

## SECTION 2000 - CONCRETE

2001 SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

2002 GENERAL. All cast-in-place concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein.

The Contractor shall inform the Engineer at least twenty-four (24) hours in advance of the times and places at which the concrete is to be placed.

2003 MATERIALS.

Concrete Materials. All concrete materials shall conform to the specifications of the Kansas City Metropolitan Materials Board (KCMMB). Information is available on the website [www.kcmmb.org](http://www.kcmmb.org).

Liquid Curing Membrane. Type 2, Class A or B; White Pigmented compound; ASTM C309 or AASHTO M148.

Polyethylene Sheeting Curing Material. White, opaque polyethylene sheeting/film with a 4 mil nominal thickness.

Curing Mats. New or used burlap composed of jute, manila hemp or kenaf. Used burlap shall have been previously used for curing concrete. Burlap fabricated from bags shall not be used.

Reinforcing Steel Bars. Non-epoxy coated bars shall conform to ASTM A615; Epoxy coated bars shall conform to ASTM A775; Grade 60; unless otherwise specified.

Fibers. When specified in the Contract Documents, fibers shall be incorporated into the concrete at the rate recommended by the manufacturer but no less than a minimum of 3 pounds per cubic yard of concrete for macro fibers and 1 pound to 1.5 pounds per cubic yard of concrete for micro fibers. Fibers shall meet the requirements in the current edition of the KDOT Standard Specifications. The synthetic fibers shall be in a collated and fibrillated or monofilament form. Unless otherwise specified, micro fibers shall be used for "fiber reinforcement" on all general call-outs. Macro fibers may be used as a substitute for micro fibers but micro fibers are not a suitable alternative for macro fibers.

2004 CONCRETE MIX DESIGNATIONS.

- A. Concrete mixes for street and apron approach pavements, sidewalk, shared use path, ramps, curbs, curb and gutter, cast-in-place storm sewer structures, channel and flume pavements, storm sewer collars and inverts, foundations, and pole bases shall conform to the specifications of and be approved by the Kansas City Metropolitan Materials Board (KCMMB). Approved suppliers, approved aggregates, and approved mixes are available on the website [www.kcmmb.org](http://www.kcmmb.org). Use of all KCMMB Optional Admixtures must be approved by the Engineer.
- B. All City projects shall use KCMMB approved concrete mixes as specified in this section. However, exception is given to concrete mixes for residential driveway aprons and residential sidewalks which may use coarse aggregates for on grade concrete, as specified in the current edition of the KDOT Standard Specifications, or locally produced crushed limestone coarse aggregates if the concrete work is not funded by the City and not part of a public improvement plan. Separate curb and gutter sections shall be isolated from driveway aprons and shall use KCMMB approved concrete mixes.
- C. Exposed aggregate concrete shall conform to the following mix design unless otherwise specified or approved.

Proportions

<u>Materials</u>	<u>One Cubic Yard</u>
Cement, Type I/II	395 lbs
Slag	169 lbs
Coarse Aggregate (smooth river rock)	1816 lbs
Fine Aggregate	1211 lbs
Water	248 lbs
Air Entraining Agent	3 +/- oz

Properties

Cementations Material, sack/yard	6.00
Water/Cement Material Ratio	.44
Fine Aggregate percent of total (by absolute volume)	40%
Unit weight pcf	32 +/- 1
Air Content	7 +/- 1
Slump	4 +/- 1
Compression Strength (not determined)	-----

- D. All concrete delivery tickets shall include the plant name, design w/c ratio, batch weights per cubic yard, total batched weight of all materials for quantity delivered, time batched, design slump, water withheld (2 gal/yd maximum), allowable slump range, moisture correction for aggregates, and dosages of all approved admixtures.

E. Water may not be added to concrete after initial mixing except when it is withheld at the batch plant. Up to 2 gallons/cubic yard may be added at the project site to adjust the slump to meet the specifications.

**Concrete slump shall not exceed 5” unless otherwise specified or approved by the Engineer.** The need for additional water must be determined as soon as the load arrives at the site. Water must be added to the entire load using a calibrated measuring device. Do not add more water than was withheld at the batch plant. After adding water, turn the drum or blades an additional 20 to 30 revolutions at mixing speed. The Engineer will observe the addition of water and will allow the procedure only once per load.

2005 PLACEMENT. The limits of each concrete pour shall be predetermined by the Contractor and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcements, and embedments shall be rigidly secured in proper position and all dirt, mud, water and debris shall be removed from the space to be occupied by the concrete. Bonding surfaces shall be cleaned of all foreign material and shall be free from laitance. Concrete shall not be placed on frozen subgrade or in excavations, which have not been dewatered.

Placement of concrete shall conform to requirements of ACI 304. Concrete shall be placed within forty-five (45) minutes of mixing operations, with the exception that the Engineer may extend the period to ninety (90) minutes (maximum) dependent upon weather conditions. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. Concrete shall not be placed in horizontal layers exceeding eighteen (18”) inches and shall not be deposited in large quantities at any point in the forms and then run or worked along the forms, thus causing segregation of the materials. During and immediately after placement, concrete shall be thoroughly consolidated and worked around all reinforcements and embedments and into the corners of the forms. The concrete shall be vibrated or spaded to produce a solid mass without honeycomb or surface air bubbles.

Concrete shall not be dropped in the forms a distance of more than five (5’) feet, unless confined by chutes or pipes; and care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of projecting reinforcement.

2006 COLD WEATHER CONCRETE. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when the

descending air temperature in the shade and away from artificial heat reaches thirty-five (35°) degrees F. Concrete operations may be resumed when the ascending air temperature in the shade and away from artificial heat reaches thirty-five (35°) degrees F.

When concrete work is authorized during cold weather, the concrete may be heated in accordance with ACI specifications. The temperature of the concrete shall be not less than sixty (60°) degrees F and not more than eighty (80°) degrees F at the time of placement in the forms.

No concrete shall be placed on frozen subgrade. Sudden cooling of concrete shall not be permitted. Concrete exposed to frost action or freezing weather shall be removed and replaced at the Contractor's expense.

A sufficient supply of approved blanketing material shall be provided and placed on all concrete placed between November 1 and April 1 and at other times when the ambient air temperature is expected to drop below forty (40°) degrees F. Blanketing material shall protect the concrete and maintain a minimum temperature of forty (40°) degrees F in the concrete as measured on the surface. Concrete shall be covered for at least four days. Blankets can only be excused with engineer or inspection staff approval.

2007 HOT WEATHER CONCRETE. The provisions of this section shall apply to all concrete work, which is done when the air temperature is above eighty (80°) degrees F at the time of placement. The temperature of the concrete, when placed, shall not be high enough to cause excessive loss of slump, flash set or cold joints. Forms, reinforcing and sub-grade surfaces against which the concrete is to be placed shall be wetted down immediately before placement. In no case shall the temperature of the concrete, when placed, exceed ninety (90°) degrees F.

When the air temperature exceeds ninety (90°) degrees F and as soon as practicable without causing damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, or other means acceptable to the Engineer at no expense to the Owner. This cooling with water shall be in addition to the initial sealing by membrane curing compound.

**No concrete shall be placed when the air temperature is above ninety-five (95°) degrees F.**

2008 CURING AND PROTECTION. Concrete shall be cured by protection against loss of moisture, rapid temperature changes and mechanical injury for at least four days after placement. Acceptable methods shall be moist curing, white polyethylene sheeting, liquid membrane-forming compounds, or a combination thereof, unless specified otherwise. After concrete

finishing operations have been completed, the entire surface of the newly placed concrete shall be covered by the curing medium. The Contractor shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped at joints to prevent drying between adjacent sheets.

White polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18") inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material during the curing period shall be immediately repaired or replaced with material in acceptable condition.

White membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one (1) gallon per one hundred fifty (150) square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply a new coat of compound to the affected area.

2009 FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood, metal, or other rigid materials approved by the Engineer and shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces which will be visible after backfilling shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

- 2010 REPAIRING DEFECTIVE AND DAMAGED CONCRETE. Any concrete found not to be formed as indicated on the plans, out of alignment or level, having a defective surface, or damaged prior to acceptance of the project by the city, shall be considered as not conforming to the intent of these specifications and may be ordered removed and replaced by the Contractor at their expense unless the Engineer authorizes patching of the defective or damaged area.

Concrete repair work shall conform to the current edition of ACI standards and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured and protected from further damage.

Surface defects such as ridges and bulges shall be removed by grinding.

Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be filled. The methods used in this type of repair shall be approved by the Engineer. Material used for patching shall be a non-shrink, non-metallic grout with a minimum twenty- eight (28) day compressive strength of five thousand (5,000) psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material.

- 2011 REINFORCEMENT. Reinforcing steel shall be protected by the thickness of concrete indicated on the construction drawings or as specified. Protect all steel reinforcement from weather while stored on-site.

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel according to the plans or as approved by the Engineer and shall be secured in place with wire ties or suitable clips.

Steel reinforcement, at the time concrete is placed, shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

- 2012 CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings, as specified, or as approved by the Engineer and shall conform to the requirements of ACI 318.

- 2013 ISOLATION AND CONTRACTION JOINTS. Isolation and contraction joints shall be of the type and at locations as specified, as indicated on the drawings or as required by the Engineer.