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New Jersey Institute of Technology

Fenster Parking Deck Restoration



Project Specifications

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SECTION 033000 - CAST-IN-PLACE CONCRETE

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 formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Concrete curbs.
 - 2. Concrete repairs > 3" in depth.
- B. Related Sections include the following:
 - 1. Division 7 Section "Garage Waterproofing Systems" for waterproofing applied to cast-in-place concrete.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATION SUBMITTALS

- A. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- B. Welding certificates.
- C. Qualification Data: For Installer, manufacturer and testing agency.
- D. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures, including compatibility certification.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Semirigid joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.
 - 15. Chloride ion certification.
- E. Field quality-control test and inspection reports.
- F. Minutes of pre-installation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

- D. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
 - G. Preinstallation Conference: At least 30 days prior to the start of concrete work, conduct conference at Project site to comply with project requirements.
 - 1. Review proposed concrete design mixtures and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Independent testing agency responsible for field quality control.
 - d. Ready-mix concrete manufacturer.
 - e. Concrete subcontractor.
 - f. Primary admixture manufacturers.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab finish requirements, concrete repair procedures, and concrete protection.
 - H. For the purposes of this Specification, all concrete within the parking structure is considered to be "exposed to public view".
 - I. The Contractor shall keep the following references at the project site:
 - 1. ACI 301 (latest edition) "Specification for Structural Concrete for Buildings".
 - 2. ACI 305R "Hot Weather Concreting".
 - 3. ACI 306.1 "Cold Weather Concreting".
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch**, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than **1 inch** to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than **1 inch** in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, **Grade 60**, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, **Grade 60**, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, **Grade 60**, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82, galvanized.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, **Grade 60**, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I. Use one brand of cement throughout Project unless otherwise acceptable to Architect. PM Note: Verify that the referenced paragraph below is still consistent after editing the entire Section.
 2. See Paragraph 2.11.B. for limitation of use for supplementary cementitious materials.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: **3/4 inch** nominal.
 2. Fine Aggregate: ASTM C 1260, Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Non-Set-Accelerating Calcium Nitrite Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Available Products:
 - a. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - b. Euclid Chemical Company (The); Eucon CIA (with appropriate retarder as required).
 - c. OR approved equal.
 2. Add three (3) gallons per cu. yd. of concrete in cast-in-place slabs.

2.7 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, **1/2 to 1-1/2 inches** long.
1. Available Products:
 - a. Monofilament Fibers:
 - 1) Axim Concrete Technologies; Fibrasol IIP.
 - 2) Euclid Chemical Company (The); Fiberstrand 100.
 - 3) FORTA Corporation; Forta Mighty Mono.
 - 4) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
 - 5) Metalcrete Industries; Polystrand 1000.
 - 6) SI Concrete Systems; Fibermesh 150.
 - b. Fibrillated Fibers:
 - 1) Axim Concrete Technologies; Fibrasol F.
 - 2) Euclid Chemical Company (The); Fiberstrand F.
 - 3) FORTA Corporation; Forta Econo-Net.
 - 4) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
 - 5) SI Concrete Systems; Fibermesh.
 - c. Macro Synthetic Fibers:
 - 1) Euclid Chemical Company (The); Tuf-Strand SF.
 - 2) Grace Construction Products, W. R. Grace & Co.; Strux 90.40.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, Div. of ChemRex; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.

- n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
 - p. Unitex; Pro-Film.
 - q. US Mix Products Company; US Spec Monofilm ER.
 - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- 1. Available Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoco; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinfilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure W.
 - j. Meadows, W. R., Inc.; 1100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
 - m. Tamms Industries, Inc.; Horncure WB 30.
 - n. Unitex; Hydro Cure 309.
 - o. US Mix Products Company; US Spec Maxcure Resin Clear.
 - p. Vexcon Chemicals, Inc.; Starseal 1315.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 or aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types I and II, non-load bearing or IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch** and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch** and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than **5000 psi** at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use of supplementary cementitious materials will be permitted in footings, pile caps, column piers, retaining walls and grade beams only. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.

3. Ground Granulated Blast-Furnace Slag: 50 percent.
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 8. The exact percentages of supplementary cementitious materials used shall be based on successful placement onsite. If weather or other conditions affect the concrete properties, finishing, curing, etc. the contractor shall adjust the mix as required and resubmit for approval.
 9. In mass concrete of more than 2 feet thick, the usage rate may be increased up to 50% for fly ash and 80% for slag as long as all other requirements are met.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent for prestressed or post-tensioned concrete and 0.15 percent for mildly reinforced concrete, by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use high range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Refer to the General Notes Sheet of the Contract Drawings.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
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.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, **1/8 inch** for smooth-formed finished surfaces.
 - 2. Class C, **1/2 inch** for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Do not use earth cuts as concrete formworks unless approved by the Engineer.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than **50 deg F** for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 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 material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with **ACI 318** and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints **6 inches** and seal with manufacturer's recommended tape.
 - 2. Vapor retarder installation must be approved prior to concrete placement.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches** into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below **40 deg F** for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Use specified non-chloride accelerator only. Do not use calcium chloride, salts or other admixtures containing more than 0.05% chloride ions by weight.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below **90 deg F** at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
 3. Use approved water-reducing, retarding admixture to "normalize" initial set.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete and as indicated.

- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Architectural Concrete Finish: Provide smooth uniform finish upon form removal with no patching, stoning or other form of repair, except washing, permitted unless otherwise noted, for walls, columns and other surfaces visible to view when the work is complete. The surface shall match approved jobsite mockup.
- E. 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.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of **1/4 inch** in 1 direction.
1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of

trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish for Flatwork in Parking and Drive Areas: Apply a broom finish to all driving and parking areas, ramps, and elsewhere as indicated.
1. Bullfloat immediately after screeding. Complete before any excess moisture or bleed water is present on surface (ACI 302.1R, Article 7.2.3). Use of power-propelled rotary trowelling machines with float blades shall be prohibited.
 2. After excess moisture or bleed water has disappeared and concrete has stiffened sufficiently to allow operation, give slab surface a coarse straight broom transverse finish scored 3/16 inch deep texture by drawing a stiff bristle broom across surface to match existing. Texture shall be as accepted by Architect from sample panels. Coordinate with Traffic Topping manufacturer and applicator as to acceptability.
 3. Finishing Tolerance: Bullfloated floor finish tolerance per ACI 117 section 4.5.7. If required, more stringent tolerances shall be used to assure that the slabs drain freely to floor drains. In addition, floor surface shall not vary more than $\pm 3/4$ " from elevation noted on Drawings.
 4. Before installation of flatwork and after submittal, review, and approval of concrete mix design, Contractor shall fabricate one or more acceptable test panels simulating finishing techniques and final appearance to be expected and used on Project. Test panels shall be minimum of 15 ft. in area cast to thickness of typical parking and drive area wearing surface in Project. (Maximum thickness of test panels need not exceed 6 inches.) Test panels shall be cast from concrete supplied by similar concrete batch used for this project. Contractor shall finish panels following requirements of items 1,2 and 3 above. Architect may reject finished panels, in which case Contractor shall repeat procedure until Architect 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 insure that all surface water will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear cost of any corrections to provide for this positive drainage requirement.
 6. The Contractor shall arrange for and wet all slabs with water for the purpose of detecting any defects in the concrete that would result in leaks and/or inadequate drainage. Slab surfaces shall be wetted until water flows freely to drains. No finished spaces shall be sealed or insulated or ceilings installed until drainage test has been completed on the slab above and reviewed by the Architect for acceptance.

- a. Repair low spots, puddles, or bird baths with an area not less than four square feet of standing water with a visible sheen, isolated by drying concrete and smaller low spots that do not dry within 12 hours.
- b. Rout and seal leaking joints that are usually located at expansion joints, control joints, or construction joints. These leaking joints are located by water observed on the underside of the slabs and opposite faces of walls. If the expansion joint is not installed at the time of the flood test, this area shall be tested after it is installed.
- c. Rout and seal cracks that are located when water is observed on the underside of the slab. Cracks may also be observed on the top surface of the slab when the concrete slabs are drying and the cracks are highlighted with moisture.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching **0.2 lb/sq. ft. x h** before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the methods shown below. Use moisture curing, moisture-retaining cover curing, or a combination thereof under normal weather conditions. Use of curing compounds shall be allowed only in excessive hot or cold weather conditions subject to the approval of the Engineer.
 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** 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound (to be used for hot or cold weather concreting only): Apply uniformly in continuous operation by power spray or roller 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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a **No. 16** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/4 inch** in any dimension in solid concrete, but not less than **1/2 inch** in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding

- color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of **0.01 inch** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with approved underlayment or overlayment materials. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch** to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 5. Repair defective areas, except random cracks and single holes **1 inch** or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a **3/4-inch** clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes **1 inch** or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and /or polymer repair mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 1. Steel reinforcement placement.

2. Steel reinforcement welding. (IF REQUIRED)
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Water Content: Verify water content for one cylinder out of each composite sample in accordance with AASHTO T-318, "Standard Method of Test for Water Content Using Microwave Oven Drying", one test at point of placement for each concrete cylinder but not less than one test for each 100 cu. yd. of placement or fraction thereof.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each truck of concrete. Reduce frequency of tests when concrete tests results were consistently within acceptable range upon approval from Engineer.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each truck of concrete. Reduce frequency to one test out of each composite sample when test results are consistently within acceptable range upon approval from Engineer.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567, fresh unit weight of concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M; choose either 6"x12" specimens (two cylinders per set) or 4"x8" specimens (three cylinders per set) for standard cylinder testing., Test minimum 3 sets of standard cylinders for each composite sample. Mold and store cylinders for laboratory-cured test specimens for 28-day strength testing. Field-cured cylinders shall be maintained at the site under conditions identical to concrete represented by them.
 - a. Cast and laboratory-cure 2 sets of standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M.
 - a. Test 1 set of laboratory-cured specimens at 28 days. Retain 1 set of laboratory-cured specimens in reserve for later testing if required.

- b. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
9. When 7-day strength of laboratory-cured cylinders is less than 75 percent of design strength, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than **500 psi**.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Non-Compliant Test Reports: All test reports indicating non-compliance should be electronically sent immediately to all parties on the test report distribution list. Hard copies of non-conforming test reports shall be submitted on different colored paper.
13. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
14. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
15. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
16. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Composite floor deck.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Evaluation Reports: For steel deck, from ICC-ES.

- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.; The Canam Manac Group
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.
 - l. Valley Joist; Division of EBSCO Industries, Inc.
 - m. Vercor Manufacturing Co.
 - n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation

2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
2. Profile Depth: To match existing.
3. Design Uncoated-Steel Thickness: To match existing.
4. Span Condition: As indicated.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile to match existing.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- J. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch-long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Butted.

- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at **24 inches** apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on bottom surface of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surface of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 079020 - GARAGE WATERPROOFING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes the following:
 - 1. Elastomeric traffic deck coating system.
 - 2. Vertical membrane system
 - 3. Slab and deck control joint sealant system.
 - 4. Protective concrete sealer system

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-place Concrete".
 - 2. Division 32 Section "Pavement Marking".

1.3 SUBMITTALS

- A. General: Submit the following in accordance with the Conditions of the Contract and Division 1 Specification sections.
- B. Product Data: For each product indicated.
- C. A detailed statement describing the deck waterproofing system to be installed, as well as the installation methods to be employed, shall be submitted for approval prior to installation. Literature, details, samples, shop drawings, warranties, etc., shall be included in the submittal as requested.
- D. A manufacturer's written acceptance and approval of the intended system applicator shall be required.
- E. Qualification Data: For Installer and testing agency.
- F. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that products comply with requirements.
- H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of waterproofing systems required for this Project.
- B. Source Limitations: Obtain each type of product through one source from a single manufacturer.
- C. A site inspection shall be made by applicator prior to commencing installation of the system for purposes of reviewing related conditions affecting performance requirements of this specification.
- D. All products described in this section must be used with adequate ventilation and personal protection. Refer to the Material Safety Data Sheet which accompanies each product shipment for detailed health and safety information prior to use.
- E. At Architect's option, Testing Agency shall take one core from each trial section per Section 3.3 to test for sealer effectiveness in accordance with ASTM C642. Such cores will then serve as "base cores" for which the remainder of sealer application will be tested. At Architect's direction, additional cores shall be taken randomly for testing comparison with the "base cores".
- F. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- G. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

- H. Preconstruction Field-Adhesion and Slip Resistance Testing: Before installing elastomeric sealants, deck coating, and expansion joint nosing material, perform field tests as follows:
1. Locate field test mockup where indicated or, if not indicated, as directed by Architect.
 2. Conduct field-adhesion tests for each application indicated below:
 - a. Each type of elastomeric sealant indicated and the applicable joint substrates.
 - b. Each type of deck coating indicated and the applicable substrates.
 3. Conduct field slip resistance tests for each application indicated below:
 - a. Each type of deck coating indicated and the applicable substrates.
 4. Notify Architect seven days in advance of dates and times when tests will be performed.
 5. Arrange for tests to take place with product manufacturer's technical representative present.
 6. Refer to Field Quality Control under Part 3 for additional requirements.
- I. Preinstallation Conference: Conduct conference at Project site to comply with project requirements.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide products that establish and maintain watertight and airtight continuous waterproofing system without staining or deteriorating joint substrates.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing systems within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply waterproofing systems to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
- B. Do not proceed with installation of waterproofing systems under the following conditions:
1. Do not apply waterproofing systems in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
 2. Contaminants capable of interfering with adhesion have not yet been removed from substrates.
 3. Where conditions exist that do not meet the manufacturer's requirements for applications indicated.
 4. Where conditions exist that can cause off gassing of the waterproofing systems.
- C. Do not install waterproofing systems until items that penetrate the waterproofing have been installed.

1.7 WARRANTY

- A. The system manufacturer and the approved applicator shall furnish a written performance joint warranty that, subject to certain specific exclusions as described in such joint warranty, the system provided will be free of defects related to workmanship or material deficiency. The following conditions shall be specifically covered under the joint warranty:
1. Cohesive or adhesive failure of materials.
 2. Weathering deficiencies resulting in failure of the system to provide its intended function.
 3. Abrasion or tear failure of the system resulting from normal traffic use. (Abrasive maintenance equipment, truck and construction traffic are not normal traffic use and related problems are exempted from the warranty.)
 4. Joint Warranty Period: Refer to Section 1.7.C.1 below for joint warranty period requirements, with the exception of concrete sealer.
- B. The system manufacturer and the approved applicator shall submit to the Owner for approval a detailed joint warranty statement consistent with the terms of this specification prior to construction. The approved joint warranty shall represent the sole warranty statement and warrant obligation for the project relating to this trade. Where an apparent conflict is found to exist with respect to the warranty language of this section and the detailed warranty statement, the more stringent warranty requirement shall supersede and control.
- C. Special Manufacturer and Installer Joint Warranty: Manufacturer's standard form in which the Manufacturer and Installer jointly agree to furnish and repair or replace the product(s) that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Joint Warranty Period for all products listed in Part 2 of this Section, unless noted otherwise: Five years from date of Substantial Completion.
- D. Special joint warranty specified in this article exclude deterioration or failure from the following:
1. Movement caused by structural settlement or errors attributable to design or construction resulting in stresses exceeding the manufacturer's written specifications for elongation and compression.
 2. Disintegration from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide waterproofing systems including backings, and other related materials that are compatible with one another and with substrates under conditions of service and application, as demonstrated by the system manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Protective Concrete Sealer System:
1. Acceptable concrete sealers are listed below. Application rates and solids content shall be in accordance with certified test results on the NCHRP 244 performance criteria.
 2. Four Inch Cube Tests: 75% effective in reducing water absorption when compared to an untreated control sample.
 3. Southern Exposure Tests: 90% effective in reducing chloride ion content when compared to an untreated control sample.
 4. The following materials are approved for usage under this section:
 - a. 100% Solids Content:
 - 1) "Iso-Flex 618 - 100 CRS", LymTal International Inc.
 - 2) "Protectosil 300S", Evonik Industries.
 - 3) "MasterProtect H 1000 or H 1001", BASF Building Systems.
 - 4) "Planiseal WR 100", Mapei Corporation.
 - 5) "Baracade Silane 100", Euclid Chemical.
 - 6) "Sealmaster 100%", Kelmar Waterproofing Systems, Technical Barrier System, Inc.
 - 7) "Klere-Seal 9100-S", Pecora Corporation.
 - 8) "Sikagard 705L", Sika Corporation.
 5. Apply Sealer to the following locations:
 - a. As indicated on plans.
- D. Surface Applied Vapor Reduction Coating
1. AQUAFIN, Inc.; Vapor tight Coat Aquafin SG-3, or equal.
- E. Elastomeric Traffic Deck Coating:
1. Traffic deck coating systems specified herein shall be complete systems of compatible materials. Components of systems shall include a base membrane, a traffic topping and all sealants, primers, flashing, aggregates and miscellaneous materials as required by the manufacturer to complete the system.

2. Traffic deck coating systems shall meet the following slip resistance requirements:
 - a. Coefficient of friction not less than 0.85 when tested under wet conditions.
 - b. Variation in slip resistance test results not greater than +/- 0.10.
 - c. Refer to Field Quality Control under Part 3 for additional requirements.
3. Aggregates: Aggregate type, size and gradation as recommended by system manufacturer and as needed to meet or exceed slip resistance requirements. Comply with ACI 503.3.
 - a. Oven-dried, washed, angular shaped silica sand, flint, basalt or aluminum oxide aggregate applied in wear coats with minimum Mohs scale hardness as follows:
 - 1) Silica sand: 7 minimum
 - 2) Flint: 7 minimum
 - 3) Basalt: 7 minimum
 - 4) Aluminum oxide: 9 minimum
 - b. Aluminum oxide powder applied in seal coat.
4. The following deck coating systems are approved for usage under this section:
 - a. Urethane Systems:
 - 1) The following materials are approved for use under this section, subject to compliance with requirements:
 - a) "Autogard FC", Neogard, Division of Jones-Blair.
 - b) "Iso-Flex 750U", LymTal International Inc.
 - c) "MasterSeal Traffic 2500", BASF Building Systems.
 - d) "Mapefloor Parking Deck System – Mapefloor PU 400LV/Finish 415 NA/Finish 450", Mapei Corporation.
 - e) "Pecora-Deck 800 FC", Pecora Corporation.
 - f) "Qualideck Vehicular Traffic Bearing Membrane System", Advanced Polymer Technology Corporation.
 - g) "Sikalastic 720/745", Sika Corporation.
 - 2) Application rates for medium and heavy duty systems: rates are for bidding purposes and are to be confirmed in the field using a 100 sf mockup.
 - a) Primer: 0.33 gal. minimum per 100 sf (300 sq. ft. maximum per gal.)
 - b) Polyurethane base coat: 1.33 gal. minimum per 100 sf (75 sq. ft. maximum per gal.)
 - c) Polyurethane wear coat: 0.5 gal. minimum per 100 sf (200 sq. ft. maximum per gal.)
 - d) Broadcast aggregate into wear coat: 15 lbs. minimum per 100 sq. ft. to excess
 - e) 2nd Polyurethane wear coat (*for heavy duty systems*): 0.75 gal. minimum per 100 sf (133 sq. ft. maximum per gal.)
 - f) 2nd Broadcast aggregate into wear coat (*for heavy duty systems*): 15 lbs. minimum per 100 sq. ft. to excess

2. Type O (open-cell material)
 3. Type B (bicellular material with a surface skin)
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to **minus 26 deg F (minus 32 deg C)**. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 GENERAL

- A. All work shall be installed in strict accordance with system manufacturer's recommendations employing trained installers utilizing proper tools and equipment and working under the direct supervision of a technically competent and experienced supervisor. An authorized technical representative shall attend a pre-installation conference, be present for the first day of installation and provide a minimum of three field inspection reports to the Architect during the duration of the installation.
- B. All surfaces related to work under this section shall be inspected by the applicator prior to commencing work. Any conditions discovered which render the substrate unsuitable shall be reported and satisfactorily corrected prior to installation of the specified system.
- C. Coordinate and verify that related work items meet the following requirements:
1. All surfaces shall be clean, dry and of sound substrate at time of application. Surfaces shall be provided free of voids, ridges and sharp projections.
 2. Concrete surface finishes shall be subject to approval of the applicator.

3. Concrete surfaces shall be water cured or cured with a compatible curing compound as recommended by the manufacturer.
4. Concrete surfaces shall have cured for an acceptable period as recommended by the system manufacturer for the various components of the applicable system.

D. Environmental Conditions:

1. System application shall be at temperatures as recommended by the system manufacturer.
2. The deck surface shall be dry at time of application according to ASTM D4263, Standard Test Method for Indicating Moisture in Concrete.
3. Provide adequate ventilation in accordance with system manufacturer's recommendations during installation of the deck waterproofing system.

E. Protect all work areas from traffic until fully cured.

3.2 EXAMINATION

- A. Examine joints indicated to receive waterproofing system, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting product performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PROTECTIVE CONCRETE SEALER SYSTEM

- A. Clean surfaces to be treated in accordance with the system manufacturer's recommendations. Acceptable methods include sweeping, blowing, vacuuming, pressure washing, water blasting, acid etching, sand blasting, or shot blasting as required to remove all laitance and surface contaminants to insure proper penetration and/or adhesion of the sealer.
- B. Seal all joints prior to general surface treatment.
- C. Select and install a test section prior to general application to verify installation procedures, application rates, adhesion, penetration and condition of the finished surface.
- D. Concrete sealer shall be applied in accordance with system manufacturer's recommendation at the same rates and solids contents as tested against the criteria established in NCHRP 244.
- E. Materials shall be applied by pressure sprayer, spray bar or roller.
- F. Application rate shall be 200 sq. ft. per gallon for a 100% silane sealer.
- G. Unsatisfactory results rejected under Section 1.4.E shall be grounds for rejection of sealer and sealer application or sealer reapplication using an approved product shall be completed at no additional cost to the Owner.
- H. Sealer shall not be applied until concrete has fully cured but no earlier than 14 days after concrete has been poured. Striping shall not be placed until full cure of concrete sealer (generally, 14 days @ 70 degrees or higher) has been obtained.

3.4 ELASTOMERIC TRAFFIC DECK COATING SYSTEM

- A. All traffic deck coatings are to be applied to acceptable clean, dry, sound substrates. Clean surfaces to be treated in accordance with the system manufacturer's recommendations. Acceptable methods include sweeping, blowing, vacuuming, pressure washing, water blasting, acid etching, sand blasting, or shot blasting as required to remove all laitance and surface contaminants to insure proper adhesion of the deck coating.
- B. Select and install a test area prior to general application to establish procedures, verify adhesion, slip resistance, and acceptable appearance.
- C. Surface preparation shall produce a surface profile matching CSP 4, 5 or 6 per ICRI 03732, as required to meet the requirements of the selected deck coating. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning. Coordinate surface preparation with the surface preparation for the corrosion-inhibiting treatment and vapor drive coating, as applicable.
- D. Notify Architect 7 days prior to completion of the surface preparation. Meet with the Architect and manufacturer's representative to review surface preparation, joint preparation, adhesion test results, and crack preparation, as applicable. All joint and crack preparation shall be included in the cost of the traffic deck coating system.
 - 1. Seal all underlying control and construction joints.
 - 2. Cracks greater than 1/16"
 - a. All static cracks shall be routed (V-groove) and gravity fed with a polymer sealer. Fill cracks with oven-dried sand before applying the polymer sealer per the manufacturer's requirements. After application of the polymer sealer, broadcast dry silica sand to refusal evenly over the crack.
 - b. All dynamic cracks shall be routed (U-groove) and receive bond breaker and sealant as detailed.
 - 3. Detail all joints and cracks, including cracks less than 1/16", with liquid flashing a distance of 3" on each side of the joint/crack to yield a total thickness of 30 dry mils. All dynamic cracks and joints, cracks and joints 1" and wider, and joints above framing shall receive reinforcing fabric embedded in the liquid flashing detail strip. The reinforcing fabric shall be compatible with the selected deck coating system and shall prevent the deck coating system from cracking due to thermal and dynamic movement of the crack or joint. However, the reinforced detail strip is not expected to prevent cracking of the deck coating system if there are structural deficiencies that causes excessive movement, such as broken connections.
- E. Other detailing work including sealing around drains, penetrations, curb, column and wall bases, etc., shall be accomplished in accordance with system manufacturer's recommendations prior to general application.
- F. Provide a grid system marked on the deck surface to designate the area for which a container of material must be used evenly applied to obtain the desired average dry mil film thickness. A wet mil gauge shall also be used to randomly verify that mil thickness at application is consistent with system manufacturer's recommendations.

- G. Broadcast clean, dry aggregate into wear coats and mix slip resistant powder into seal coat as needed to meet slip resistance requirements.
- H. Application shall be by squeegee, roller and power sprayer.
- I. Install the Elastomeric Traffic Deck Coatings in accordance with a "wear-rated" heavy and medium duty system per Section 2.2.E.

3.5 SLAB AND DECK CONTROL JOINT SEALANT SYSTEM

- A. All sealants are to be applied to clean, dry, sound substrates. Follow system manufacturer's recommendations for cleaning and preparation of joints. Tooled control joints provided by the Goldblatt Groover #06-314-M7 shall be prepared by grinding with V- shaped wheel prior to sealing.
- B. Select and install a test section prior to general application to verify adhesion and acceptable appearance.
- C. Backer rods, bond breakers and primers shall be used in accordance with system manufacturer's recommendations.
- D. Care shall be taken to completely fill joints without overflowing the joint or smearing adjacent surfaces.
- E. Exposed joints shall be filled with sealant and tooled to a slightly recessed configuration to avoid direct contact with wheel traffic.
- F. Sealant shall not be applied until after concrete curing procedures has been completed (normally at least 7 days after concrete has been poured).

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform the field tests and inspections.
- B. Joint Sealant Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test mockups and completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor.
 - 2. Test Method: ASTM C 1193, Appendix X1.1.
 - a. As appropriate for type of joint-sealant application indicated, test joint sealants according to one of the following:

- 1) Method A, Field-Applied Sealant Joint Hand Pull Tab
 - 2) Method B, Exposed Surface Finish Hand Pull Tab
 - 3) Method C, Field-Applied Sealant Joint Hand Pull Flap
 - 4) Method D, Water Immersion.
 - b. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- C. Deck Coating Field-Adhesion Testing: Field test deck coating adhesion to substrates as follows:
1. Extent of Testing: Test mockups and completed deck coatings as follows:
 - a. Perform 6 tests for the first 10,000 square feet of deck coating for each type of deck coating and substrate.
 - b. Perform 1 test for each 10,000 square feet of deck coating thereafter, but not less than 1 test per floor.
 2. Test Method: ASTM D7234.
 3. Inspect deck coating for bubbles, voids, aggregate distribution, and for application complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect deck coating preparation, installation, and testing. Record results in a log and report on the following:
 - a. Dates when surface preparation was performed.
 - b. Type of surface preparation.

- c. If surface contaminants such as engine oil were present on the slab prior to surface preparation and cleaning.
 - d. If surface contaminants remain on the slab after surface preparation and cleaning.
 - e. Relative humidity of the slabs prior to application of deck coatings.
 - f. Time, date, temperature, precipitation, relative humidity, and sun exposure when deck coatings were installed. Note if conditions changed during the installation.
 - g. Type of materials used for deck coating installation and wait times between each application.
 - h. Deck coating dry mil thickness and if the thickness complies with specified requirements.
 - i. Test dates, test locations, and adhesion results (whether deck coating failed to adhere to substrates or tore cohesively).
 - j. Names of persons who performed surface preparation, who performed relative humidity testing, who installed deck coatings, and who performed adhesion tests.
5. Repair deck coatings pulled from test area by applying new deck coating following same procedures used originally. Ensure that original surfaces are clean and that new deck coating overlaps original deck coating.
- D. Deck Coating Field Slip Resistance Testing: Field test deck coating slip resistance as follows:
1. Extent of Testing: Test mockups and completed deck coatings as follows:
 - a. Perform 6 tests for the first 10,000 square feet of deck coating for each type of deck coating.
 - b. Perform 1 test for each 10,000 square feet of deck coating thereafter, but not less than 1 test per floor.
 2. Test Method:
 - a. ANSI/NFSI B101.1 - Test Method for Measuring Wet Static Coefficient of Friction (SCOF) of Common Hard-Surface Floor Materials
 3. Inspect deck coating for variations in aggregate distribution. Locate tests at areas with high density of aggregate and with low density of aggregate. Record results in a log and report on the following:
 - a. Test method, test dates, test locations, and slip resistance results.
 - b. Names of person who performed tests.
 - c. Type of deck coating and aggregate.
 - d. Application rates of deck coating system components.
 - e. Approximate area (square feet) of deck coating that exhibits a low density of aggregate, an average density of aggregate, and a high density of aggregate.
 4. Repair deck coating test area, if damaged during testing, by applying new deck coating following same procedures used originally. Ensure that original surfaces are clean and that new deck coating overlaps original deck coating.
- E. Evaluation of Field Test Results: Products not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove

products that fail to adhere to substrates during testing or to comply with other requirements. Reapply mockups and retest until test results prove products comply with indicated requirements. Do not use products that fail to adhere to substrates during testing.

3.7 CLEANING

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

3.8 PROTECTION

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

END OF SECTION 079020

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes painted markings applied to concrete pavement including the following:
 - 1. Parking Striping
 - 2. Traffic Arrows.
 - 3. Accessibility International Symbol.
- B. Related Requirements:
 - 1. Division 7 "Garage Waterproofing systems".

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - a. Pavement aging period before application of pavement markings.
 - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.
 - c. Surface treatments that may affect pavement markings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

- C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.5 QUALITY ASSURANCE

- A. Verify compatibility of paint with all sealers, sealants, traffic coatings and all other materials of the surface to be painted.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. [Benjamin Moore & Co.](#)
 - 2. [M.A.B. Paints.](#)
 - 3. [PPG Industries.](#)
 - 4. [Sherwin-Williams Company \(The\).](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.3 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N or Type S; colors complying with FS TT-P-1952.
 - 1. Color: As indicated.
- B. Pavement-Marking Paint: MPI #32, solvent-borne traffic-marking paint.
 - 1. Color: As indicated.
- C. Glass Beads: AASHTO M 247, Type 1.
 - 1. Roundness: Minimum 80 percent true spheres by weight.

- D. VOC Content: Pavement markings used on building interior shall have a VOC content of 150 g/L or less.
- E. Accessibility International Symbol character shall follow proportions as specified in ANSI A117.1-1986.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Coordination of Work: Review other Sections in which surface treatments are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Proceed with pavement marking only after unsatisfactory conditions have been corrected.
 - 1. Notify the Architect of anticipated problems using the materials specified over substrates.

3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- A. Allow paving to age for a minimum of 30 days before starting pavement marking.
- B. Pve ment marking paint shall not be placed until full cure of concrete sealer (generally, 14 days @ 70 degrees or higher) or bituminous pavement (generally, 30 days @ 45 degrees or higher) has been obtained.
- C. Clean and prepare surfaces as required to remove all existing paint, surface treatment residue, oil, grease, laitance and other surface contaminants that could impair bond of paints. Pavement-marking paint shall be applied to clean, dry, sound substrates that are in accordance with the paint manufacturer's written installation requirements.
 - 1. Acceptable cleaning and surface preparation methods include sweeping, blowing, vacuuming, pressure washing, water blasting, acid etching, sand blasting, shot blasting, and use of pavement cleaners.
 - a. Pavement Cleaners: Chemical cleaners acceptable to manufacturers of pavement-marking paint, free of oily residues or other substances capable of staining or harming pavement substrates in any way, or preventing adhesion.
 - 2. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..
- E. Lay out all striping in accordance with the dimensions and details shown on the Drawings. Before starting, notify Architect of any discrepancies or interferences for actual field conditions. Contractor shall be responsible for removing paint and repainting any incorrect markings that would have been corrected by such notification.

3.3 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when pavement marking paint is being applied:
 - 1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
 - 2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
 - a. Quantitative materials analysis.
 - b. Apparent reflectivity.
 - c. Washability.
 - d. Accelerated weathering.
 - e. Dry opacity.
 - f. Color retention.
 - 3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are incompatible.

3.4 PROTECTING AND CLEANING

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Protect pavement markings from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Provide "Wet Paint" signs to protect newly painted finishes.

END OF SECTION 321723