SECTION 1400 - CONCRETE FLATWORK

1401 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct concrete pavement, curb, curb and gutter, concrete sidewalk, concrete driveway entrances, and exposed aggregate concrete work.

1402 MATERIALS.

A. Concrete. All construction covered in this section shall conform to the requirements of Section 2000 Concrete.

B. Reinforcing. Materials shall be as specified in Section 2000 Concrete or as indicated on the plans.

C. Isolation Joint Fillers. Isolation joint fillers shall be a preformed isolation joint filler of the non-extruding and resilient type conforming to ASTM D1751, D1752, or D7174.

D. Joint Sealing Compounds. Joint sealing compounds shall conform to the standards for the type of sealant specified as listed in the following table:

Joint Seals and Sealants	AASHTO	ASTM
Hot-poured, Polymeric Asphalt Based, Type II	M324	D6690
Preformed Polychloroprene Elastomeric		D2628
Lubricant for Installation of Preformed Seal	-------	D2835
Preformed Expansion Joint Filler	M213	D1751, D1752, or D7174

E. Curing Membrane. All material to be used or employed in curing concrete must be approved by the Engineer prior to its use. It shall be of the white pigmented liquid membrane type and shall conform to ASTM C309 or AASHTO M148, Type 2, Class A or B.

F. Detectable Warning Surface Material for Ramps. The surface material used to provide contrast shall be ADA-compliant and an integral part of the walking surface. The material for detectable warning surface shall consist of either tiles or panels. Surface applied retrofit tiles or panels shall not be allowed unless a sufficient anchoring system is utilized as determined and approved by the Engineer.

1. Tiles or Panels. Acceptable products include Detectable Warning System's E-Z-Set Ceramic Composite Detectable Warning Panels, Armor Tile's Cast In Place System, ADA Solution's Composite Paver, CASTinTACT Detectable Warning Panel, TufTile Surface-Applied

(Replaceable), TufTile Wet-Set (Replaceable), any KDOT prequalified ADA-compliant ramp panels, or approved equal.

2. Color for all surface options shall be the Federal Standard Color Code No. 20109 (Red Brown). Any color variation to meet contrast requirements must be approved by the Engineer.

G. Concrete Sealant. Material for sealing exposed aggregate concrete shall be W.R. Meadows' Decra-Seal or similar non-yellowing, acrylic-based sealing product.

H. Stamped and Colored Concrete. Unless otherwise specified or approved for stamped and colored sidewalks and crosswalks, "Running Bond Used Brick" shall be the pattern used for stamped concrete and "Prism P5860 Sable" or "Solomon 385 Bark" shall be the pigment color used for colored concrete. Unless otherwise specified or approved for stamped and colored medians, splitter islands, and mountable roundabout or traffic calming circle truck aprons, "Ashlar Cut Slate" shall be the pattern used for stamped concrete and "Prism P4110 Chestnut" or "Solomon pigment color matching Prism P4110 Chestnut" shall be the pigment color used for colored concrete. A clear cure and seal shall be applied per manufacturer's recommendations to finished stamped and colored concrete.

1403 CONSTRUCTION DETAILS. The concrete pavement shall be constructed to the configuration, lines and grades shown on the plans.

A. Grading and Subgrade Preparation. All excavation or embankment required shall be completed in accordance with Sections 1100 *Grading* and 1200 *Subgrade Preparation*.

B. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than one fourth (1/4) inch in horizontal and vertical alignment for each ten (10) feet in length. Forms may be wood or steel. No aluminum forms shall be allowed.

1. Size. Forms shall have a height equal to or greater than the prescribed edge thickness of the pavement slab unless otherwise approved by the Engineer.

2. Strength. Forms shall be of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment, which they may support.

3. Installation. Forms shall be set true to line and grade, supported through their length and, joined neatly in such a manner that the joints are free from movement in any direction.

4. Preparation. Forms shall be cleaned and lubricated with a release agent prior to each use and shall be so designed to permit their removal without damage to the new concrete.

5. Paving Machine. A slip-form paving machine may be used in lieu of forms. The machine shall be capable of placing the concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances as approved by the Engineer. The machine must be equipped with mechanical internal vibrators of the same type and size, mounted with a maximum spacing of 12 inches centers. Vibrators shall be mounted so that they enter the concrete in a vertical position under the influence of their own weight, with enough flexibility to work themselves around the reinforcing steel.

1404 JOINTS. Generally, joints shall be formed at right angles to the true alignment of the pavement and to the depths and configuration specified by the standard drawings or as modified by the plans and project specifications.

A. Isolation Joints. Isolation joints shall extend the entire width of the pavement and from the subgrade to the surface of the pavement or the material will have a suitable tear strip or removable cap provided to allow for the application of the joint sealer to the required depth. Under no circumstances shall any concrete be left across the isolation joint at any point.

1. Location. Isolation joints in pavement shall be placed at all locations where shown on the plans and standard details or as directed by the Engineer. Isolation joints in concrete sidewalks shall be placed adjacent to existing concrete structures, as indicated in the standard details, or as directed by the Engineer. Isolation joints in curbs and curb and gutter shall be placed at each end of curves, curb inlets, or other locations as indicated on the plans or as directed by the Engineer.

2. Material. Isolation joints shall be formed by a one-piece, preformed joint filler cut to the configuration of the correct section. For pavement, the filler shall be three fourths (3/4) inch thick. For sidewalk, curb and curb and gutter, the filler shall be one half (½) inch thick and extend for the full depth and width.

3. Stability. Isolation joints shall be secured in such a manner that they will not be disturbed during the placement, consolidation and finishing of the concrete.

4. Dowels. If isolation joints are to be equipped with dowels they shall be of the size and type specified, and shall be firmly supported in place by means of a dowel basket or other support method approved by the Engineer, which shall remain in place. The basket shall be installed in such a position that the center line of the joint assembly is perpendicular to the center line of the slab and the dowels lie parallel to the slab surface and parallel the center line of the slab. One half of each dowel shall be lightly painted or greased with a product approved by the Engineer.

B. Contraction Joints. Contraction joints shall be of the type and dimensions and at the spacing shown on the plans or standard drawings or as directed by the Engineer. Contraction joints shall be sawed to produce a controlled crack in the proper location unless other methods are approved by the Engineer.

1. Configuration. The standard contraction joint is a one eighth (1/8) inch wide joint to a depth of one third of the slab thickness plus one fourth inch (D/3 + ¼") unless otherwise indicated or specified.

2. Sawing and Sealing. Sawed contraction joints shall be cut as soon as the concrete has hardened sufficiently to prevent excessive tearing and raveling regardless of the time or weather. Joints shall be sawed and finished before conditions induce uncontrolled cracks. Material created by sawing shall be removed from the pavement surface before it has had time to dry or set. Sawed contraction joints shall be joint sealed. For 4 inch thick sidewalks only, contraction joints may be tooled rather than sawed. The edges of tooled joints shall be rounded with a one fourth (¼) inch radius. Contraction joints shall be sawed for any concrete pavement greater than 4 inches thick.

3. Spacing. The spacing for pavement shall be as shown on the plans or as directed by the Engineer. The spacing for joints in curb and curb and gutter shall be placed at maximum intervals of 10 feet except as specified for curb and gutter with concrete pavement which shall be located to coincide with contraction joints in concrete pavement and shall extend through the entire curb section from the top of curb to a depth of two (2) inches below pavement surface. Transverse joints in sidewalk shall be spaced at a distance equal to the width of the sidewalk.

C. Longitudinal and Construction Joints. Longitudinal joints or construction joints for pavement shall be placed as shown on the plans or where the Contractor's construction procedure may require them to be placed.

1. Center Joints. Longitudinal center joints shall be constructed using the methods specified in Section 1404B "Contraction Joints" or as specified for longitudinal construction joints as required.

2. Longitudinal Construction Joints. Longitudinal construction joints (joints between construction lanes) shall be constructed with tie-bars. Joint configuration shall conform to the dimensions shown on the plans or standard drawings.

3. Transverse Construction Joints. Transverse construction joints shall be constructed with tie-bars and placed wherever concrete placement is suspended for such a time that the concrete has begun to take its initial set.

4. Tie-bars. Tie-bars shall be of deformed steel of the dimensions specified by the plans or standard drawings. Tie-bars shall be installed at the specified spacing, placed according to a method approved by the Engineer, and be firmly secured so as not to be disturbed by the construction procedure. Tie-bars shall either be inserted into plastic state concrete or drilled and epoxied into a construction joint. Tie-bars shall be epoxy-coated, and free from dirt, oil, paint, grease, loose mill scale, and thick rust, which could impair bond of the tie-bar with the concrete.

5. Sawing and Sealing. If sawed, construction joints shall be joint sealed.

1405 CONCRETE CURB. Concrete curb will be constructed as shown on the plans unless otherwise approved by the Engineer. Curb may be either integral with or separate from concrete pavement. Concrete in curbs and gutter shall be vibrated. If curbs are hand-poured, a strap shall be used for shaping. All excess material below, in front of, or behind forms shall be removed before the concrete hardens.

A. Integral curb. Integral curb shall be constructed during or immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag behind the pavement construction and form a "cold joint."

Curb forms or integral slipforming shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections or as otherwise approved by the Engineer.

In placing curb concrete, sufficient spading shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a float not less than four (4) feet in length.

The finished surface of the curb and gutter shall be checked by the use of a ten (10) foot straightedge and corrected if necessary. Where grades are less than one percent (1%) and while the concrete is still plastic, the drainage of the gutter should be checked with a four (4) foot level to ensure positive drainage is provided.

B. Separate Curb and Gutter with Tie-bars for Concrete Pavement. Separate curb and gutter may be poured prior to the remaining pavement. Tie-bars shall be epoxy-coated and cast in the curb and gutter as shown on the standard details. Tie-bars may be placed in drilled holes after the curb is placed as long as the required embedment length can be obtained and the bars are epoxied in place.

C. Separate Curb and Gutter for Asphaltic Pavements. Contraction joints shall be spaced no more than 10 feet apart and shall extend through the entire curb section from the top of curb to a depth of two (2) inches below pavement surface. Contraction joints shall be sawed.

1406 PLACING, FINISHING, CURING, AND PROTECTION. Concrete shall be furnished in quantities required for immediate use and shall be placed in accordance with the requirements of Section 2000-*Concrete* and as specified herein.

A. Placement. Prior to placement of the concrete pavement, all debris and foreign material shall be removed from the inner surfaces of the forms and all forms and subgrade properly moistened. All required reinforcement shall be properly and firmly set into position to preclude movement during placement of the concrete.

The concrete shall be deposited over the entire width of the prepared subgrade between the forms in such a manner to prevent segregation and to require as little rehandling as possible. The pour shall be made to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. Concrete shall be thoroughly vibrated. Attachments on finishing machines to vibrate the concrete will be permitted provided satisfactory results are attained. Care shall be taken that the vibrator does not penetrate the subgrade or dislodge or move the joints. The vibrating shall be sufficient to produce a smooth pavement. Under no

circumstances shall the vibrator be used to move concrete. Honeycomb in the edge may be cause for rejection of the pavement.

When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete. Internal mechanical vibration shall be used along all formed surfaces.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade, alignment, and cross slope. All utility appurtenances shall be boxed out or otherwise isolated using isolation joint material as indicated or as directed by the Engineer. Concrete shall not be allowed to extrude below the forms.

B. Finishing

1. Pavement. The pavement shall be finished to the elevations as shown on the drawings by either mechanical or hand-finishing methods.

   Do not apply moisture (water, finishing aids, etc.) to the surface of the concrete pavement. The concrete should be provided with proper consistency and workability to place, strike off, consolidate, finish and texture without the addition of moisture. Only in the event of exceptional and unusual circumstances may the Engineer consider allowing a fine, fog mist to be added to the air above the concrete.

   a. Floating. All surfaces shall be consolidated and floated after strike-off, within 15 minutes of initial concrete placement, and prior to final surface finish. Use of a “fresno” steel trowel/ float (or walking trowel) will not be allowed for floating concrete pavement.

   b. Final Surface Finish. A burlap drag or a broom finish shall be used as the final finishing method. When a drag is used it shall be at least three (3’) feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged in the direction in which the pavement is being laid. When broom finishing, a hard bristle broom shall be used. The broom shall be kept clean and used in such a manner as to provide a uniform textured surface.

      The final surface of the concrete pavement shall have a uniform gritty texture free from excessive harshness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

2. Curb, Curb and Gutter. In all cases the resulting surface shall be smooth and of uniform color with all rough spots, projections, and form stakes removed. No plastering of the concrete will be allowed on exposed surfaces. The finished curb shall have a true surface, free from sags, twists, or warps, and shall have a uniform appearance, and shall be true to the specified lines, grades, and configurations shown on the drawings. Curbs and gutter shall be broom finished with brush strokes parallel to the back of curb.

3. Sidewalk, Shared Use Path, and Driveway Entrances. After the concrete has been thoroughly consolidated and leveled, and the initial set has taken place, the surface shall be finished with a float and then broom finished with no other mortar than that contained in the placed concrete. The resulting surface shall be uniform in color and contain no imperfections. The edges shall be tooled with a one fourth (¼) inch radius. Special care shall be taken to ensure a straight, neat appearance along the edges of the sidewalk or driveway entrance and at the joints. Any concrete pavement greater than 4 inches thick shall be vibrated for consolidation.

4. Surface Tolerances. Finished sidewalks, drives, and multi-use paths shall have a surface tolerance of one-fourth (1/4) inch in 10 feet when checked with a 10-ft straightedge. Vertical deflections at sidewalk joints shall not exceed one-fourth (1/4) inch. All surfaces must drain and no low spots, which allow water to pond, shall be left in the finished surface.

   When surface tolerances are not met, use one of the following methods for corrections:
   - Grinding
   - Remove and replace the entire section as directed by the Engineer
   - Other methods proposed by the Contractor as approved by the Engineer.

   The corrected areas shall have uniform texture and appearance.

C. Curing. Curing shall conform to the requirements set forth in Section 2000 – *Concrete.*

D. Protection. The Contractor shall, at their own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the city.

All vehicular traffic, including construction vehicles, shall be prohibited from using the new concrete pavement for a period of seven (7) days unless approved otherwise by the Engineer.

When approved or designated for use, high strength gain concrete (KCMMB 5K mix or a high early strength type mix approved by the Engineer) may be opened to vehicular traffic after ninety-six (96) hours. If a Contractor wishes to open the concrete pavement to traffic earlier than ninety-six (96) hours, material test results indicating the concrete has reached a minimum compressive strength of 3,500 psi or a minimum flexural strength of 450 psi must be provided.

Concrete work, which is damaged or defaced, shall be removed and replaced, or repaired, to the satisfaction of the Engineer. All costs for replacement or repairs shall be the responsibility of the Contractor.

Pavement that develops uncontrolled or undesirable cracks shall be removed and replaced at the Contractor's expense. If approved by the Engineer, the Contractor may be allowed to make repairs to cracked pavement and/or a reduction in payment for the concrete pavement will be negotiated. All damaged sections to be removed shall be sawed a minimum of three (3) feet from a joint or removed to the nearest joint.

E. Temperature Limitation. Concrete work shall proceed in accordance with the requirements established in Section 2000-*Concrete*.

1407 BACKFILL. A minimum of twenty-four (24) hours shall elapse before pavement forms are removed and a minimum of five (5) days shall elapse before pavement shall be backfilled unless otherwise approved by the Engineer.

1408 JOINT SEALING. All sawed joints in pavement shall be sealed with an approved joint sealer applied in accordance with the manufacturer's recommendations. The joints shall be sealed after seven (7) days following placement of the concrete and prior to the opening of the pavement to traffic.

1409 CLEANUP. The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of the construction.

1410 SURFACE TOLERANCES AND PROFILOGRAPHING. Concrete pavement with a design speed less than 35 mph shall have a surface tolerance in all directions of one fourth (1/4) inch in ten (10) feet when checked with a ten (10) foot straightedge. Pavement surface must drain when complete. No low areas, which allow water to pond, shall be left on

the surface. For new construction and reconstruction only, concrete pavement with a design speed greater than or equal to 35 mph shall be profilographed at the Contractor's expense in accordance with KDOT specifications and test methods. The Contractor shall provide profilograph reports to the Engineer. No pay adjustments (incentive or disincentive) shall be made to the smoothness or pavement items based on the results of the profilograph testing.

When surface tolerances are not met, the Contractor shall use one of the following methods for corrections at the contractor's expense including traffic control:

- Diamond grinding
- Remove and replace the entire pavement thickness
- Other methods proposed by the Contractor as approved by the Engineer.

The corrected areas shall have uniform texture and appearance.

1411 THICKNESS TOLERANCES. It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the plans. The thickness of the pavement may be measured by coring. If any pavement is found deficient in thickness, it may be compensated for at an adjusted unit price or shall be removed and replaced. In removing pavement, it shall be removed from the outside edge of the curb and gutter (curb and gutter with tie-bars may remain if in good condition) to a longitudinal joint and on each side of the deficient measurement until no portion of the exposed cross sections are more than two tenths (2/10) inch deficient.

1412 DETECTABLE WARNINGS IN SIDEWALK OR RAMPS. Detectable warnings shall extend across the full width of the walking surface of the sidewalk or ramp, and shall be 2 feet long in the direction of pedestrian travel. Detectable warning materials shall be installed in accordance with manufacturer's recommendations.

1413 EXPOSED AGGREGATE CONCRETE. Place as specified in Section 2000 Concrete and as follows:

After the mixture has been properly struck off, to the line and grade as shown on the plans or as directed by the Engineer, the surface shall be lightly finished as not to force the coarse aggregate too deep into the mix. As soon as the bleed water has dissipated apply a uniform coating of an approved surface retarder at the rate specified by the manufacturer. Once sufficient cure has been attained on the concrete the Contractor shall pressure wash and or broom surface exposing the coarse aggregate to the desired effect.

Once the concrete surface has sufficiently dried so that surface water has completely disappeared, an approved clear sealant shall be applied in accordance with the manufacturer's recommendations. Sealant shall be applied by rolling or by an approved sprayer and nozzle.

When the concrete has hardened enough so that excess raveling or spalling will not occur, and before random cracking occurs, the Contractor shall saw one-eighth (1/8) to one-fourth (1/4) inch wide relief joints to a depth equal to one-third the pavement thickness plus one-fourth inch (D/3 + ¼"). The contractor has the option to add an additional cut ¼" to 3/8" by ¼" to 3/8" to assist with joint sealant application. Joints shall be located as shown on the plans or as directed by the Engineer. For raised islands care should be taken to joint the exposed aggregate concrete to match the curb and gutter joints. Joints shall be sealed with a gray or beige silicone or polyurethane caulk approved by the Engineer.