# SECTION 03 30 10CAST-IN-PLACE CONCRETE FOR SITE WORK

**BASED ON DFD MASTER SPECIFICATION DATED 11/5/2024**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

## PART 1 GENERAL

### SCOPE

The work under this section consists of providing all work, materials, labor and supervision necessary to provide cast-in-place concrete as required for site concrete such as curb and gutter, steps, pavement, pole bases, and exterior flatwork and ancillary concrete. Requirements of this section do not apply to structural concrete such as manholes, duct banks, buildings, or retaining structures. Structural concrete work is included in 03 30 00. Included in the section are the following topics:

PART 1 GENERAL

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Concrete Pavement

Cold Weather Placing

Hot Weather Placing

Detectable Warning Plate Installation

Curing

Repair and Protection

### Related Work

Applicable provisions of Division 01 govern work under this Section.

03 30 00 – Cast-In-Place Concrete

30 05 00 – Common Work Results for All Exterior Work

32 11 23.33 – Dense Graded Base

**REFERENCES**

Incorporated Guides and References

American Concrete Institute (ACI):

 ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.

 ACI 305R - Hot Weather Concreting.

 ACI 306R – Cold Weather Concreting.

 ACI 309R – Guide for the Consolidation of Concrete.

 ACI 347 – Guide to Formwork for Concrete.

State of Wisconsin, Department of Transportation (WisDOT):

 Standard Specifications for Highway and Structure Construction (SSHSC)

 Construction and Materials Manual (CMM)

### Submittals

Mix Design: Submit mix design for review at least ten days prior to use. Mix design shall be derived from tests performed by a qualified testing laboratory or from previous tests performed on aggregate from same source.

Product Data: Submit product data for joint fillers, curing compound, admixtures, reinforcing, and all other concrete components.

Delivery Tickets: Submit delivery tickets to DFD Construction Representative for each load of concrete delivered to project.

Test Reports: Submit reports for laboratory and field tests required under "Testing" article.

Joint Layout Plan: Submit a joint layout plan for approval prior to starting work.

Make submittals in accordance with Division 01.

### QUALITY ASSURANCE

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

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.

Manufacturer certified according to National Ready Mixed Concrete Association’s "Certification of Ready Mixed Concrete Production Facilities."

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

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

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

### Testing

Contractor shall arrange and pay for concrete testing by a qualified testing agency, acceptable to State and independent of Contractor.

Testing agency shall test concrete to measure slump, entrained-air content, temperature, and compressive strength to determine compliance with specifications. Furnish test apparatus and cylinders, perform on-site sampling and testing, and have compressive strength cylinders tested by a qualified laboratory.

* On-site tests shall be performed under observation of A/E unless waived.
* Perform slump, air content, and temperature tests prior to concrete placement each day, whenever there is a change in consistency of concrete, and when concrete cylinders are prepared. If measured slump, air content, or temperature falls outside specified limits, immediately check another portion of same batch. In event of a second failure, concrete shall be rejected.
* During progress of work, prepare three test cylinders per **[100 cu yd**] fraction thereof for each class of concrete placed each day [*AE to confirm frequency of testing*]. Identify samples, moist cure in accordance with ASTM C31, and ship samples to testing laboratory for one 7-day compressive strength test and two 28-day tests.
* Test procedures shall be in accordance with ASTM C31, C39, C143, C172, C231, and C1064.
* Cost of tests, including materials and transportation, shall be paid by Contractor and shall be considered incidental to the various items of concrete work.

The Quality Management Program (QMP) provisions of the referenced WisDOT SSHSC sections do not apply to this concrete work.

### MOCK-UP

***(AE Note: Mock-up is intended to be needed only for colored, stamped, or decorative concrete. Mock-up section should be deleted if decorative concrete is not in the project scope.)***

Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship. DFD Construction Representative and/or AE will review mock-up for approval.

Build panel approximately 100 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by the DFD Construction Representative and/or AE.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion. If not incorporated into the work, then the contractor must demolish and remove the mock-up from the project site.

### Notification

Notify DFD and AE 48 hr. prior to placing any concrete.

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## PART 2 PRODUCTS

### Concrete

Concrete shall be in accordance with WisDOT SSHSC, Section 501, for grade A, air entrained concrete.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CLASS | Min. Comp. Strength, PSI | Slump, In. | Min. Cement. Lbs/ Cu Yd | Max. Water-Cement Ratio | Air Content, % By Volume | Use |
| A | 4,000 (28-day) | 1-4, 2 ½ for slip form | 565 | 0.45 | 6-8 | Pavements, curbs, sidewalks, slabs, pole bases, manhole benches |
| HES | 3,000 (3-day) | 1-3 | 660 | 0.45 | 6-8 | High Early |

 Use epoxy coated rebar unless otherwise specified.

### Colored concrete

Integrally color concrete using non-fading pigments conforming to ASTM C979.

Add integral concrete colorant according to manufacturer's instructions. Provide a copy of those manufacturer instructions to the AE before producing material for incorporation into the work.

The accepted color will be based on color samples available from the manufacturer and approved mock-up.

Maintain mix characteristics for colored concrete requiring a matching finish. Use the same source,

brand, type, and color of cement, supplementary cementitious materials, aggregates, and admixtures

for colored concrete throughout the project. Use constant cement content, supplementary cementitious

material content, and water/cementitious materials ratio to maintain consistent color.

### Reinforcement

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

***(AE Note: Generally, epoxy coated rebar is required. If not needed then edit and include paragraph below.)***

Reinforcing Bars and Tie Bars: ASTM A615, Grade 60, deformed steel bars, epoxy-coated in accordance with ASTM A775, with less than 2 percent damaged coating in each 12-inch bar length.

Dowel Bars: ASTM A615, Grade 60, plain steel bars, epoxy-coated in accordance with ASTM A775.

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

### Forms

Forms may be either stationary or slip-form type. If slip forms are used, finished product shall be of quality equal to that produced by stationary forms.

Provide forms of steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects, extending full depth of concrete.

Use flexible spring steel forms or laminated boards to form radius bends as required.

Coat forms with a form release agent which will not discolor or deface surface of concrete.

### ExPANSION JOINT FILLER

Expansion joint filler meeting requirements of WisDOT SSHSC, Subsection 415.2.

### Curing Compound

Curing compounds and curing agents meeting requirements of WisDOT SSHSC, Subsection 415.2.

For colored concrete, furnish a liquid membrane-forming clear curing compound conforming to ASTM C1315, type 1, or compatible with the coloring agent manufacturer.

**ADMIXTURES**

Admixtures to be used in the concrete mixture shall be submitted for approval as part of the mixture design. No other admixtures will be allowed except those listed without the A/E’s approval.

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

Water reducing admixture shall conform to ASTM C494, Class A.

Other admixtures which do not adversely affect strength and durability of concrete may be used with permission of A/E, if used in strict accordance with manufacturer's instructions. Care shall be exercised to ensure that the admixture does not increase or decrease air content outside of allowable limits. Do not use salt or chemical anti-freeze admixtures.

For colored concrete, furnish admixtures designed for use with and compatible with colored concrete pigments. Do not use calcium chloride or other admixtures containing chlorides.

### DETECTABLE WARNING PLATES

Detectable warning plates shall consist of pre-manufactured cast iron panels with raised truncated domes complying with the Americans with Disabilities Act (ADA) Accessibility Guidelines. Panels shall have a skid-resistant finish. Finish color shall be natural cast iron *(Confirm color with Agency)*. Provide panels from WisDOT's current approved products list.

## PART 3 EXECUTION

### Preparation for Concrete

Remove loose material from compacted subgrade. Proof-roll subgrade; give notice of unstable areas. Moisten subgrade to provide a uniformly damp condition.

Set clean forms to required grades and lines, rigidly braced and secured. Provide minimum concrete thicknesses as indicated on Drawings.

Check tolerances as follows (slip form methods shall produce equivalent results):

* Top of form: 1/8 in. in 10 ft.
* Alignment of vertical face: 1/4 in. in 10 ft.

Adjust manholes and utility structures to grade.

### Joints

General: Form construction, expansion, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

* When abutting existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

Joint Layout: Provide a joint layout plan for approval by the AE.

Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at expansion joints.

* Provide tie bars at sides of paving strips where indicated.
* Drill and epoxy tie bars where new concrete abuts existing concrete, as shown. If not shown, then provide two tie bars for curb and gutter and provide tie bars at 24” on center at other locations. Tie bars must be minimum of 18” with 6” embedment unless otherwise shown. Tie bars shall be minimum #4 size.
* Butt Joints: Provide butt joints for joints not subject to traffic. Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
* Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys for joints subject to traffic, except where doweled joints are designated. Embed keys at least 1-1/2 in. into concrete.

Expansion Joints: Form expansion joints of preformed joint-filler strips abutting concrete radius points, catch basins, manholes, inlets, structures, existing concrete, other fixed objects, and where indicated.

* Locate additional expansion joints in curb and gutter at a maximum of 300 ft on center, unless otherwise indicated. Locate additional expansion joints in other concrete work at a maximum of 100 ft on center, unless otherwise indicated.
* Extend joint fillers full width and depth of joint.
* Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
* Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
* During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to one-fourth to one-third of the concrete thickness by forming or sawing.

* Formed Joints: Form contraction joints by using parting strips or by grooving to depth shown on details, or herein.
* Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
* Locate joints in curbs and gutters at between 12 ft and 20 ft on center, unless otherwise shown. Joints in sidewalks shall be a distance equal to the sidewalk width, but no more than 7 ft on center.
* Locate joints in pavements as shown on the Drawings. Joints shall be continuous across slab, unless interrupted by an expansion joint. If not shown, then develop a joint layout plan.

### Concrete Placement

Mix and place concrete in accordance with the following.

Place concrete in accordance with the most stringent of either ACI 304 or this section.

Concrete must be placed within the timeframe specified in WisDOT SSHSC 501. Retarders may be used if approved by the DFD Construction Representative and AE.

Before placing concrete, remove debris, ice, snow, and other foreign materials from the subgrade or

formwork.

Remove standing water from subgrade. Dry and compact subgrade in accordance with the requirements of

Division 2. Do not place concrete on soft or frozen subgrade.

Place and secure steel reinforcement prior to placing concrete.

Position and secure expansion joint material, sleeves, waterstops and other embedded items prior to placing

concrete. Place embedded items in accordance with the most stringent of either drawings or manufacturer

recommendations.

Apply bonding agent to existing concrete surfaces requiring a bond with new concrete.

Convey concrete from truck to final position by method that will prevent separation. Unless otherwise approved, limit free fall of concrete to 4’ maximum height to avoid separation.

Place concrete continuously so that concrete is deposited on or adjacent to concrete that is still plastic. When

placing of concrete is temporarily halted or delayed, provide construction joints.

Place concrete in lifts not exceeding 18”.

Consolidate concrete by mechanical vibration. Allow vibrator to penetrate the full depth of the slab or lift.

Overlap previously vibrated areas by 25%.

After striking off and consolidating concrete, smooth surface by screeding and floating. Test surface for trueness with a 10 ft straightedge. Remove surface irregularities and refloat repaired areas to provide a continuous, smooth finish of uniform texture.

Work edges of slabs and formed joints with edging tool to form a 1/4 in. radius.

After floating and when excess moisture has disappeared, provide broom finish by drawing a fine-hair broom perpendicular to direction of travel.

After 24 hours, remove forms, clean ends of joints, and repair honeycombed areas by means approved by the AE.

**COLORED CONCRETE PLACEMENT**

Construct work incorporating colored concrete conforming to contract specifications. Cure with clear curing compound and use only non-chloride admixtures.

Produce consistently colored concrete in full cubic yard increments. DFD will not allow variations in the quantities, types, or source of materials with the exception of minor adjustments of water and air-entraining agent. Other changes require mix and mock-up re-approval.

Schedule to minimize exposure to rapid drying, wind, and full sun before applying curing compound. Do not place colored concrete if rain, snow, or freezing temperatures are forecast within 24-hours.

Cover or otherwise protect adjacent concrete work from discoloration and spillage while placing and

curing colored concrete. Remove and replace discolored concrete as the DFD Construction Representative directs.

Perform finishing operations consistently to avoid color variation. Do not begin finishing while bleed water is present. DFD will order removal and replacement of colored concrete if the contractor adds water to the surface to aid in finishing. Apply strokes in the same direction during final finishing and texturing.

Protect colored concrete from premature drying and excessive cold or hot temperatures by promptly applying curing compound. Do not allow plastic sheeting to come into contact with colored concrete.

Protect the colored concrete from damage. Do not permit construction traffic or material storage on colored concrete. Exclude foot traffic from colored concrete for at least 24 hours after placement.

**CONCRETE CURB AND GUTTER**

Concrete work shall meet the requirements of Division 3, and WisDOT SSHSC, Sections: 601 - Concrete Curb

and Gutter.

Provide curb and gutter as shown on the drawings and transition to match adjacent existing curb and gutter.

Construct joints true-to-line with face perpendicular to surface. Construct transverse joints at right angles to

centerline, unless otherwise shown.

When abutting to existing walks, align transverse joints with previously placed joints, unless otherwise shown.

Where curb and gutter are located adjacent to sidewalks, provide a continuous ½” thick expansion joint.

The location and type of joints in curb and gutter shall match joints in adjacent pavement whenever possible.

**SIDEWALKS, DRIVEWAY APRONS, BIKE PATHS**

***(AE Note: Add additional ancillary concrete requirements if needed for the project.)***

Concrete work shall meet the requirements of Division 3, and WisDOT SSHSC, Sections: 602.

Provide Standard Duty concrete sidewalk with a minimum thickness shown on the plans for all sidewalks, bike lanes, and plaza/patio areas with little or no motorized vehicle traffic. If no thickness is shown on the plans, then provide a minimum of 5-inches.

Provide Heavy Duty concrete for concrete drives, fire lanes, handicap ramps, the concrete walk through

driveways, and any pavement subject to vehicular traffic, with a minimum concrete pavement thickness as shown on the plans. If no thickness is shown on the plans, then provide a minimum of 7-inches.

Unless otherwise shown on the drawings, provide all walks with a cross slope of 1/4" per foot and scored contraction joints of width approximately equal to the length.

Provide expansion joints between the walk and the back of the abutting parallel curb. Provide expansion joints where abutting existing concrete pavements as directed by DFD Construction Rep.

Dowel replacement concrete adjacent to existing slabs or to building walls or retaining walls with epoxy coated reinforcing rod set into the new slab 12" and into the structural wall 4" at 18" on centers.

Provide a boxed out square 12" larger than the casting, where manholes or valve boxes occur in a walk.

Unless otherwise noted, joint all replacement concrete work to match adjacent work. Generally provide square layout of joints, subject to the DFD Construction Representative's approval. Consult with AE and DFD Construction Representative before laying out joints for large areas and areas of intersecting walks.

Hand tool all joints outside of concrete pavement areas and stamped concrete.

Remove and replace, at no cost to the Owner, any adjacent slabs not noted for removal, but which are broken or

cracked by the Contractor's activities.

Contractor shall review sidewalk grades with the AE prior to concrete placement to verify that positive drainage will be provided. Contractor shall provide minor adjustment of sidewalk grades as requested by the AE to provide positive drainage. Minor adjustments of up to 3” +/- in elevation shall be considered incidental. Contractor shall be responsible for remedial actions required to provide positive drainage for all areas identified following placement of surface materials where this requirement has not been met.

**CONCRETE PAVEMENT**

Construct concrete pavement (roads, driveways, parking areas) per WisDOT SSHSC, Subsection 415.3. WisDOT SSHSC, Subsection 415.3 supersedes Part 3 of Section 03 30 10 if a discrepancy arises.

### Cold Weather Placing

Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as specified below.

1. When air temperature falls to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 60 deg F (50 deg F for heavy sections) and not more than 90 deg F at point of delivery.
* Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Verify forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
* During seasons when atmospheric temperatures may be expected to drop below 40 deg F, concrete shall be protected by covering with impermeable paper and not less than 12 in. of loose dry hay or straw or thick insulating blankets. Retain covering for ten days.

### Hot Weather Placing

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305R and as specified below.

* Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated in total amount of mixing water.
* Cover reinforcing steel with water-soaked burlap if it becomes too hot to prevent steel temperature from exceeding the ambient air temperature immediately before embedment in concrete.
* Spray forms, reinforcing steel, and subgrade just before concrete is placed.
* Do not use set-control admixtures, unless approved by A/E.

### DETECTABLE WARNING PLATE INSTALLATION

Locate detectable warning plates where indicated on the Drawings. Embed detectable warning plate arrays in plastic concrete conforming to manufacturer-recommended procedures. Do not install on hardened concrete. Do not field cut plates except where ends of radial arrays abut ramp edges. Smooth edges of field cuts. Edges of warning plate shall fit surrounding concrete with no variation in height at edges. Completed warning plates shall be free of concrete, curing compound, and other foreign materials. Clean warning plate as required.

### Curing

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Cure formed and unformed concrete for seven days or until 75 percent of the required 28-day compressive strength is obtained, whichever is less.

For standard gray concrete, methods may include plastic sheets, constant wetting of surface with water, curing paper, or commercial curing compound. Apply curing compound at not less than 200 sq ft per gal in accordance with manufacturer's recommendations.

### Repair and Protection

Analyze and repair defects or deficiencies per Section 424 of the WisDOT CMM. Repair or replace broken or defective concrete. Remove surface stains.

Exclude traffic from concrete until the specified curing period is complete (generally 7 days). Protect concrete from damage until Substantial Completion.

Prior to final inspection, sweep concrete and wash free of stains, dirt, and other foreign materials.

END OF SECTION