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SECTION 03 08 00
COMMISSIONING OF CONCRETE
BASED ON DFD MASTER SPECIFICATION DATED 03/01/14

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PART 1 - GENERAL

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SCOPE

This section includes commissioning forms for construction verification and functional performance testing. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Submittals

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

Commissioning Forms

CV-03 30 00 Cast in Place Concrete

RELATED WORK

Section 01 91 01– Commissioning Process

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

Reference Section 01 91 01 Commissioning Process for Construction Verification Checklist and Functional Performance Test submittal requirements.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

COMMISSIONING FORMS

Commissioning forms are to be filled in as work progresses by the individuals responsible for installation and shall be completed for each installation phase.

Provide a description of the work completed since the last entry, the percentage of the total work completed for the system for that area and the step of installation or finalization.

Circle Yes or No for each commissioning form item. If the information requested for an item does not apply to the given stage of installation for the system, list it as “N/A”. Explain all discrepancies, negative responses or N/A responses in the negative responses section.

Once the work is 100% complete and the responses to each item are complete and resolved for a given commissioning forms group, mark as complete, initial and date in the spaces provided.

Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress meetings.

Construction Verification Checklist
03 30 00 - Cast in Place Concrete

CV-03 30 00 – Cast in Place Concrete

Identification/Tag: _____

Location: _____

A) PRE-POURING CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)	
				1)	2)
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
				YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____	
				DATE: _____	

Question Details

- 1) Shop drawings, product data and samples have been submitted and approved.
- 2) All materials are as designed, specified, and approved.

Construction Verification Checklist
03 30 00 - Cast in Place Concrete

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
03 30 00 - Cast in Place Concrete

B) POURING CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Reinforcement sized correctly, placed as designed and supported properly.
- 2) Forms are clean and are placed, plumb, true and square.
- 3) Forms are properly shored and braced and maintained in accordance with ACI 301 to support loads that might be applied until concrete structure can support such loads.
- 4) Anchor bolts and other embedded items are accurately located to elevations required.
- 5) Granular fill is of proper gradation and base is placed level, compacted and true.
- 6) Level of compaction is verified by a qualified testing agency and approved.
- 7) Concrete is placed in suitable weather and temperature conditions. If required, cold/hot weather placement requirements are performed in accordance with ACI.
- 8) Qualified testing agency has verified proper slump, air content, water cement ratio and air temperature is as specified at each frequency specified.
- 9) Compressive test cylinders were cast at time of placement and compressive strength testing by qualified testing agency has been performed, in the specified intervals and the compressive-strength test values are at or above those specified.
- 10) Construction joints are properly located and, for slabs on grade, contraction joints are installed or sawed in the appropriate time interval, in locations indicated at the proper width and depth.

Construction Verification Checklist
03 30 00 - Cast in Place Concrete

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
03 30 00 - Cast in Place Concrete

C) POST POURING CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)		
				1)	2)	3)
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____	DATE: _____	

Question Details

- 1) Type of finish specified has been applied and approved by architect.
- 2) Curing measures were undertaken and the concrete is properly cured as specified.
- 3) Defective areas including but not limited to spalls, pop-outs, honeycombs, rock pockets and cracks are properly repaired and patched.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE
BASED ON DFD MASTER SPECIFICATION DATED 8-28-2019

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PART 1 - GENERAL

SCOPE

Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes. The work under this section consists of providing all work, materials, labor equipment and supervision necessary to provide cast in-place concrete as required in these specifications and the drawings.

PART 1 - GENERAL

- Scope
- Related Work
- References
- Definitions
- Pre-Installation Meetings
- Submittals
- Quality Assurance
- Mock up
- Delivery, Storage, and Handling
- Field Conditions

PART 2 - PRODUCTS

- Form-facing Materials
- Steel Reinforcement
- Reinforcement Accessories
- Concrete Materials
- Admixtures
- Fiber Reinforcement
- Waterstops
- Vapor Retarders
- Floor And Slab Treatments
- Liquid Floor Treatment
- Curing Materials
- Related Materials
- Repair Materials
- Concrete Mixtures, General
- Fabricating Reinforcement
- Concrete Mixing

PART 3 - EXECUTION

- Formwork
- Embedded Items
- Removing And Reusing Forms
- Shores And Reshores
- Vapor Retarders
- Steel Reinforcement
- Joints
- Waterstops
- Concrete Placement
- Finishing Formed Surfaces
- Finishing Floors And Slabs
- Quantification of Relative Humidity at 40% of Concrete Thickness
- Quantifying Ph Level

- 1 Miscellaneous Concrete Items
- 2 Concrete Protecting And Curing
- 3 Liquid Floor Treatments
- 4 Joint Filling
- 5 Concrete Surface Repairs
- 6 Field Quality Control
- 7 Protection Of Liquid Floor Treatments

8

9 **RELATED WORK**

10 Applicable provisions of Division 1 govern work under this Section.

11

12 Related work specified elsewhere:

13

14 13 34 19 - Metal Building Systems

15

16

17 **REFERENCES**

18 Incorporated Guides and References

19 American Concrete Institute (ACI):

- 20 ACI 302.1R – Guide for Concrete Floor and Slab Construction.
- 21 ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
- 22 ACI 304.2R - Placing Concrete by Pumping Methods.
- 23 ACI 305R - Hot Weather Concreting.
- 24 ACI 309R – Guide for the Consolidation of Concrete.
- 25 ACI 347 – Guide to Formwork for Concrete.
- 26 ACI SP-66 – ACI Detailing Manual.

27 Specifications

28 American Concrete Institute (ACI):

- 29 ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
- 30 ACI 301 - Specifications for Structural Concrete.
- 31 ACI 303.1 – Specification for Cast-In-Place Architectural Concrete.
- 32 ACI 306.1 – Specification for Cold Weather Concreting.
- 33 ACI 308.1 – Specification for Curing Concrete.
- 34 ACI 315 - Details and Detailing of Concrete Reinforcement.
- 35 ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

36

37 ASTM International (ASTM):

- 38 ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 39
- 40 ASTM A704 – Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- 41
- 42 ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- 43
- 44 ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- 45 ASTM A820 – Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- 46 ASTM A884 – Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- 47
- 48 ASTM A934 – Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
- 49 ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
- 50
- 51 ASTM C33 – Standard Specification for Concrete Aggregates.
- 52 ASTM C94 – Standard Specification for Ready-Mixed Concrete.
- 53 ASTM C150 – Standard Specification for Portland Cement.
- 54 ASTM C156 – Standard Test Method for Water Loss (From a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.
- 55

1 ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
2 ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
3 ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing
4 Concrete.
5 ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
6 ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for
7 use in Concrete.
8 ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.
9 ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
10 ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
11 ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.
12 ASTM C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic
13 Cement Concrete.
14 ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving
15 and Structural Construction (Non-extruding and Resilient Bituminous Types).
16 ASTM D3963 – Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel
17 Reinforcing Bars.
18 ASTM E164 3 – Standard Practice for Selection, Design, Installation, and Inspection of Water
19 Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
20 ASTM E1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or
21 Granular Fill Under Concrete Slabs.
22

23 **DEFINITIONS**

24
25 Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic
26 cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
27

28 W/C Ratio: The ratio by weight of water to cementitious materials.
29

30 Cured Concrete: The concrete strength at 28 days.
31

32 Dry Concrete: The measure of concrete at 80% relative humidity at 40% of the concrete slab-on-grade depth.
33

34 Self-Consolidating Concrete (SCC): a highly workable concrete that can flow through densely reinforced or complex
35 structural elements under its own weight and adequately fill voids without segregation or excessive bleeding without
36 the need for vibration.
37

38 Passing Ability: The ability of SCC to flow through openings such as the spaces between reinforcing bars without
39 segregation or aggregate blocking.
40

41 J-Ring Test: Test used to determine the passing ability of SCC, or the degree to which the passage of concrete through
42 the bars of the J-Ring apparatus is restricted.
43

44 J-Ring Flow: The distance of lateral flow of concrete using J-Ring in combination with a slump cone.
45

46 Slump Flow: Test method used to measure the unconfined flow and stability of SCC using a slump cone (upright or
47 inverted)
48

49 Slump Flow Spread: The numerical value in inches of flow and stability of SCC using a slump cone (upright or
50 inverted).
51

52 Slump Flow Spread: The numerical value in inches of flow determined as the average diameter of the circular deposit
53 of SCC at the conclusion of the slump flow test.
54

1 T₅₀ Value: Time (in seconds) the edge of the concrete mass takes to reach 50 cm (20 inches) diameter from the time
2 the mold is first raised in the slump flow test.

3
4 Stability: The ability of a concrete mixture to resist segregation of the paste from the aggregates.

5
6 Static Segregation (Segregation Factor): Segregation of the mortar from the coarse aggregate that occurs after
7 placement while the concrete is still in the plastic state.

8
9 Visual Stability Index (VSI) Rating: An assessment of the homogeneity of concrete based on the visual inspection of
10 the concrete sample at the end of the slump flow test.

11 **PREINSTALLATION MEETINGS**

12 Prior to submitting design mixtures, contractor shall hold a meeting to review detailed requirements for preparing final
13 concrete design mixes and to establish procedures for placing, finishing, curing, and protecting concrete to meet
14 required quality under anticipated conditions. Representatives of each entity directly concerned with cast-in-place
15 concrete to attend, including the following:

- 16 Contractor's superintendent.
- 17 Architect
- 18 DFD Construction Representative
- 19 Testing Laboratory responsible for field quality control.
- 20 Ready-mix concrete supplier.
- 21 Concrete Subcontractor.
- 22 Special concrete finish Subcontractor.

23
24 Minutes of the meeting shall be recorded, typed, reproduced and distributed by Contractor to all parties concerned
25 within five working days of meeting. Minutes shall include a statement by admixture manufacturer(s) indicating that
26 proposed mix design and placing can produce concrete quality required by this Section.

27
28 Contractor shall notify Architect at least 10 days prior to scheduled date of meeting.

29 **SUBMITTALS**

30 Product Data: For each type of product.

31
32 Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials,
33 Project conditions, weather, test results, or other circumstances warrant adjustments.

34 Indicate amounts of mixing water to be withheld for later addition at Project site.

35 Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar
36 sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps,
37 mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

38 Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

39 Location of construction joints is subject to approval of the Architect.

40 Welding certificates.

41 Material Certificates: For each of the following, signed by manufacturers:

- 42 Cementitious materials.
- 43 Admixtures.
- 44 Form materials and form-release agents.
- 45 Steel reinforcement and accessories.
- 46 Fiber reinforcement.

- 1 Waterstops.
- 2 Curing compounds.
- 3 Bonding agents.
- 4 Adhesives.
- 5 Vapor retarders.
- 6 Semirigid joint filler.
- 7 Joint-filler strips.
- 8 Repair materials.

9
10 Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
11 Aggregates

12
13 Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing
14 fabrication, assembly, and support of formwork.

15
16 Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and
17 reshoring installation and removal.

18
19 Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

20
21 Field quality-control reports.

22
23 Minutes of preinstallation conference.

24
25 Samples: For **vapor retarder** .

26
27 **QUALITY ASSURANCE**

28 Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork
29 Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

30
31 Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies
32 with ASTM C 94/C 94M requirements for production facilities and equipment.

33
34 Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

35
36 Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for
37 testing indicated.

38
39 Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to
40 ACI CP-1 or an equivalent certification program.

41
42 Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete
43 Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete
44 Laboratory Testing Technician, Grade II.

45
46 Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

47
48 **MOCK UP**

49 Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture,
50 tolerances, floor treatments, and standard of workmanship.

51
52 Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location
53 indicated or, if not indicated, as directed by Architect.

54

1 Subject to compliance with requirements, approved mockups may become part of the completed Work if
2 undisturbed at time of Substantial Completion.

3
4 **DELIVERY, STORAGE, AND HANDLING**

5 Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

6
7 **FIELD CONDITIONS**

8 Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or
9 reduced strength that could be caused by frost, freezing actions, or low temperatures.

10
11 When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain
12 delivered concrete mixture temperature within the temperature range required by ACI 301.

13
14 Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade
15 or on subgrade containing frozen materials.

16
17 Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators
18 unless otherwise specified and approved in mixture designs.

19
20 Hot-Weather Placement: Comply with ACI 301 and as follows:

21
22 Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice
23 may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing
24 water. Using liquid nitrogen to cool concrete is Contractor's option.

25
26 Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly
27 moist without standing water, soft spots, or dry areas.

28
29
30 **PART 2 - PRODUCTS**

31
32
33 **FORM-FACING MATERIALS**

34 Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces.

35
36 Furnish in largest practicable sizes to minimize number of joints.

37
38 Plywood, metal, or other approved panel materials.

39
40 Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

41 High-density overlay, Class 1 or better.

42 Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

43
44 Structural 1, B-B or better; mill oiled and edge sealed.

45
46 B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

47
48 Overlaid Finnish birch plywood.

49
50
51
52 Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on
53 at least two edges and one side for tight fit.

1 Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes
2 that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide
3 units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
4

5 Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without
6 detrimental deformation.
7

8 Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of
9 plastic concrete and other superimposed loads.
10

11 Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
12

13 Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
14

15 Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect
16 concrete surfaces and does not impair subsequent treatments of concrete surfaces.
17

18 Formulate form-release agent with rust inhibitor for steel form-facing materials.
19

20 Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to
21 resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
22

23 Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
24

25 Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
26

27 Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
28

28 **STEEL REINFORCEMENT**

29 Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content
30 not less than **25** percent.
31

32 Reinforcing Bars: ASTM A 615/A 615M, Grade 60 , deformed.
33

34 Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into
35 flat sheets.
36

37 Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
38
39

40 **REINFORCEMENT ACCESSORIES**

41 Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and
42 welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according
43 to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
44

45 For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-
46 protected steel wire or CRSI Class 2 stainless-steel bar supports.
47
48

49 **CONCRETE MATERIALS**

50 Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's
51 plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
52

53 Cementitious Materials:

54 Portland Cement: ASTM C 150/C 150M.
55

1 Fly Ash: ASTM C 618, **Class C**.

2
3 Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single
4 source .

5
6 Maximum Coarse-Aggregate Size: 3/4 inch nominal.

7
8 Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
9

10 **ADMIXTURES**

11 Admixtures to be used in the concrete mixture shall be submitted for approval as part of the mixture design. No other
12 admixtures will be allowed except those listed without the Architect's approval.

13
14 Air-Entraining Admixture: ASTM C 260/C 260M.

15
16 Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute
17 water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or
18 admixtures containing calcium chloride.
19

20
21 Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

22
23 Retarding Admixture: ASTM C 494/C 494M, Type B.

24
25 Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

26
27 Viscosity-Modifying Admixture: ASTM C 494/C 494M, Type S.

28
29 High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

30
31 High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

32
33 Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
34

35
36 Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and
37 anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement
38 in concrete and complying with ASTM C 494/C 494M, Type C.
39

40 Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic
41 inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride
42 reactions with steel reinforcement in concrete.
43

44 Water: ASTM C 94/C 94M.
45

46 **FIBER REINFORCEMENT**

47
48 Novomesh 950 Macro-Synthetic Fiber Blend or Approved Equivalent
49 - 5 pounds per cubic yard of concrete.
50

51 **VAPOR RETARDERS**

52 Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive
53 tape.
54

1
2 Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.
3
4
5

6 **LIQUID FLOOR TREATMENTS**

7 Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate
8 materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
9

10 **CURING MATERIALS**

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

12
13 Masterkure ER 50 as manufactured by BASF Chemical Company. Install per manufacturer's recommendations.
14

15 **RELATED MATERIALS**

16 Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
17
18

19 **CONCRETE MIXTURES, GENERAL**

20 Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture
21 or field test data, or both, according to ACI 301.
22

23 Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on
24 laboratory trial mixtures.
25

26 Cementitious Materials: Use fly ash as needed to reduce the total amount of portland cement, which would otherwise
27 be used, by not less than 15 percent.
28
29

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

31
32 Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for
33 placement and workability.
34

35 Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other
36 adverse placement conditions.
37

38 Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking
39 structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
40
41

42 **CONCRETE MIXTURE SCHEDULE**

43
44

45	46	47	48	49	50	51	52	53
Class	Type of Construction	Min. Comp Strength @ 28 Days (PSI)	Slump Before addn. of HRWR (in. +/- 1 in.)	Max. Agg. Size (in.)	Water Cement Ratio	Air Entrainment % +/- 1½%	Notes	
51	Footings	3000	5	1.0	0.59	4.5	(1)	
53	Interior slab-on-grade	4000	3	0.75	0.68	none	(2)	

54
55

1	2a	Exterior slab-on-grade	4500	3	0.75	0.44	6.0	(2)(4)
2								
3								
4	2b	Exterior Site concrete	4500	3	0.75	0.44	6.0	(2)(4)(6)
5								
6								
7	4	Walls and piers	4000	4	0.75	0.57	none	(2)
8								
9	4a	Exposed walls	4000	3	0.75	0.48	6.0	(2)(3)
10								
11	9	Miscellaneous non-scheduled concrete	3000	5	0.75	0.59	6.0	(2)
12								
13								
14								
15								

Notes:

- (1) Use a maximum of 50% replacement of portland cement with ground granulated blast-furnace slag and fly ash at a 1:1 ratio, up to 350 pounds per cubic yard. If fly ash is used alone, limit the maximum replacement to 25%.
- (2) Use a maximum of 30% replacement of portland cement with ground granulated blast-furnace slag and fly ash at a 1:1 ratio, up to 350 pounds per cubic yard, with a maximum 25% fly ash. If fly ash is used alone, limit the maximum replacement to 25%.
- (3) Use High-Range, Water-Reducing Admixture in mixture.
- (4) High-Range, Water-Reducing Admixture may be used in mixture.
- (5) Maximum equilibrium dry weight of lightweight aggregate mix: 115 pounds per cubic foot, as determined by section 9.5 of ASTM C 567.
- (6) Coordinate with site/civil and landscape concrete elements. May contain colored concrete elements. Provide epoxy coated rebar for all concrete.

FABRICATING REINFORCEMENT

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

CONCRETE MIXING

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

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.

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

For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..

1 Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name
2 and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate
3 location of final deposit in structure.
4
5

6 PART 3 - EXECUTION 7

8 FORMWORK INSTALLATION

9 Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and
10 dynamic loads, and construction loads that might be applied, until structure can support such loads.
11

12 Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position
13 indicated, within tolerance limits of ACI 117.

14 Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

15 Class A, 1/8 inch for smooth-formed finished surfaces.
16

17 Construct forms tight enough to prevent loss of concrete mortar.
18

19 Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking
20 plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5
21 horizontal to 1 vertical.
22

23 Install keyways, reglets, recesses, and the like, for easy removal.
24

25 Do not use rust-stained steel form-facing material.
26

27 Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished
28 concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type
29 screeds.
30

31 Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
32

33 Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate
34 temporary openings in forms at inconspicuous locations.
35

36 **Do not chamfer** exterior corners and edges of permanently exposed concrete.
37

38 Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
39

40 Determine sizes and locations from trades providing such items.
41

42 Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before
43 placing concrete.
44

45 Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper
46 alignment.
47

48 Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before
49 placing reinforcement.
50

51 EMBEDDED ITEM INSTALLATION

52 Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or
53 supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished
54 with items to be embedded.
55

1 Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5
2 of AISC 303.

3
4 Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame
5 at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

6
7 Install dovetail anchor slots in concrete structures as indicated.

8 9 **REMOVING AND REUSING FORMS**

10 General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of
11 concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete.
12 Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations
13 need to be maintained.

14
15 Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete
16 in place until concrete has achieved[at least 70 percent of] its 28-day design compressive strength.

17
18 Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing
19 shores.

20
21 Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-
22 facing material are not acceptable for exposed surfaces. Apply new form-release agent.

23
24 When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints
25 to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

26 27 **SHORING AND RESHORING INSTALLATION**

28 Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

29
30 Do not remove shoring or reshoring until measurement of slab tolerances is complete.

31
32 In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such
33 a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without
34 sufficient steel reinforcement.

35
36 Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring
37 to support construction without excessive stress or deflection.

38 39 **VAPOR-RETARDER INSTALLATION**

40 Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's
41 written instructions.

42
43 Lap joints 6 inches and seal with manufacturer's recommended tape.

44
45 Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written
46 instructions.

47 48 **STEEL REINFORCEMENT INSTALLATION**

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

50
51 Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

52
53 Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

1 Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with
2 bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

3
4 Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

5
6 Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

7 Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap
8 edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent
9 continuous laps in either direction. Lace overlaps with wire.

10
11 Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to
12 ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

13
14 Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to
15 ASTM A 780/A 780M. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

16 **JOINTS**

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

18
19
20 Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as
21 approved by Architect.

22
23 Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless
24 otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

25
26 Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

27
28
29 Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as
30 indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

31
32 Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-
33 rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise
34 damage surface and before concrete develops random contraction cracks.

35
36 Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical
37 surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

38
39 Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless
40 otherwise indicated.

41
42 Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete
43 surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

44
45 Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip
46 sections together.

47
48 Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-
49 half of dowel length to prevent concrete bonding to one side of joint.

50 **CONCRETE PLACEMENT**

51 Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that
52 required inspections are completed.

53
54
55 Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

1 Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

2
3 Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

4
5 Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on
6 concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously,
7 provide construction joints as indicated. Deposit concrete to avoid segregation.

8
9 Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to
10 avoid inclined construction joints.

11
12 Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

13
14 Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly
15 spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert
16 vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of
17 vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other
18 embedded items without causing mixture constituents to segregate.

19
20 Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints,
21 until placement of a panel or section is complete.

22 Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement
23 and other embedded items and into corners.

24
25 Maintain reinforcement in position on chairs during concrete placement.

26
27 Scream slab surfaces with a straightedge and strike off to correct elevations.

28
29 Slope surfaces uniformly to drains where required.

30
31 Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before
32 excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing
33 operations.

34 35 **FINISHING FORMED SURFACES**

36 Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired
37 and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

38
39 Apply to concrete surfaces not exposed to public view.

40
41 Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and
42 symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other
43 projections that exceed specified limits on formed-surface irregularities.

44
45 Apply to concrete surfaces exposed to public view.

46
47 Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed
48 surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface
49 treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

50 51 **FINISHING FLOORS AND SLABS**

52 General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for
53 concrete surfaces. Do not wet concrete surfaces.

1 Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-
2 driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface
3 is left with a uniform, smooth, granular texture.

4
5 Apply float finish to surfaces to receive trowel finish.

6
7 Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven
8 trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and
9 appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

10 Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring or carpet.

11
12 Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor
13 surface:

14
15 Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values
16 of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

17
18
19
20 Trowel and Fine-Broom Finish: Apply a first trowel finish to exterior concrete surfaces. While concrete is still plastic,
21 slightly scarify surface with a fine broom.

22
23 Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

24
25 Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

26
27 Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom
28 perpendicular to main traffic route. Coordinate required final finish with Architect before application.

29 30 31 **MISCELLANEOUS CONCRETE ITEM INSTALLATION**

32 Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise
33 indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous
34 concrete filling indicated or required to complete the Work.

35
36 Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling
37 surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

38
39 Equipment Bases and Foundations:

40 Coordinate sizes and locations of concrete bases with actual equipment provided.

41
42 Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in
43 each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless
44 required for seismic anchor support.

45
46
47 Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods
48 on 18-inch centers around the full perimeter of concrete base.

49
50 For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor
51 into structural concrete substrate.

52
53 Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams,
54 instructions, and directions furnished with items to be embedded.

1 Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to
2 supported equipment.
3

4 Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and
5 accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.
6

7 **CONCRETE PROTECTING AND CURING**

8 General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with
9 ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
10

11 Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause
12 moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's
13 written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
14

15 Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar
16 surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of
17 curing period, continue curing for remainder of curing period.
18

19 Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and
20 slabs, concrete floor toppings, and other surfaces.
21

22 Cure concrete according to ACI 308.1, by one or a combination of the following methods:
23

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

26
27 Continuous water-fog spray.
28

29 Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and
30 edges with 12-inch lap over adjacent absorptive covers.
31

32 Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing
33 concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by
34 waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during
35 curing period, using cover material and waterproof tape.
36

37 Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor
38 coverings.
39

40 Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive
41 penetrating liquid floor treatments.
42

43 Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a
44 curing compound that the manufacturer certifies does not interfere with bonding of floor
45 covering used on Project.
46

47 Curing Compound: Apply uniformly in continuous operation by power spray or roller according to
48 manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial
49 application. Maintain continuity of coating and repair damage during curing period.
50

51 Removal: After curing period has elapsed, remove curing compound without damaging
52 concrete surfaces by method recommended by curing compound manufacturer unless
53 manufacturer certifies curing compound does not interfere with bonding of floor covering
54 used on Project.
55

1 Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by
2 power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy
3 rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat.
4

5 Maintain continuity of coating and repair damage during curing period.
6

7 **LIQUID FLOOR TREATMENT APPLICATION**

8 Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to
9 manufacturer's written instructions.

10 Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
11

12 Do not apply to concrete that is less than 28 days' old.
13

14 Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming
15 or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar
16 manner if surface is rough or porous.
17

18
19 Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by
20 power spray or roller according to manufacturer's written instructions.
21

22 **JOINT FILLING**

23 Prepare, clean, and install joint filler according to manufacturer's written instructions.
24

25 Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic
26 has permanently ceased.
27

28 Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and
29 dry.
30

31 Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and
32 trim joint filler flush with top of joint after hardening.
33

34 **CONCRETE SURFACE REPAIRS**

35 Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that
36 cannot be repaired and patched to Architect's approval.
37

38 Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate
39 passing a No. 16 sieve, using only enough water for handling and placing.
40

41 Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles,
42 honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot
43 be removed by cleaning.
44

45 Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any
46 dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete
47 surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact
48 with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs
49 secured in place with bonding agent.
50

51 Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement
52 so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to
53 verify mixture and color match before proceeding with patching.
54

55 Compact mortar in place and strike off slightly higher than surrounding surface.

1
2 Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as
3 determined by Architect.
4

5 Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface
6 tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope
7 and smoothness; use a sloped template.
8

9 Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock
10 pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely
11 through unreinforced sections regardless of width, and other objectionable conditions.
12

13 After concrete has cured at least 14 days, correct high areas by grinding.
14

15 Correct localized low areas during or immediately after completing surface finishing operations by cutting
16 out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
17

18 Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and
19 apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth,
20 uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
21

22 Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a
23 minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair
24 topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and
25 level surface.
26

27 Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and
28 replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement
29 with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and
30 apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except
31 without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same
32 manner as adjacent concrete.
33

34 Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks
35 and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete
36 surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching
37 mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
38

39 Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
40 Repair materials and installation not specified above may be used, subject to Architect's approval.
41

42 **FIELD QUALITY CONTROL**

43 Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit
44 reports.
45

46 Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be
47 performed according to the following requirements:
48

49 Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5
50 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
51

52 Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each
53 concrete mixture placed each day.
54

1 When frequency of testing provides fewer than five compressive-strength tests for each concrete
2 mixture, testing shall be conducted from at least five randomly selected batches or from each batch
3 if fewer than five are used.

4 Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for
5 each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

6
7 For SCC; test slump flow in accordance with ASTM C1611. Cone can be used either upright or inverted.
8 Same procedure shall be followed throughout project.

9
10 For SCC; tester shall record the Visual Stability Index (VSI)

11
12 Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite
13 sample, but not less than one test for each day's pour of each concrete mixture.

14
15 Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80
16 deg F and above, and one test for each composite sample.

17
18 Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite
19 sample, but not less than one test for each day's pour of each concrete mixture.

20
21 Compression Test Specimens: ASTM C 31/C 31M.

22
23 Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

24
25 Cast and field cure two sets of two standard cylinder specimens for each composite sample.

26
27 Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one
28 set of two specimens at 28 days.

29
30 Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

31
32 A compressive-strength test shall be the average compressive strength from a set of two specimens obtained
33 from same composite sample and tested at age indicated.

34
35 When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor
36 shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

37
38 Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength
39 tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified
40 compressive strength by more than 500 psi.

41
42 Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing.
43 Reports of compressive-strength tests shall contain Project identification name and number, date of concrete
44 placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive
45 strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for
46 both 7- and 28-day tests.

47
48 Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect
49 but will not be used as sole basis for approval or rejection of concrete.

50
51 Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that
52 slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by

53

1 Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders
2 complying with ASTM C 42/C 42M or by other methods as directed by Architect.

3 Additional testing and inspecting, at Contractor's expense, will be performed to determine
4 compliance of replaced or additional work with specified requirements.

5 Correct deficiencies in the Work that test reports and inspections indicate do not comply with the
6 Contract Documents.

7
8 Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.
9

10 **PROTECTION OF LIQUID FLOOR TREATMENTS**

11 Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective
12 methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
13

14

END OF SECTION 03 30 00