

CW - CONCRETE WORK

CW-1 GENERAL

CW-1.1 Description

The extent of the concrete work is shown on the Drawings.

CW-1.2 Submittals

Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design.

CW-1.3 Quality Assurances

Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings".
ACI 318 "Building Code Requirements for Reinforced Concrete".
Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".
SDDOT Standard Specifications For Roads And Bridges (current edition)

Concrete Testing Services: Engage a testing laboratory acceptable to the City Engineer to perform material evaluation tests and to design concrete mixes.

CW-2 PRODUCTS

CS-2.1 Form Materials

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

Form Ties: Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.

Provide ties which, when removed, will leave holes not larger than 1” diameter in concrete surface.

CW-2.2 Reinforcing Materials

Reinforcing Materials: SDDOT Standard Specifications Sections 380, 460, and 480 and other SDDOT sections by reference.

Welded Wire Fabric: SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference.

CW-2.3 Concrete Materials

Portland Cement: SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference. Use one brand of cement throughout project, unless otherwise acceptable to the Engineer.

Aggregates: SDDOT Standard Specifications Sections 380 and 460 Class A or Class M as specified and other SDDOT section by reference. Provide crushed aggregates (quartzite) from a single source for exposed exterior exposed concrete sidewalks & pavement.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Water: Drinkable.

Admixtures: SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference.

CW-2.4 Related Materials

Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

Curing Materials: SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference.

CW-3 CONCRETE QUALITY AND PROPORTION

SDDOT Standard Specifications Sections 380 and 460 and other SDDOT sections by reference.

CW-4 CONCRETE MIXING

Ready-Mix Concrete: SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference.

CW-5 EXECUTION

CW-5.1 Forms

Design, erect, support, brace, and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain form work construction tolerances complying with ACI 347.

Construct forms to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, blocking, screeds, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

Provision for Other Trades: Provide openings in concrete form work to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

CW-5.2 Placing Reinforcement

Details and methods of reinforcement placement and supports shall comply with the most stringent of the following two referenced sources and the notes below: Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" and SDDOT Standard Specifications Sections 380 and 460 and other SDDOT sections by reference.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support, and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

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

CW-5.3 Concrete Placement

Preplacement Inspection: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

General:

Details and methods of Concrete placement shall comply with the most stringent of the following two referenced sources and the notes below: ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete" and SDDOT Standard Specifications Sections 380 and 460 and other SDDOT sections by reference.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

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

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

CW-5.4 Finish of Formed Surfaces

Surface Finish shall generally comply with SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference and the notes below:

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring 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.

CW-5.5 Concrete Curing and Protection

Curing Concrete and Protection of Concrete shall generally comply with SDDOT Standard Specifications Sections 380 and 460 and other SDDOT section by reference and the notes below:

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations hereof, as herein specified.

Provide moisture-cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:

Apply specified curing and sealing compound to concrete slabs as soon as finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

CW-5.6 Removal of Forms

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F. (10°C.) for 24 hours after placing concrete, provided concrete is sufficiently hard and not to be damaged by form removal operations, and provided curing and protection operations are maintained.

CW-5.7 Concrete Surface Repairs

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Engineer.

For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plans to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair methods not specified above may be used, subject to acceptance of the Engineer.

CW-6 QUALITY CONTROL TESTING

When included in the bid items, the Contractor will employ a testing laboratory, at the Contactor's expense, approved by the Engineer to perform tests and to submit test reports.

Sampling and testing for quality control during placement of concrete includes the following, as directed by the Engineer.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Fresh Concrete Tests:

Slump: ASTM C 143, one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: Test hourly when air temperature is 40°F. (4°C.) and below, and when 80°F. (27°C.) and above; and each time a set of compression test specimens are made.

Concrete Strength Tests:

Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens.

Compressive Strength Tests: ASTM C 39, one set for each day's pour exceeding 5 cu. yds. Plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, one specimen tested at 14 days, one specimen tested at 28 days, and one specimen retained in reserve for a 28 day backup specimen if required.

When total quantity of a given class of concrete is less than 50 cu. yds., strength test may be waived by the Engineer if, in his judgement, adequate evidence of satisfactory strength is provided.

Structure Strength Tests:

To determine concrete strength for backfill purposes where class M6 concrete is utilized for structures (including drop inlets and junction boxes), the Contractor shall either provide Fresh Concrete Tests and Concrete Strength Tests as outlined above (7 and/or 14 day concrete break information) or may utilize a swiss hammer as outlined in the South Dakota Department of Transportation Materials Manual test number SD 409. The impact hammer tests shall be accomplished by the approved testing laboratory or shall be witnessed by the Engineer. Approval to backfill shall only be given by the Engineer. This test frequency may be reduced at the discretion of the Engineer. Reduction in or increase in the number of tests shall not be cause for adjustment in unit prices for testing.

Test results will be reported in writing to the Engineer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, location of concrete batch in structure, design compressive strength at 28 days, compressive breaking strength and type of break for both 7 day tests and 28 day tests.

CW-7 CONCRETE CURB AND GUTTER

Materials and construction shall conform to SDDOT requirements per Section 650 provisions. Measurement and payment will be in accordance with SDDOT 650.4 and 650.5 provisions.

CW-8 CONCRETE DROP INLETS

Materials and construction will conform to SDDOT requirements per Section 670 provisions. Measurement and payment will be in accordance with SDDOT 670.4 and 670.5 provisions.

CW-9 CONCRETE PAVEMENT/VALLEY GUTTER

Materials and construction will conform to SDDOT requirements per Section 380 provisions. Measurement and payment will be in accordance with SDDOT 380.4 and 380.5 provisions on a square yard or square foot basis.