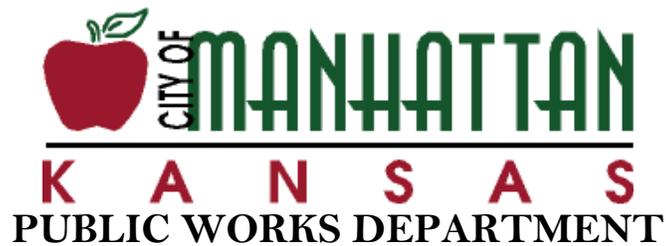


# Division II

## Section 2600

### Paving



**DIVISION II  
CONSTRUCTION AND MATERIAL SPECIFICATIONS**

**SECTION 2600 PAVING**

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## **SECTION 2600 PAVING**

### **2601 CONCRETE STREETS**

The work to be done under these specifications consists of furnishing all materials, equipment and labor for the construction of concrete pavement and monolithic curb. The work shall be performed in accordance with these specifications and in such a manner that completed items will conform to lines, grades and elevations as shown on the plans.

Concreting operations shall be stopped when descending air temperature away from artificial heat reaches 40 degrees Fahrenheit. Concreting operations may resume when ascending air temperature away from artificial heat reaches 35 degrees Fahrenheit. Concrete shall not be mixed or placed at temperatures of 35 degrees Fahrenheit and below without expressed permission of the City Engineer, and then only with adequate frost protection. Aggregate, water, or both, shall be heated as required to permit placing of the mixture at concrete temperatures ranging from 50 to 100 degrees Fahrenheit. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials or materials containing snow or ice shall be used.

#### **2601.1 MATERIALS**

Upon the request of the City Engineer the Contractor shall provide three (3) copies of certified test reports indicating the material conforms to the specifications as outlined in the following sections. The manufacturer shall perform all tests in conformance with applicable standards. Testing may be witnessed by the City Engineer or approved independent testing laboratory.

All materials shall be stored so as to prevent deterioration or intrusion of foreign matter. No deteriorated or damaged material shall be used.

2601.1.1 Concrete

2601.1.1.1 Cement

Cement shall be Type I Portland Cement, and shall conform to ASTM C150. Air entrained cement will not be accepted. Only one brand of cement shall be used throughout any job.

2601.1.1.2 Aggregates

Concrete aggregates shall conform to ASTM C33. Aggregate shall be free from injurious amounts of alkali, organic matter or deleterious substances. When tested for soundness under ASTM C88, the Aggregate shall pass 5 cycles without showing evidence of disintegration, or a total loss greater than 12% for the coarse particles, and 10% for the fine portions.

2601.1.1.3 Water

Water used in mixing concrete should be potable; however, nonpotable water may be used if mortar cubes made with the water in question have 7 and 28 day strengths equal to, or greater

than, companion specimens in which potable water was used. Water shall be clean and free from injurious amounts of sewage, oil, acids, strong alkalies and vegetable matter.

#### 2601.1.1.4 Admixtures

Admixtures, when used, shall conform to appropriate ASTM Standards. The use of admixtures not specifically listed in these specifications, including but not limited to, fly ash, calcium chloride, other accelerators and retardants, shall be approved by the City Engineer prior to construction.

#### 2601.1.1.5 Fly Ash

Fly ash shall be Type C from Jeffery Energy Center or equivalent. Certification of fly ash may be required. No more than 100 pounds of fly ash shall be added per cubic yard of concrete. The Contractor shall be responsible for protecting the surface of the concrete until the initial set occurs, and should therefore consider factors such as weather conditions prior to using fly ash in the concrete, as fly ash will increase the time required for the concrete to set.

#### 2601.1.2 Reinforcing Steel

Steel used in concrete reinforcement shall conform to the appropriate ASTM specifications as noted in the following paragraphs. All steel shall be free from rust, oil, grease or other foreign matter which will inhibit the bonding of the concrete and the steel.

##### 2601.1.2.11 Reinforcing Bars

Reinforcing bars shall be grade 60 and shall conform to ASTM A615 or ASTM 617.

##### 2601.1.2.2: Deformed Bars

Deformation on deformed bars shall conform to ASTM A615, A616, or A617.

##### 2601.1.2.3 Bar and Rod Mats

Bar and rod mats shall conform to ASTM A184.

##### 2601.1.2.4 Wire

Wire shall be cold drawn and conform to ASTM A82.

##### 2601.1.2.5 Welded Wire Fabric

Welded wire fabric shall conform to ASTM A185.

#### ~~2601.1.3 Backer Rod~~

~~Backer rod shall be heat resistant to withstand the high temperature associated with hot sealants. When applicable, it shall be compatible with silicon based cold sealers. Backer rod shall be Carter-Waters Cera-Rod or approved equivalent.~~

#### 2601.1.4 Hot Joint Sealer

Koch 9001, Meadows 164 or approved equivalent shall be used in joints filled with a rubberized joint sealer. The sealer shall be placed according to the manufacturer's directions.

#### 2601.1.5 Cold Joint Sealer

Dow Corning 888 or approved equivalent silicon based material shall be used as a cold joint sealer. The sealer shall be placed according to the manufacturer's directions.

#### 2601.1.6 Transparent Membrane Compound

A transparent sealing solution that will form an impervious film within 30 minutes of application shall be applied at the manufacturer's prescribed rate.

The impervious film shall have a water retention efficiency index of at least 90 according to ASTM C156. The solution shall contain sufficient temporary coloring or dye so as to be visible on the surface of the concrete for at least four hours after application, and shall contain nothing chemically harmful to the concrete, or which will permanently discolor the surface. The Contractor may be required to submit certified test reports by an approved laboratory indicating compliance with these specifications by each lot or run of material from which shipment was made. Material shall be delivered to the job in original containers plainly marked with Manufacturer's name, trade name of material, and lot identification.

### **2601.2 CONCRETE MIX DESIGN**

The proportions of the concrete shall produce a mixture that will work readily into corners and angles of forms, and around reinforcement with placement methods used. Segregation of the materials in the mixture shall not be permitted nor shall collection of excess free water on the surface. The Contractor shall submit a mix design for approval by the City Engineer for each project. If ready-mix concrete is to be used, a mix design approved within the same calendar year as the project will be acceptable.

#### 2601.2.1 Concrete Strength

The mix design shall be for 4000 psi concrete at twenty-eight (28) days.

#### 2601.2.2 Aggregate

Aggregate used in concrete shall be composed of limestone and sand, or limestone, sand and gravel. The total aggregate gradation of the mix shall conform to the limits shown on the Aggregate Gradation Curve (Fig. 1). The Contractor shall be required to initially certify the aggregate quality, and total gradation of their mix, when it is obtained from a ready-mix company. Additional certification may be required periodically as the City Engineer deems necessary. Prior to operation, all batch plant concrete shall require the same aggregate certification from the Contractor as previously stated. This certification shall be required for each project on which the batch plant is used, and may be required periodically throughout larger projects, as the City Engineer deems necessary.

### 2601.2.3 Cement Content

A minimum of 550 pounds of cement shall be used per cubic yard of concrete. Up to 100 pounds of fly ash may be substituted, pound for pound, for cement.

### 2601.2.4 Water Cement Ratio

The water/cement ratio shall be less than .55 and shall be as low as possible while still maintaining adequate workability.

### 2601.2.5 Admixtures

Admixtures, if approved, shall be used according to the manufacturer's recommended proportions, adopted to suit field conditions, and only with written approval of the City Engineer.

### 2601.2.6 Air Content

Concrete shall be air-entrained according to ASTM C260. Air content shall be seven (7) percent, plus or minus one (1) percent.

### 2601.2.7 Slump

The slump of concrete at the time of placement shall not exceed three (3) inches as tested according ASTM C143. This shall not apply in special circumstances where a plasticizer has been approved for use.

## **2601.3 CONSTRUCTION**

### 2601.3.11 Subgrade Preparation

The subgrade shall be graded to the lines and elevations shown on the plans. Soil shall be stabilized, if required, and compacted in accordance with the EARTHWORK AND TRENCHING Section of these specifications. The subgrade shall be free of debris, standing water or ice prior to placing concrete.

### 2601.3.2 Forms

Forms shall be metal, except through curb returns at intersections, and on sidewalks. Wood forms will be allowed at these locations. All forms shall be sufficiently strong to support the loads resulting from construction without deflection in any direction. Furthermore, forms shall be set true to line and grade with all curves being smooth. Joints in the forms shall be locked rigidly in true alignment so as to prevent play or movement of the joint in any direction. Forms shall be cleaned and thoroughly oiled prior to placing concrete. Slipform paving machines are acceptable.

### 2601.3.3 Reinforcement

All reinforcement shall be accurately placed according to the plans, and adequately secured in position by metal, or other approved chairs, spacers, or ties. The contractor shall furnish shop drawings, lists, and bending diagrams where required.

#### 2601.3.4 Mixing

Ready mixed concrete shall be mixed and delivered in accordance with ASTM C-94, and shall be in compliance with all other requirements outlined herein. The Inspector shall be allowed to have free access to the mixing plant.

At the Contractor's option, the Contractor may provide one or more approved batch-type mixing plants. Batch plants shall be equipped with adequate facilities for accurate measurement and control of all materials and for readily changing proportions of the mix. They shall also be designed to permit all operations to be easily inspected at all times.

For job mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer. If mixer performance tests are not made, each batch of 1/2 cubic yard or less shall be mixed for at least one (1) minute after all materials are in the mixer. The mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

#### **2601.3.5 CURB**

Care shall be taken to finish the curb section true to line and grade. The curb shall conform to straightedge inspection procedures as does the surface of the finished pavement. The curb shall be straight on top, on the face, and into the gutter section when checked longitudinally. Any deviation from the straightedge of over 1/8 inch shall not be allowed. At the City Engineer's option, poorly constructed or finished curb which does not conform shall be removed and replaced at the Contractor's expense.

##### 2601.3.5.1 Curb Marking

During construction, and as a last step before curing, the Contractor shall be responsible for marking the face of the curb concerning water, sewer, and other underground services. An "S" shall be marked on the fresh face of the curb to indicate where a sewer service is immediately behind the curb. In the same manner, a "W" for water, "C" for conduit, and other markings as required, shall be placed as directed by the City Engineer. Letters shall be three (3) inches tall.

The Contractor is not responsible for locating services, but only for marking those which are evident from existing markers and those specified on the job by the City Engineer.

#### 2601.3.6 Placing and Finishing

##### 2601.3.6.1 Placing

Concrete shall be conveyed from the mixer to the final position in the forms as rapidly as practicable. Methods of conveying shall be used which insure prevention of segregation or loss of ingredients. Chutes shall be used only when necessary, and the slope of the chute shall be such that the concrete slides but does not flow. Tremies or elephant trunks shall be used where verticle drops are greater than five (5) feet.

The concrete shall be placed before the initial set occurs. In no event shall concrete be placed more than one (1) hour after the initial addition of water at the batching facility. Concrete shall be placed on a properly prepared subgrade. Do not place on mud, dry porous earth, rock, or

frozen surfaces. The concrete shall be worked into all corners and angles of the forms and around reinforcement and embedded areas in such a manner as to avoid segregation.

#### 2601.3.6.2 Consolidation

After placing, the concrete shall be mechanically vibrated, struck off, and screeded to such elevations that when finished, the surface of the pavement shall be at the elevations indicated on the drawings. All concrete shall be thoroughly consolidated, however care shall be taken not to excessively vibrate the concrete.

#### 2601.3.6.3 Floating

Immediately following the screed the pavement shall be floated with an approved hand or mechanical float. Each section floated shall overlap the one previously floated, by at least four (4) inches. Floating shall be done in conjunction with straightedging for a straight surface. At no time will water be added to concrete in place to facilitate finishing.

#### 2601.3.6.4 Straightedging

As soon as practicable, and in conjunction with floating operations, the slab surface shall be tested for trueness with a straightedge. For this purpose the Contractor shall furnish and use an accurate ten (10) foot straightedge. The straightedge shall be constructed in such a manner that it can be placed longitudinally on the slab at any location without disturbing the fresh concrete. Any depressions found shall immediately be filled with freshly mixed concrete, struck-off, consolidated, and refinished. The straightedge testing and refloating shall continue until the entire surface is found to be free from observable departures from the straightedge.

#### 2601.3.6.5 Surface Finish

When most of the water glaze or sheen has disappeared and just before the concrete becomes non-plastic the surface shall be finished by brooming or burlap drag. In either case the finish shall not have disfiguring marks.

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#### 2601.3.6.6 Edging

All edges shall be finished with a three-eighths (3/8) inch radius edger.

#### 2601.3.6.7 Surface Test

After the concrete has hardened, the surface of the pavement shall be tested with a straightedge as described in Section 1.3.6.4 of STREETS AND PARKING LOTS.

On Arterial and Collector Streets, all portions of the pavement which vary or depart from the testing edge of a ten (10) foot straightedge by more than three-sixteenths (3/16) of an inch shall be removed and replaced by the Contractor, unless otherwise directed by the City Engineer. Any area or section so removed shall not be less than ten (10) feet in length, and shall be removed and replaced at the Contractor's expense.

On Residential Streets, construction shall be performed in such a manner to provide a smooth riding surface. Although the surface of Residential streets will not routinely be straightedged, a maximum departure of one-quarter (1/4) of an inch on a ten (10) foot straightedge is recommended. If so directed by the City Engineer, sections of Residential Streets which do not provide smooth ride characteristics shall be removed and replaced at the Contractor's expense.

#### 2601.3.7 Joints

All joints shall be constructed to the dimensions and at the locations shown on the drawings, or as required by the City Engineer. Care shall be taken to insure compliance with straightedge requirements through the joint section. All joints shall be perpendicular to the surface of the pavement. Longitudinal joints shall be parallel to the centerline. Transverse joints shall be continuous from edge to edge of pavement, including curb. Edges of all joints, except sawed contraction joints, shall be finished with a three-eighths (3/8) inch edger unless otherwise approved by the City Engineer.

##### 2601.3.7.1 Transverse Construction Joints (Type T)

Transverse construction joints shall be placed whenever the placing of concrete is suspended for 30 minutes or more, and shall conform to the specifications as shown in the drawings. If practicable, transverse construction joints shall be placed at regular locations; however, transverse construction joints shall not be placed within eight (8) feet of the nearest joint. The header shall hold the surface of the edge true to grade and crown and straight from end to end.

##### 2601.3.7.2 Contraction Joints (Type C)

Contraction joints shall be constructed in conjunction with other joints at intervals of fifteen (15) feet, unless otherwise specified or required by the City Engineer. Contraction joints shall be either saw cut, dummy groove type, or an approved, premolded ribbon type, constructed at the locations and dimensions specified herein, or on the drawings. Joints shall be to a depth in the finished concrete equal to onequarter (1/4) of the full depth. Care shall be taken to ensure sawed joints are constructed before random cracking occurs, but after ravelling is no longer evident during sawing. If for any reason joint construction is delayed so long that the concrete has begun to crack, or the joint construction causes cracking to occur on unjointed concrete, the jointing procedure shall be stopped. If cracking is not too excessive, or damaging to the finished product, the cracks shall be sealed where possible. However, if in the judgement of the City Engineer, the cracks are excessive, or damaging to the finished product, the cracked areas shall be removed and replaced at the Contractor's expense.

##### 2601.3.7.3 Isolation Joints (Type 1)

Isolation joints shall be constructed at those locations where new pavement abuts an existing structure. Isolation joints shall be constructed straight from edge to edge, and fully sealed after construction. All pavement reinforcing shall terminate not less than three (3) inches from either side of the joint. One-half (1/2) inch premolded expansion material shall be installed in the joint from the bottom of the concrete to a point three-quarters (3/4) inch below the surface of the concrete. The remainder of the joint shall be filled with joint sealer to within one-quarter (1/4) inch of the surface.

#### 2601.3.7.4 Joint Sealing

The faces and bottom of all joints to be sealed shall be thoroughly cleaned by sandblasting, or by using a power wire brush. After cleaning, sand and dust shall be removed from the joints using oil-free compressed air, sweeping, brooming, re-sawing, and additional methods, as required by the City Engineer, to insure absolutely clean joints for sealing. The use of water to clean joints is prohibited, and all joints shall be dry before sealing. After the joint has been properly cleaned, backer rod shall be placed in the joint sealer reservoir to provide the proper dimensions for the joint sealer. The finished surface of the joint sealant shall be smooth and slightly, and shall be one-quarter (1/4) inch below the surface of the concrete. The Contractor shall exercise caution to prevent pouring any material on the exposed surfaces of the pavement adjacent to the joint. Any such material shall be removed immediately.

#### 2601.3.8 Curing

Transparent membrane curing compound shall be applied on all projects, regardless of season, to all concrete surfaces that are exposed to the air. The membrane shall be applied to the green concrete surface at the rate recommended by the manufacturer, immediately following the disappearance of water sheen. The purpose of the membrane is to prevent detrimental loss of water from the surface of the concrete for the full duration of the curing period. The surface shall be backspotted to obtain uniform distribution. Immediately after the forms are removed the entire area of the sides of the slabs shall be coated with curing compound at the rate specified for pavement.

When the ambient air temperature is at or below 40 degrees Fahrenheit, the Contractor shall protect the concrete from freezing using auxiliary covering. The concrete shall be protected until a strength of 3000 psi is achieved, or a maximum of seven days. Concrete damaged by improper curing shall be removed and replaced as directed by the City Engineer. This shall be done at the Contractor's expense.

### **2601.4 SAMPLING AND TESTING CONCRETE**

As work progresses, concrete shall be sampled in accordance with Method of Sampling Fresh Concrete ASTM C172. The Contractor shall correct job conditions if a determination is made by the City Engineer that a change is necessary.

#### 2601.4.1 Slump Test

The slump of concrete shall be tested by the Inspector according to ASTM C143; Method of Test for Slump of Portland Cement Concrete. The slump of the concrete at the time of placement shall not exceed three (3) inches.

#### 2601.4.2 Air Content Test

Air content of concrete may be tested by the Inspector according to ASTM C173. Air content shall be uniformly maintained, and shall not exceed seven (7) percent plus or minus one (1) percent.

### 2601.4.3 Compression Test

Compression test cylinders shall be made and cured according to ASTM C31. Compression tests shall be conducted at intervals of 150 cubic yards during concrete placement, or at least one test per day. The Contractor shall make no fewer than four (4) cylinders per test. The cylinders shall be made in the presence of the Inspector. Cylinders cured under job conditions may be required, when in the opinion of the City Engineer job conditions necessitate. Cylinders shall be tested according to ASTM C39. The testing shall be done by an approved laboratory, and shall be conducted at cure times of 24 hours, 7 days and 28 days. Results of the tests shall be sent directly to the City Engineer from the testing lab as soon as each test is complete. The fourth cylinder is a backup for any of the three required tests. If all three tests are conducted successfully the fourth cylinder need not be tested. The Contractor shall be responsible for providing all materials and labor needed to take the test cylinders, and shall be responsible for all costs associated with the making and testing of the cylinders.

### 2601.4.4 Core Test

Cores shall be required to verify the thickness of the pavement in place. The following table shows the number of cores required for a project based on the number of square yards of concrete to be poured:

Square Yards	N o. of Cores
0-1000	2
1001-2500	3
2501 -4000	4

For each additional 1000 square yards  
or fraction thereof, add 1 core.

The location of all cores shall be determined by the City Engineer. Additional cores may be required to determine the extent of any areas that are deficient in thickness or strength. The maximum diameter of a core shall be three (3) inches, and-core holes shall be filled with concrete or non- shrink grout. The Contractor shall be responsible for all costs associated with coring, including the costs incurred making deficiency determinations.

## **2602 ASPHALTIC CONCRETE STREETS**

The work covered under this section shall consist of furnishing all materials, equipment and labor for construction of combined curb and gutter and asphaltic concrete pavement. The work shall be performed in accordance with these specifications and in such a manner that completed items will conform to the lines, grades and elevations as shown on the plans.

All combined curb and gutter shall be constructed of concrete. No asphaltic curb and gutter will be accepted. All materials, methods of construction and curing for combined curb and gutter shall conform to the specifications outlined in the Concrete Street section of these specifications. Combined curb and gutter shall be subject to the same tests as concrete streets.

## **2602.11 MATERIALS**

All materials shall conform to the standard specifications for the State Road and Bridge Construction of the State Highway Commission of Kansas. The asphaltic cement for these mixtures shall be AC-5, and shall be mixed with the aggregate at the rate of five (5) percent, plus or minus two (2) percent, by dry weight of aggregate. The tack material shall be SS-1H, emulsified asphalt, and shall be applied at the approximate rate of one-tenth (0.1) gallon per square yard of surface.

## **2602.2 CONSTRUCTION**

Asphaltic Concrete Pavement shall be constructed as specified by the Standard Specifications for State Road and Bridge Construction of the State Highway Commission of Kansas. The base course shall be BM-2C or BM-2, and the surface course shall be BM-1.

### 2602.2.1 Subgrade Preparation

The subgrade shall be graded to the lines and elevations shown on the plans. Soil shall be stabilized, if required, and compacted in accordance with the EARTHWORK AND TRENCHING Section of these specifications. The subgrade shall be free of debris, standing water or ice prior to placing asphalt.

### 2602.2.2 Tack Requirements

Emulsified asphalt shall be applied to the subgrade for a tack coat unless the subgrade is free of loose fines. In that case no tack shall be required.

A tack coat shall also be applied between lifts if there has been sufficient time delay between the placing of lifts to cause surface oxidation, or there is sufficient accumulation of surface dirt to inhibit bonding between lifts.

A tack coat shall be applied to the vertical face of the toe of the gutter immediately prior to placing asphalt next to concrete curb and gutter. This is to insure a good bond between the concrete and the asphalt.

### 2602.2.3 Thickness of Lifts

The standard asphalt street thickness shall be eight and one-half (8 1/2) inches. The BM-2C shall be laid in two equal lifts which total seven and three-quarters (7 3/4) inches. The BM-1 shall be placed in one lift of three-quarters (3/4) of an inch. For projects requiring thicker pavement, the base course shall be adjusted accordingly, but at no time will lift thicknesses greater than four (4) inches be allowed.

## **2602.3 INSPECTION AND TESTING**

Prior to asphalt work, the Contractor shall submit to the City Engineer, asphalt test reports for each asphalt mix to be used on the project. This report shall include sieve analysis in accordance with Kansas Testing Method KT-1-80 and KT-2-80 and Marshall Test of Bituminous Mixtures in accordance with Kansas Testing Method KT-14-80. During production, the Contractor shall provide at least one sieve analysis and one Marshall Test for every 400 tons of material

produced, but no more than one for each production day. For each Marshall Test performed during production the Contractor shall also test the in-place density of the asphalt mixture utilizing either core drilled specimens or nuclear testing apparatus. in-place densities shall be tested in accordance with Kansas Test Method KT-15-80, and shall be 95% of the field mold density.

Cores shall be required, and shall be taken as outlined in Section 2601.4.4 of "PAVING"