accordance with Section "Pavement Marking - Restoration."
   6. All procedures shall be in accordance with Section "Pavement Marking - Restoration."

WI 45.5 COAT BUMPER WALLS (ALTERNATE)

A. Scope of Work
   1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to locate, prepare surface, and coat locations of exposed rebar on concrete surfaces. Refer to Detail 45.5 for specific requirements.
   2. This Alternate Work Item applies to Parking Structure #2. Payment (if accepted) shall be per square foot of coating applied. Contractor to verify requirements in field prior to submitting Bid.

B. Materials
   1. Detail Coat: Carbomastic 615. Apply to all exposed steel surfaces. Apply by brush/roller to ensure coverage of 8-10 mils dry.
   2. Epoxy Primer: Carboguard 635. Apply by brush/roller to ensure coverage.
   3. Topcoat (2 coats): Carbothane 133 LH.
   4. Engineer-approved equivalent system by PPG or Tnemec.
   5. Confirm color with Owner prior to ordering materials. Provide samples for Owner selection and install mockup for approval.

C. Execution
   1. Contractor shall locate Work areas in field with Engineer.
   2. Contractor shall prepare surfaces to be coated in accordance with manufacturer's recommendations and Section "Exterior Painting".
WI 45.6 CLEAN/PAINT STEEL CONNECTIONS (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to locate, prepare surfaces, and paint existing roof level steel connections (exposed to sky).

2. This Alternate Work Item, if accepted, applies to Parking Structures #2 and #5, and is payable per each connection painted.

B. Materials

1. Carboline:
   a. Base Coat: Carbomastic 615.
   b. Topcoat (2 coats): Carbothane 133 LH.

2. PPG:
   a. Base Coat: Pittguard 97-145.

3. Tnemec:
   b. Topcoat (2 coats): Series 73 EnduraShield.

4. Confirm color with Owner prior to ordering materials. Provide samples for Owner selection and install mockup for approval.

C. Execution

1. Contractor shall locate and confirm Work areas in field with Engineer.

2. Contractor shall verify requirements in field prior to submitting Bid. Intent is to clean and paint all steel precast connections exposed to the sky on levels 5 & 6 of PS#2, and level 4 of PS#5.

3. Contractor shall prepare surface to be painted in accordance with manufacturer's recommendations and Section “Exterior Painting”.

4. Submit samples for Owner approval of color. Install mockups for approval prior to proceeding with full scale operations.

WI 45.7 PAINT STAIR TOWER INTERIORS (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, clean/prepare, and paint all interior masonry walls of all stair towers. Work scope also includes localized surface preparation and painting of steel stair framing where rusting.
2. Payment for this Work shall be lump sum to clean, prepare, and paint all interior masonry surfaces in the Southwest and Northeast stair towers of PS#5, all levels. Contractor shall also include cleaning, surface preparation, and painting of steel framing at all localized rusting areas (Contractor to verify requirements prior to submitting Bid). Galvanized steel is NOT to be painted.

3. This Work Item applies to Parking Structure #5.

B. Materials

1. Masonry Surfaces: Refer to Section “Exterior Painting”.
2. Steel: Same system as W.I. 6.3.

C. Execution

1. For masonry surfaces:
   a. Contractor shall locate and layout Work areas as indicated on Drawings.
   b. Contractor shall clean existing painted masonry surfaces using minimum of detergent and brush-scrubbing, and pressure-washing.
   c. Contractor shall prepare surface to be painted in accordance with Section "Exterior Painting" and manufacturer's recommendations.
   d. Protect adjacent non-painted surfaces from being painted. Mask off adjacent features not receiving paint.
   e. Contractor shall apply paint in accordance with referenced specification section listed in Article "Materials" above, and manufacturer's recommendations.

2. For steel surfaces:
   a. Contractor shall locate and layout Work areas. Verify in field with Engineer.
   b. Contractor shall clean existing painted metal surfaces per requirements of SSPC-SP3.
   c. Contractor shall prepare surface to be painted in accordance with Section "Exterior Painting" and manufacturer's recommendations.
   d. Contractor shall air blast and remove all debris from Work area prior to application of primer or paint.
   e. Contractor shall apply primer to all cleaned and prepared metal surfaces on same day (within 8 hrs) as cleaning/preparation operations. Apply primer according to Section "Exterior Painting" and in strict accordance with manufacturer's recommendations.
   f. Protect adjacent non-painted surfaces from being painted. Mask off adjacent features not receiving paint.
   g. Contractor shall apply paint in accordance with referenced specification section listed in Article "Materials" above, and manufacturer's recommendations.
SECTION 025130 - 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° 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 025130

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SECTION 025140 - SURFACE PREPARATION FOR PATCHING

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 delaminated and unsound concrete, existing failed patches, 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 and ELECTRICAL CONDUIT in repair area and mark these locations for reference during concrete removal. Do NOT nick, cut, or damage any embeds.

H. Boundaries of repair 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 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 proved 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 boundaries to depth of 0.75 in. into floor slab, unless otherwise noted. No saw-cutting required at 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 saw-cutting to avoid damaging existing reinforcement and electrical conduit and any other embedded items near surface of concrete. Any damage to existing embedded reinforcement or conduit 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 repair material shall be heavy abrasive blasted or heavy shot-blasted prior to placement of repair material, to produce a final concrete surface profile matching ICRI CSP 8 or above.

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.

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 exposed embedded reinforcement that is left in place. Minimum of 1.5-in. concrete cover shall be provided over all new and existing reinforcement.

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. Clean entire bar diameter 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 025140
SECTION 033021 - 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. 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).

1.6 REFERENCES

A. American Concrete Institute (ACI):

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.”
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):

11. ASTM C 138, “Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.”
17. ASTM C 231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.”
22. ASTM C 618, “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in 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 185, fabricated from as-drawn steel wire into flat sheets, mats only. Roll stock prohibited.

C. 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:
   2. Michigan Department of Transportation.
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.

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, not exceeding ¾-inch nominal size. 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 or manufactured sand conforming to ASTM C 33 and having preferred grading shown for normal weight aggregate in ACI 302.1R, Table 5.1.


I. 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 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 deg F.
5. Use corrosion-inhibiting admixture in parking structure slabs and other areas noted on drawings.
6. Use shrinkage reducing/shrinkage compensating admixture where indicated on drawings to keep shrinkage below 0.04%.
7. 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:
   c. “Master Pozzolith Series,” or “Master PolyHeed Series,” BASF Corporation.
   e. “OptiFlo Series” or “EcoFlo Series,” Premiere Concrete Admixtures.
   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:
   d. “Sikaplast Series” or “PlastoCrete Series,” Sika Corporation.
   e. “Polychem 1000” or “KB Series,” General Resource Technology.
   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.
   d. “Sikament Series” or “Sika ViscoCrete Series,” Sika Corporation.
   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:
d. “Sikatard Series,” or “Plastiment Series” or “Plastocrete Series,” Sika Corporation.
f. “LC-400 Series” or “LC-500 Series,” Russ Tech Admixtures, Inc.
g. “OptiFlo Series,” Premiere Concrete Admixtures.

   1. Products: Subject to compliance with requirements, provide one of following:
      c. “Master Air AE90”, or Master Air AE 200", or “Master Air VR10,” BASF 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:
      c. “MasterSet FP 20” or “MasterSet AC 534,” by BASF Corporation.
      d. “Sika Set NC,” “Plastocrete 161FL”, or “Sika Rapid-1,” by Sika Corporation.
      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.
      d. “Sika CNI,” Sika Corporation.
      e. “Catexol 1000 CN-CI,” Axim Concrete Technologies.
      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.
   d. “Sika Control 40,” Sika Corporation.

2.5 CURING MATERIALS

A. 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.

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

C. Water: Potable.

D. Curing Compound: Not allowed.

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 concrete with a water-cementitious materials ratio of 0.45 or less.

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

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:
   c. “Dural #452 and Dural Series”, by The Euclid Chemical Company, Cleveland, OH.
   d. Sikadur 32 Hi-Mod LPL”, by Sika Corporation, Lyndhurst, NJ.
   e. Other types may be used only with Engineer/Architect's approval in writing prior to bidding.

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

1. Provide one of following epoxy coatings:
   a. “Sikadur 32 Hi-Mod,” Sika Chemical Corp.
c. “Scotchkote 413 PC,” 3M 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:
   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.

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:

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.

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. Before installation of flatwork and after submittal, review, and approval of concrete mixture proportions, Contractor shall fabricate two acceptable test panels simulating finishing techniques and final appearance to be expected and used on Project. Test panels shall be minimum of 4 ft. by 4 ft. in area and shall be reinforced and cast to thickness of typical parking and drive area wearing surface in Project. (Maximum thickness of test panels need not exceed 6 in.) Contractor shall finish panels following requirements of paragraphs above. Finished panels (one or both)
may be rejected by Engineer, in which case Contractor shall repeat procedure on rejected panel(s) until Engineer acceptance is obtained. Accepted test panels shall be cured in accordance with Specifications and may be incorporated into Project. Accepted test panels shall serve as basis for acceptance/rejection of final finished surfaces of all flatwork.

5. 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:


   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.

      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.

      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 ADA guidelines.

      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.

   c. Walkway surfaces shall provide a slip resistant surface.

      1) Concrete surfaces shall be troweled 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 BASF Corporation.
   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.
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, 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.
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 1 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. 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.

G. 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. Reserve one set of cylinders for 56 days.
d. Unless notified by Engineer, reserve cylinders may be discarded without being tested after 56 days.

H. 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.

I. 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 033021
## APPENDIX: Concrete Mix Design Submittal Form

### I. GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Project:</th>
<th>City:</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Contractor:</td>
<td></td>
</tr>
<tr>
<td>Concrete Supplier:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixture Identification No.:</th>
<th>Concrete Grade:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Use (Describe)¹:</th>
</tr>
</thead>
<tbody>
<tr>
<td>example: floor slabs, topping, columns, etc.</td>
</tr>
</tbody>
</table>

### II. MIXTURE PROPORTIONING DATA

Proportioning Based on (Check only one):

- Standard Deviation Analysis: _____
- Trial Mix Test Data: _____

<table>
<thead>
<tr>
<th>Mixture Characteristics: (see Mixtures in Drawings General Notes)</th>
<th>Density: pcf;</th>
<th>Air: % specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density: pcf;</td>
<td>Air: % specified</td>
<td></td>
</tr>
<tr>
<td>Slump ____ in. before superplasticizer</td>
<td>Slump ____ in. after superplasticizer</td>
<td></td>
</tr>
<tr>
<td>Or for SCC: Spread ____ in.</td>
<td>Strength: ________ psi (28 day);</td>
<td></td>
</tr>
</tbody>
</table>

---

WALKER SUBMITTAL STAMP

CONTRACTOR SUBMITTAL STAMP
### III. MATERIALS

#### Aggregates: (size; type; source; gradation report; specification)
- **Coarse:**
- **Fine:**
- **Other Materials:**
  - **Type**
  - **Product-Manufacturer (Source)**
  - Cement:
  - Fly ash, 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)

<table>
<thead>
<tr>
<th></th>
<th>WEIGHT (lbs.) (per yd³)</th>
<th>ABSOLUTE VOL. (cu. ft.) (per yd³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Aggregate: (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregate: (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flash, slag, or other pozzolan:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silica Fume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processes Ultra-Fine Fly Ash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water: (4) (gals. &amp; lbs.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrained Air: (oz.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Other) _________:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Component</th>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water(1)</td>
<td>( = )</td>
<td>lb.</td>
</tr>
<tr>
<td>Cementitious Material(2)</td>
<td>( = )</td>
<td>lb.</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>( = )</td>
<td>lb.</td>
</tr>
<tr>
<td>Total Aggregate</td>
<td>( = )</td>
<td>lb.</td>
</tr>
</tbody>
</table>

### VI. SPECIFIC GRAVITIES

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Aggregate</td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td></td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Component</th>
<th>Unit</th>
<th>Amount per yd³</th>
<th>Amount per 100# cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Entraining Agent (A.E.A.)</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superplasticizer</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Reducer</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-corrosive Accelerator</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retarder</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithium Nitrate</td>
<td>gal.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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: | Standard Deviation: |
| (One test is average of two cylinder breaks) | (Single Group) |

| Attach copy of test data considered: | Standard Deviation: |
| | (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").

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>Mix #1 (comp. str.)</th>
<th>Mix #2 (comp. str.)</th>
<th>Mix #3 (comp. str.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Water Soluble Chloride Ion Content of mix:</th>
<th>____ % (by weight of cement)</th>
<th>ASTM C 1218</th>
</tr>
</thead>
</table>

Hardened Air Content (per ASTM C457):

<table>
<thead>
<tr>
<th>Air content:</th>
<th>____ %</th>
<th>Air void spacing Factor</th>
<th>____ in.</th>
<th>Specific surface:</th>
<th>____ in²/in³</th>
</tr>
</thead>
</table>

Chloride Ion Content of Concrete Mixture: ASTM C 1218

Shrinkage (Length Change, Average) per ASTM C157:

<table>
<thead>
<tr>
<th>____ %</th>
<th>@ 4 days</th>
<th>____ %</th>
<th>@ 7 days</th>
<th>____ %</th>
<th>@ 14 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ %</td>
<td>@21 days</td>
<td>____ %</td>
<td>@28 days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Xl. Remarks:

<table>
<thead>
<tr>
<th>Remarks</th>
</tr>
</thead>
</table>

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Ready Mix Concrete Supplier Information

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Main Plant Location:</td>
</tr>
<tr>
<td>Miles from Project Site:</td>
</tr>
<tr>
<td>Secondary or Backup Plant Location:</td>
</tr>
<tr>
<td>Miles from Project Site:</td>
</tr>
</tbody>
</table>

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

Signature ____________________________________________

Typed or Printed Name ________________________________________

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REQUIRED ATTACHMENTS

<table>
<thead>
<tr>
<th>Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse aggregate grading report</td>
</tr>
<tr>
<td>Fine aggregate grading report</td>
</tr>
<tr>
<td>Concrete compressive strength data used for calculation of required</td>
</tr>
<tr>
<td>average strength and for calculation of standard deviation</td>
</tr>
<tr>
<td>Chloride ion data and related calculations</td>
</tr>
<tr>
<td>Admixture compatibility certification letter</td>
</tr>
<tr>
<td>Shrinkage information per ASTM C157</td>
</tr>
<tr>
<td>ASTM C 457</td>
</tr>
<tr>
<td>Alkali Content Data and Calculations OR</td>
</tr>
<tr>
<td>ASTM C1293, ASTM C1260, ASTM C 1567 or CE CRD-C662 Test report for each</td>
</tr>
<tr>
<td>aggregate</td>
</tr>
</tbody>
</table>
SECTION 033713 - SHOTCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. 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

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

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

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

1.4 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.

E. Material Test Reports: For shotcrete materials.

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

A. 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.

B. 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.

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

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

D. 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.

E. 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.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
1.6 PROJECT CONDITIONS

A. 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.

B. 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, as drawn.

C. Plain-Steel-Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.


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. 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, 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.
3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Acceptable Blended Shotcrete Cement

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

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

1. Aggregate Gradation: ACI 506R, Gradation No. 2 with 100 percent passing 1/2-inch (13-mm) sieve.
2. Coarse-Aggregate Class: 3S.

D. 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: Match existing adjacent surfaces to satisfaction of Owner.

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

F. Carbon-Steel Fiber: ASTM C 1116, Type 1, carbon-steel fiber and ASTM A 820, Type 1, cold-drawn wire not less than 1 inch (25 mm) long.

G. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in shotcrete, complying with ASTM C 1116, Type III, not less than 1/2 inch (12 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.

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.

2.5 CURING MATERIALS

A. 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.

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

C. Water: Potable.

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

2.6 SHOTCRETE MIXES, GENERAL

A. Prepare design mixes for each type and strength of shotcrete.

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.

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

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

D. Carbon-Steel Fiber or Synthetic Fiber (if utilized): Uniformly disperse in shotcrete mix, according to manufacturer's written instructions.

E. 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.
2.7 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): 5,000 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 BASF Construction Chemicals, Shakopee, MN.
7. “Sikacem 103F”, (Dry or Wet Method) by Sika Corporation, Lyndhurst, NJ.
8. “Sikacem 133F”, (Dry Method) by Sika Corporation, Lyndhurst, NJ.

2.8 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.
2.9 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. Pre-packaged shotcrete materials may be used at Contractor's option. Pre-dampen pre-packaged 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. Pre-packaged 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 hydro-blast 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. 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 pre-molded 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. Confirm joint spacing in field with engineer.
3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
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 pre-dampening 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.

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. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. 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 4-1/2 inches (115 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.

1. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.

2. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

E. 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.

F. 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.
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. All surfaces shall be cleaned and/or repainted to Owner’s satisfaction at no cost to the Owner.

END OF SECTION 033713

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SECTION 033760 – 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. "Hot Weather Concreting" reported by ACI Committee 305.
   3. "Cold Weather Concreting" reported by ACI Committee 306.
   4. "Standard Specification for Curing Concrete" (ACI 308.1)

C. Contractor shall have following ACI publications at Project construction site at all times:
   2. "Hot Weather Concreting" reported by ACI Committee 305.
   3. "Cold Weather Concreting" reported by ACI Committee 306.

D. American Society for Testing and Materials (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. BASF Building Systems (BASF), 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. The following listed materials are not acceptable for all types of repair methods and work items (i.e. form and pour, form and pump, horizontal application, overhead application, partial-depth, full-depth, etc.). Contractor to state proposed use for individual products on product submittals for Engineer approval prior to start of work.

B. 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,” by BASF.
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.

2. Acceptable polymer modified materials for this Work are as follows:

a. “MasterEmaco T310 CI” by BASF.
b. “Sika Repair 222 with Latex R” or “SikaTop 111 Plus”, by c. “Duraltop” by Euclid
d. Form-Flo P-38 by Tomes
e. Other types may be used only with Engineer/Architect’s approval in writing prior to bidding.

C. Rapid Strength Repair Mortar: Shall be pre-packaged, 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,” by BASF.
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.

D. 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,” by BASF.
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. Acceptable polymer modified materials for this Work are as follows:
   b. “Verticoat,” “Speedcrete PM,” or “Duraltop Gel” by The Euclid.
   d. “Super-Top OV” by King
   e. Other types may be used only with Engineer’s approval in writing prior to bidding.

2.3 MATERIAL ACCESSORIES

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

B. 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 BASF.
   c. “Planibond 3C,” by MAPEI.
   e. “B-1 Rebar Coating,” by Tomes.

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

1. Prohibited on surfaces to receive paints, stains, coatings, etc. Confirm with Engineer prior to use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Epoxy Bonding Agent Extended Open Time:
   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, completely 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/bonding agent is required between successive lifts of patching material, if recommended by manufacturer.

F. Finishing:
   1. Apply a non-slip 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 deg F.
   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. 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 033760

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SECTION 071800 – 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 materials or related Work with which they 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.

B. Samples:

1. Two 4-in. by 4-in. samples showing finished product of complete coating system to be used as acceptance criteria for coating installation and finished product for entire project. Acceptance criteria that will be considered includes, but is not limited to: surface texture, color, amount of aggregate used, slip-resistance. **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.

C. Sample Warranty: For each system indicated.

1.5 INFORMATION SUBMITTALS

A. Certificates:

1. Certification that products and installation comply with applicable federal, state of Michigan, and local EPA, OSHA and VOC requirements regarding health and safety hazards.
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 static coefficient of friction meets minimum requirements of Americans with Disabilities Act (ADA).
5. 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.
6. 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 allowable times between coats.
   4. Final cure time before resumption of parking and/or paint striping.
   5. Any other special instructions required to ensure proper installation.

C. Field Quality Control:
   1. Quality Control Plan as defined in Part 3.
   2. Two copies each 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.

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 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:
   2. 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.
   3. 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.
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. System Manufacturer (New Application and Complete System Recoating): Furnish Owner with written 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, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Spalling surfaces.
3. Weathering.
4. Surface crazing (does not apply to traffic coating protection course).
5. Abrasion or tear failure resulting from normal traffic use.
6. Failure to bridge cracks less than 0.0625 in. or cracks existing at time of traffic coating installation on double tees only.

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 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. BASF Building Systems (BASF), Shakopee, MN
3. Deneef Construction Chemicals (Deneef), Houston, TX.
4. Lymtal International Inc. (Lymtal), Lake Orion, MI.
5. Neogard Division of Jones-Blair Company (Neogard), Dallas, TX.
6. Pacific Polymers, Inc. a Division of ITW (Pacific Polymers), Garden Grove, CA
7. Poly-Carb Inc. (Poly-Carb), Twinsburg, OH.
8. Polycoat Products Division of Amer. Polymers (Polycoat), Santa Fe Springs, CA.
9. Pecora Corporation (Pecora), Harleysville, PA
10. Sika Corporation (Sika), Lyndhurst, NJ.
12. Tremco (Tremco), Cleveland, OH.

2.2 MATERIALS, TRAFFIC COATING

A. Acceptable coatings are listed below. Contractor to confirm that coatings are compatible with all other materials in this Section and other Division 07 Sections and related work.

1. Heavy Duty:
   b. Elasto-Deck 5000-HT, Pacific Polymers.
   c. Iso-Flex 750U-HL HVT/760U-HL HVT Deck Coating System, LymTal.
   d. MasterSeal Traffic 1500, BASF.
   e. Qualideck Heavy Vehicular (152/252/372/512), APT
   f. Sikalastic 710/715, Sika.
   h. Pecora-Deck 800 Series.
   i. Kelmar TE Exposure 3, TBS.
   j. Flexodeck Mark 170.2 Solvent Free Heavy Duty, Poly-Carb.

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

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

D. Color of finish top coat shall be as selected by Owner from manufacturer's full range.

E. 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 0.06 in. wide. Acceptable products:

1. Denedeck Crack Sealer, Deneef.
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. Existing coatings, curing compounds, etc. 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. 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. Remove all laitance and surface contaminants, including oil, grease, and dirt, by shotblasting 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.
G. 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. Rout and seal random cracks, construction joints and control joints prior to installation of primer or base coat. Crack preparation including installation of joint sealant material, where required, is incidental to traffic coating work.

H. 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:

1. Surface Preparation: Prepare concrete for system application.
4. Base Coat: Provide crack spanning in conjunction with Crack Detail noted above.
5. Aggregate Coat: To hold aggregate in system, providing skid and wear close up resistance.
6. Aggregate: Correct size, shape, hardness and amount necessary to insure proper skid and wear resistance.
7. Top Coat: Lock aggregate into place, provide a maintainable surface and provide resistance to ponding water, UV degradation, color loss and chemical intrusion.

B. Do all Work 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 and texture, and as shown on Drawings.

C. A primer coat is required for all systems. No exception.

D. Do not apply traffic coating material until concrete has been air dried at temperatures at or above 40 deg F for at least 30 days after curing period specified.

E. 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 40 deg F.

F. All adjacent vertical surfaces shall be coated with traffic coating minimum of 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.

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

H. 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.

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

C. 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. Trial section shall also be tested for:

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

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. Conformance to ADA static coefficient of friction guidelines.
4. Elcometer or equivalent pull 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.

END OF SECTION 071800

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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.
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:

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 shall contain at least 10 percent aluminum oxide and conforming to Table 1 on following page.
The aggregate shall conform to the properties listed in Table 2 below:

**TABLE 2**

<table>
<thead>
<tr>
<th>TESTS</th>
<th>Method</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Los Angeles Abrasion (after 500 revolutions)</td>
<td>AASHTO T 96</td>
<td>40% max</td>
</tr>
<tr>
<td>MOHS Scale of Hardness</td>
<td>MOHS</td>
<td>7 min</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>By Weight</td>
<td>&lt;= 0.2%</td>
</tr>
<tr>
<td>ASTM C566</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
4. Iso-Flex 200 Epoxy Overlay System - LymTal International, Lake Orion, MI
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 shotblasting, 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**

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EPOXY BROADCAST OVERLAY SYSTEMS 071810 - 10
SECTION 079233 – 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 waterproofing system, including all products specified in Division 07 Sections.

B. This Section includes the following:

1. Exterior joints in the following horizontal traffic bearing surfaces:
   b. Joints between precast concrete units.
   c. Perimeter of floor drains.
   d. Other joints as indicated on the Drawings.

2. Exterior joints in the following vertical and horizontal non-traffic surfaces:
   b. Joints between precast concrete units.
   c. Cove joints at intersection of horizontal and vertical concrete.
   d. Other joints as indicated on the Drawings.

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 14 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. At no time shall weight of stored material being placed on slab area exceed 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. BASF Building Systems (BASF), Shakopee, MN.
2. Dow Corning Corp. (Dow Corning), Midland, MI.
3. Lyntal International Inc. (Lyntal), Lake Orion, MI.
4. Pecora Corporation (Pecora), Harleysville, PA.
5. Sika Corporation (Sika), North Canton, OH.
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:

3. “MasterSeal 921 Backer Rod,” BASF.

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, BASF.
2. Iso-flex 880 GB or Iso-flex 881, Lyntal.
3. Dynatrol II-SG or Ureexpans NR 200, Pecora.
4. Sikaflex-2c SL or Sikaflex-2c NS TG, Sika.
5. THC-900, THC-901, Vulkem 45SSL, Dymeric 240, Dymeric 240 FC or Dymonic 100, Tremco.

I. Acceptable polyurethane vertical and cove joints sealants (non-traffic bearing):
1. Sikaflex-2c NS, Sika.
2. MasterSeal NP-2, BASF.
3. Dymeric 240/240FC, 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 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.
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 40 deg F.

3.4 FIELD QUALITY CONTROL

A. Contractor and Engineer/Architect will perform sealant testing to verify sealant profile:

1. Contractor, at Engineer/Architect's direction, shall cut out 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 after review.

C. Flood test joints prior to substantial completion. Repair sealants as needed until no leaks observed at no cost to Owner.

D. Testing Agency:

1. Check shore hardness per ASTM standard specified in sealant manufacturer's printed data.
2. If flood test of joints required by this Section, report results to Engineer/Architect.
END OF SECTION 079233

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SECTION 079500 – 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 waterproofing system, including all products specified in Division 07 Sections.
B. This Section includes the following: Standard expansion joint systems:
   b. Alternate W.I.s 10.6 & 10.7: Expanding foam sealants.

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. Expansion joint manufacturer shall approve of all blockout surfaces prior to joint installation.
   h. 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 based on expected movements 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.
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 deg 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.
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 2 samples for each type. Full width by 6 inches (150 mm) long, for each system required.
   2. Develop mockups of concrete surface preparation for review and to establish a control for the application.

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. 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 Michigan, and local EPA, OSHA and VOC requirements regarding health and safety hazards.

   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 Manual:** 3 copies of System Maintenance Manual.
B. Five copies of snow removal guidelines for areas covered by warranty.

C. Warranty Documentation: 2 executed copies of Labor and Material 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.
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 expansion joints will 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 ensure 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. Nominal form width shall be adjusted for the ambient temperature at time of concrete placement and expansion joint 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. 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.
3. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:
EXPANSION JOINT ASSEMBLIES

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).
3. Dow Corning Corp., Midland, MI (Dow Corning).
6. Inpro Jointmaster, Muskego, WI (Jointmaster).
7. Lymtal International Inc. Lake Orion, MI (Lymtal).
8. MM Systems Corporation, Atlanta, GA (MM).
10. Tremco, Cleveland, OH (Tremco).
11. Watson Bowman Acme Corporation, a Division of BASF Construction Chemicals NA, Amherst, NY (WBA).

2.4 PRODUCTS, STANDARD EXPANSION JOINT SYSTEMS

A. Elastomeric concrete edged, extruded rubber expansion joint system:

1. CR Series System, Jointmaster.
2. DuraFlex Chambered Wing Seal CS and DCS Series, Balco.
4. Lokcrete Membrane System (LMS) Series, MM.
5. Polycrcrete/Membrane System, Type CR Series, EMS.
6. Thermaflex Membrane/Nosing System, Type TM and TCR Series, Emseal.
8. Wabo®Crete Membrane System ME Series, WBA.
9. ZB 200/400 Series, C/S.

B. Substitutions: None for this project. Contact Engineer/Architect for consideration for future projects.
2.5 PRODUCTS, OTHER

A. Expanding foam sealants:
   1. 1200 Series Foam Seal, Jointmaster.
   2. ColorJoint Silicone Sealing System, ESS Series, MM.
   3. DSM or 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.
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 40 deg F.

D. Terminate exposed ends of joint assemblies with 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.

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 079500

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SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

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 includes surface preparation and the application of paint systems on the following exterior substrates:

W.I. 6.2 “COLUMN HAUNCH – PATCHING REPAIR” (PS#2)
W.I. 6.3 “COLUMN HAUNCH – REMOVE LOOSE CONC. & PAINT” (PS#2)
W.I. 45.5 “COAT BUMPER WALLS” (PS#2 ALTERNATE)
W.I. 45.6 “CLEAN/PAINT STEEL CONNECTIONS” (PS#2 & PS#5)
W.I. 45.7 “PAINT STAIR TOWER INTERIORS” (PS#5 ALTERNATE)

1.3 SUBMITTALS

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

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 indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

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.

1.4 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 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.

1.5 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.
1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

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.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 gallons of each material and color applied.

1.8 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 1.8A 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 end of this Section.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat 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

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.

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 Content Testing Results:

   1. No testing of existing paint materials for hazardous metal 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 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. 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. 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.

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:** A technical representative of the paint manufacturer to be used for this project shall be 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 plates, machined surfaces, and similar items already in place that 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 re-install 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.

### 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 existing construction and 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 Owner/Engineer, 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.

C. W.I. 6.2 “COLUMN HAUNCH – PATCHING REPAIR”:
   1. Carboline 615, Carboline Company.
   2. Pitt-Guard 97-145, PPG Industries, Inc.
   4. Engineer-approved equivalent.

D. W.I. 6.3 “COLUMN HAUNCH – REMOVE LOOSE CONC. & PAINT”:
   1. Carboline:
      a. Base Coat: Carboline 615.
      b. Topcoat (2 coats): Carbothane 133 LH.
   2. PPG:
      a. Base Coat: Pittguard 97-145.
   3. Tnemec:
      b. Series 73 EnduraShield.
   4. Engineer-approved equivalent.
E. **W.I. 45.5 “COAT BUMPER WALLS”:**

1. **Detail Coat:** Carbomastic 615. Apply to all exposed steel surfaces. Apply by brush/roller to ensure coverage of 8-10 mils dry.

2. **Epoxy Primer:** Carboguard 635. Apply by brush/roller to ensure coverage.

3. **Topcoat (2 coats):** Carbothane 133 LH.

4. Engineer-approved equivalent system by PPG or Tnemec.

F. **W.I. 45.6 “CLEAN/PAINT STEEL CONNECTIONS:”**

1. Same as W.I. 6.3.

G. **W.I. 45.7 “PAINT STAIR TOWER INTERIORS”**

1. **Existing Painted CMU Masonry Surfaces:** Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Benjamin Moore & Co.
   b. Kelly-Moore Paint Company (Kelly-Moore).
   c. PPG Industries, Inc. (Pittsburgh Paints).
   d. Sherwin-Williams Co. (Sherwin-Williams).
   e. United Coatings.
   f. BASF Building Systems (BASF).
   g. Carboline.
   h. Tnemec.

2. **BLOCK FILLERS**
   a. **Interior/Exterior Latex Block Filler:** MPI #4.
   b. **VOC Content:** E Range of E3.

3. **LATEX PAINTS**
   a. **Latex (Semi-gloss):** MPI #11 (Gloss Level 5).
   b. **VOC Content:** E Range of E3.

4. **ALKYD PAINTS**
   a. **Exterior Alkyd Enamel (Semi-gloss):** MPI #94 (Gloss Level 5).
   b. **VOC Content:** E Range of E2.

**END OF SECTION 099113**

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SECTION 099121 - 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 described in Section 020010:

1. Parking Stall Stripes.
2. Traffic Arrows, crosswalks, accessible stall access aisles, walkways, symbols, stop bars, words and other markings.

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 curbs and islands (including PARCS equipment islands) within parking facility.
2. Paint color for curbs and curb ramps shall be yellow.


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.

1.4 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg 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.


D. The product shall not contain mercury, lead, hexavalent chromium, or halogenated solvents.

2.2 PAVEMENT MARKING PAINTS:

A. 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:
2. Hi-Build Latex “Liquid Thermoplastic” Traffic & Zone Marking Paint, 5430/5431, by RAE Products & Chemicals Corporation
2. 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.

B. 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:

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.

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 40 deg 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 099121
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