# CITY OF ABILENE

# ITEM 360

# CONCRETE PAVEMENT

## 360.1. DESCRIPTION.

This item shall govern for the construction of Portland Cement Concrete pavement with or without monolithic curbs on a prepared subgrade or sub-base course, in accordance with the typical sections shown on the Plans, the lines and grades established by the Engineer and the requirements herein.

## 360.2. PAVING CONSTRUCTION PLAN.

The Contractor shall submit a paving construction plan for approval by the Engineer prior to beginning pavement construction operations. The plan shall contain the mix design, methods of construction, description of equipment to be used in mixing, placing, finishing, curing, and miscellaneous materials.

## 360.3. MATERIALS.

Unless otherwise shown on the Plans or required herein, all materials shall conform to the requirements of the pertinent Items of City of Abilene Standard Specifications for Construction as follows:

Item 300, "Asphalts, Oils, and Emulsions"
Item 420, "Concrete Structures"
Item 421, "Portland Cement Concrete"
Item 433, "Joint Sealants and Fillers"
Item 437, "Concrete Admixtures"
Item 440, "Reinforcing Steel"
TxDOT Item 526, "Membrane Curing"

except for the following:

**(1) Portland Cement Concrete.** Classification and mix design shall conform to Class "P" Portland Cement Concrete as defined in Item 421, "Portland Cement Concrete", unless otherwise shown on the Plans.

**(2) Joint Sealants and Fillers.** These materials shall be of the size, shape and type shown on the Plans.

Unless otherwise shown on the Plans, the joint sealant materials to be used shall be self-leveling silicone pavement sealant as manufactured by Dow Corning or approved equal.

**(3) Dowels for Expansion and Contraction Joints.** Dowels shall be smooth, straight steel dowels of the size and type shown on the Plans and shall conform to the requirements of ASTM A615, Grade 60. The free end of dowels shall be smooth and free of burrs.

Unless otherwise shown on the Plans, the entire length of each dowel shall be coated with hot applied asphalt cement. Cutback asphalt and emulsions shall not be used.

Unless otherwise shown on the Plans, the asphalt-coated end of each dowel to be used in an expansion joint shall be encased in an approved cap. The cap shall be of such strength, durability and design as to provide free movement of the dowels and shall be approved by the Engineer prior to use.

**(4) Positioning and Support Devices for Reinforcement and Joint Assemblies.** These devices shall be of sufficient structural quality to prevent movement of the dowels or steel reinforcement during concrete placement and finishing. The devices shall be a type approved by the Engineer.

Positioning and supporting devices (chairs) for steel reinforcement bars shall be either plastic or metal and of sufficient number to maintain the position of the bars within the allowable tolerances.

**(5) Reinforcing Steel.** ASTM A616 Grade 60 will be permitted for straight bars only. Reinforcing steel that requires bending shall be ASTM 615 Grade 40 with the spacing reduced to two thirds (2/3) of that shown for Grade 60 reinforcing steel. When shown on the Plans, corrosion protection shall be applied to dowels and tie bars.

**(a) Tie Bars.** Tie bars at weakened plane longitudinal joints shall be straight reinforcing bars. Tie bars at longitudinal construction joints shall be either multiple piece tie bars or straight reinforcing bars, when equipment or conditions permit.

**(b) Multiple Piece Tie Bars.** Multiple piece tie bars (threaded coupling or other adequate devices) shall develop a tensile strength over their entire length equal to 1-1/4 times the yield strength of the tie bars shown. Each end of multiple piece tie bars shall consist of deformed reinforcement of at least the size shown on the Plans, conforming to City of Abilene Item 440, "Reinforcing Steel".

## 360.4. EQUIPMENT.

**(1) General.** All equipment shall be maintained in good condition and approved by the Engineer before the Contractor will be permitted to begin construction of the pavement. Weighing, measuring equipment and mixer at Portland Cement Concrete Plant, hauling equipment, agitator trucks, grade control equipment, shall conform to the requirements set forth in applicable City of Abilene Specifications relative to production and installation of Portland Cement Concrete Pavement.

**(2) Forms.**

**(a) Side Forms.** Side forms shall be of metal except as otherwise provided herein and shall be of approved cross section. The length of form sections shall not be less than ten (10) feet, and each section shall provide for staking in position with not less than three (3) pins. Forms shall be of ample strength and shall be provided with adequate devices to secure them in place so the forms will withstand, without visible springing or settlement, the impact and vibration of the spreading and finishing machinery. In no case shall the base of the form be less than eight (8) inches wide for a form depth of eight (8) inches or more in height. The forms shall be free from warps, bends or kinks, and shall be sufficiently true to provide a reasonably straight edge on the concrete.

Flexible or curved forms of wood or metal of proper radius shall be used for curves of 100-foot radius or less.

**(b) Curb Forms.** Outside curb forms shall be of wood or metal of a section satisfactory to the Engineer, straight, free of warp, and shall be of a depth at least equal to the depth of the curb. They shall be securely mounted on the paving forms and maintained in true position during the placing of the concrete. Inside curb forms, if required, shall be of approved material and of such design as to provide the curb required and shall be rigidly attached to the outside curbs forms.

**(3) Equipment** for Spreading, Consolidating, Finishing Surface Texturing Concrete. Shall conform to the requirements set forth in City of Abilene Item 360, "Concrete Pavement".

## 360.5. QUALITY OF CONCRETE.

The quality of concrete shall be in accordance with Item 421, "Portland Cement Concrete".

## 360.6. SUBGRADE.

**(1) Preparation of Subgrade or Subbase.** The concrete pavement shall be constructed on prepared subgrade. When Slip Form equipment is used, a firm subgrade or subbase (stabilized or unstabilized) shall be maintained outside the limits of the pavement for the support of the Slip Form equipment. Refer to Item 200, "Subgrade Preparation" for additional information.

## 360.7. PLACEMENT OF REINFORCING STEEL AND JOINT ASSEMBLIES.

All reinforcing steel, including steel wire fabric reinforcement, tie bars, dowel bars, and load transmission devices shall be accurately placed and secured in position in accordance with Item 440, "Reinforcing Steel", and additional requirements set forth in Item 360, "Concrete Pavement".

## 360.8. CONCRETE MIXING AND PLACING.

**(1) Mixing.** Concrete mixing shall be in conformance with Items 421, "Portland Cement Concrete", and TxDOT Item 522, "Portland Cement Concrete Plants".

**(2) Workability of Concrete.** The concrete shall be workable, cohesive, possess satisfactory finishing qualities, and have a consistency conforming to the specified slump requirements. If detrimental bleeding occurs and this condition cannot be corrected by reasonable re-proportioning of the ingredients, the bleeding shall be immediately corrected by one or more of the following listed measures:

Redesign of the batch.
Addition of mineral filler to fine aggregate.
Increase of cement content.
Use of appropriate approved admixture.

When, in the opinion of the Engineer, excessive bleeding occurs and corrective actions do not satisfactorily reduce bleeding, concrete placement operations shall cease until the concrete mixture has been redesigned.

When the method of transporting concrete produces excessive segregation and/or bleed water on the surface of the concrete, the method used shall be discontinued and a satisfactory method shall be provided. Such segregated concrete will be subject to rejection as directed by the Engineer.

**(3) Placing.** Unless otherwise shown on the Plans, the concrete shall be placed using either forms or a slipform paver. Any concrete not placed as herein prescribed within the time limits specified will be rejected.

The Contractor shall provide a system satisfactory to the Engineer for determining that concrete delivered to the site meets the specified requirements for mixing and time of placing as outlined under Item 360, "Concrete Pavement".

The concrete shall be placed as near as possible to its final location and in such manner as to minimize segregation and re-handling. Where hand spreading is necessary, concrete shall be distributed to the required depth by use of shovels. The use of rakes will not be permitted. Concrete shall be placed, consolidated and finished to conform to the required section and grade.

**(a) Double Strike-Off Method.** Unless otherwise shown on the Plans, when concrete placement is accomplished in two (2) lifts (double strike-off method) to allow placing the reinforcement after the first lift, the first lift shall be uniformly spread and/or struck off so that the final position of the longitudinal steel will be within one half (1/2) inch of the position shown on the Plans. The second lift shall be placed as soon as reinforcing steel is in place and prior to

initial set of the first lift. The second lift shall not be placed later than 20 minutes after strike-off of the first lift.

**(b) Placing Curbs.** Where curbs are placed monolithically concrete for monolithic curbs shall be the same as for the pavement and must be placed while the pavement concrete is still plastic.

Where curbs are placed separately, they shall be placed in conformance with TxDOT Item 410, "Concrete Curb, and Gutter, Valley Gutter, Alley Apron, Driveways and Sidewalks".

**(4) Consolidation.** All concrete placed for pavement shall be consolidated by approved mechanical vibrators operated ahead of the finishing machine. Unless otherwise shown on the Plans, pan type vibrators shall be used for double lift placement of concrete and the immersion type vibrators shall be used for full-depth placement, unless otherwise approved by the Engineer. Vibratory equipment shall extend across the pavement, but shall not come in contact with the side forms. Mechanically operated vibrators shall be mounted and operated in such manner as not to interfere with the transverse or longitudinal joints. Hand operated vibrators shall be used to consolidate concrete in areas not accessible to the machine mounted vibrators.

## 360.9. JOINTS.

**(1) General.** All transverse and longitudinal joints, when required in the pavement, shall be of the type or alternate type shown on the Plans and shall be constructed at the required location and alignment, in relationship to the tie bars and joint assemblies, and in accordance with details shown on the Plans. Stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and horizontal position.

Careful workmanship shall be exercised in the construction of all joints to insure that the concrete sections are completely separated by an open joint or by the joint materials and to insure that the joints will be true to the required section. Joints shall be cleaned and sealed in accordance with Item 438, "Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete)". The sequence of construction of joints if deemed necessary shall be approved by the Engineer.

Excessive spalling of the joint groove shall be repaired to the satisfaction of the Engineer prior to the installation of the sealant.

When sawed joints are used, they shall be sawed to the depth as shown on the Plans as soon as sawing can be accomplished without damage to the pavement. Once sawing has commenced it shall be continued until completed and all such sawing must be completed within 12 hours of placement. Sawing must be accomplished even in rain and cold weather. Should the sawing for any day's placement fail to be completed within 12 hours, the following concrete placement shall be limited to the amount that was sawed on time. This limitation shall continue until the sawing crew demonstrates it can handle a larger volume of sawing. If marring of the surface occurs, the Engineer may extend the 12-hour limit.

The Contractor shall keep a standby power driven concrete saw on the project at all times when concrete operations are under way.

When membrane curing is used, the part of the seal, which has been disturbed by sawing operations, shall be re-sprayed by the Contractor with additional curing compound.

**(2) Expansion Joints.** Transverse expansion joints shall be constructed in accordance with the details shown on the Plans. After the finishing machine and before the carpet drag and tining machines have passed over the joint the Contractor shall inspect the joint filler for correctness of position. The Contractor shall make any required adjustment in position of the filler and shall install the joint seal space form in accordance with the Plans. The concrete faces of the joint seal space shall be left true to line and section throughout the entire length of the joint.

**(3) Weakened Plane Joints.** Weakened plane joints shall consist of transverse contraction joints and longitudinal joints. Unless otherwise shown on the Plans, the transverse joints shall be formed or sawed perpendicular to the centerline and surface of the pavement.

The joints shall be constructed in the sequence of operations, as shown on the Plans.

Chalk line, string line, sawing template or other approved methods shall be used to provide a true joint alignment.

**(4) Transverse Construction Joints.**

When the placing of concrete is stopped, a bulkhead of sufficient cross sectional area to prevent deflection, accurately notched to receive the load transmission devices and shaped accurately to the cross section of the pavement shall be provided.

Intentional stoppage of the placing of concrete shall be either at an expansion joint or at a weakened plane joint, when load transmission devices are shown on the Plans. When the design for load transmission does not include dowels, intentional stoppage shall be in the middle of a slab.

When an unintended stoppage of the placing of concrete occurs, the Contractor shall immediately place the available concrete to a line and install the above described bulkhead at right angles to the centerline of the pavement, perpendicular to the surface and at the required elevation. Concrete shall be placed and finished to this bulkhead. Any concrete remaining on the subgrade ahead shall be removed and disposed of as directed by the Engineer. When placement of concrete is resumed before the concrete has set to the extent that the concrete will stand on removal of the bulkhead, the new concrete shall be consolidated with the first. The edge created by construction joints of this type shall have a joint seal space and shall be sealed as required for contraction joints.

At transverse construction joints in continuously reinforced concrete pavement, the reinforcement or load transmission device immediately beyond the joint will be protected against vibration or impact by the Contractor until paving resumes.

**(5) Longitudinal Construction Joints.** Longitudinal construction joints shall be of the type and at the locations shown on the Plans.

**(6) Joint Filler Boards.** Joint filler boards shall be of the size, shape and type as shown on the Plans. Boards shall be anchored by appropriate methods against their displacement while placing concrete.

**(7) Curb Joints.** Joints in the curb shall be provided and shall be of the same type and location as the adjacent pavement. The expansion joint material shall be of the same thickness, type and quality as specified for the pavement. All expansion joints shall be carried through the curb.

When transverse sawed joints are provided for the pavement, the curb placement shall be delayed until all transverse joints in the pavement have been sawed. Dowel bars shall be placed as shown on the Plans while the pavement concrete is still plastic, unless otherwise approved by the Engineer. The weakened plane joint in the monolithic curbs may be formed or sawed.

## 360.10 SPREADING AND FINISHING.

**(1) Machine-Finishing.** All concrete pavement shall be finished with approved self-propelled machines.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When field conditions require additional moisture for the final

concrete surface finishing operation, the water shall be applied to the surface by a fine, light fog mist and the amount of water added shall be held to a minimum.

When required by the Engineer, the Contractor shall perform sufficient checks with a long handled ten (10) foot straightedge on the plastic concrete to insure that the final surface will be within the tolerances specified below. The check shall be made with the straightedge parallel to the centerline. Each pass thereof shall lap half of the preceding pass. All high spots shall be removed and all depressions over 1/16-inch in depth shall be filled with fresh concrete and floated. The checking and floating shall be continued until the surface is true to grade and free of depressions, high spots, voids and rough spots.

Final finish shall consist of a combination of a carpet drag and metal tine finish, unless otherwise shown on the Plans. Final finish shall be completed before the concrete has attained its initial set.

The final finish shall be accomplished by first drawing the specified carpet drag longitudinally along the pavement. The actual contact surface shall be regulated so that a coarse texture satisfactory to the Engineer is obtained.

Immediately following the carpet drag, the pavement surface shall be given a transverse metal-tine finish. The metal-tine device shall be operated to obtain randomly spaced grooves approximately 3/16-inch deep, with minimum depth of 1/8-inch and approximately .083 inch wide. Successive passes of the tines shall not overlap a previous pass. Manual methods for achieving similar results may be used on ramps and other irregular sections of pavement.

After completion of texturing, the edge of the slab and joints shall be carefully finished as directed by the Engineer.

**(2) Hand Finishing.** Hand finishing if permitted shall conform to the requirements specified herein.

When hand finishing is permitted, the concrete shall be struck off with an approved strike-off screed to such elevation that, when consolidated and finished, the surface of the pavement shall conform to the required section and grade.

The pavement shall be straightedged prior to final finishing. Other operations and surface tests shall be as required for machine finishing.

## 360.11. CURING.

**(1) General.** All concrete pavement shall be cured for a period of not less than 72 hours from the beginning of curing operations. All exposed surfaces, including vertical surfaces of the placed concrete, shall be cured immediately after finishing operations have been completed, in accordance with the requirements specified herein.

Failure to maintain adequate curing shall be cause for immediate suspension of concreting operations.

The applied curing material may be removed as necessary to saw joints or to comply with the requirements for any surface test. The hardened concrete surface shall be maintained wet with a water spray, if required, and the curing material replaced immediately after completion of sawing, testing and any required surface correction.

**(2) Polyethylene Film Curing.** After the final finish and the concrete surface has attained initial set, the concrete surface shall be wetted with water, applied in the form of a fine spray and covered with the polyethylene film so placed and weighted as to remain in direct contact with the surface. The polyethylene film blanket shall be maintained in place continuously for not less than the specified curing period.

All joints shall be sealed in a manner acceptable to the Engineer to provide a moisture-proof lap.

The polyethylene film blankets shall be adequately weighted to prevent displacement or billowing due to wind and the film folded down over the side of the pavement shall be secured by a continuous bank of earth or other approved material. Plowing of this windrow into place will not be permitted. Use of polyethylene film holes and cuts are not acceptable.

**(3) Membrane Curing.** After final finish and immediately after the free surface moisture has disappeared, the concrete surface shall be sprayed uniformly with a curing compound in accordance with the requirements set forth in TxDOT Item 526, "Membrane Curing".

Special care shall be taken to insure that the sides of the tining grooves are coated with the curing compound.

## 360.12. PROTECTION OF PAVEMENT AND OPENING TO TRAFFIC.

The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least four (4) days old. This period of closure to all traffic may be extended if in the opinion of the Engineer, weather or other conditions may require an extension of the time of protection. When Type II cement is used one (1) additional day shall be required for a total of five (5) days.

At the end of this period the pavement may be opened for use by vehicles of the Contractor provided the gross weight (vehicle plus load) of such vehicles and/or equipment does not exceed 14,000 pounds. Such opening, however, shall in no manner relieve the Contractor from his responsibility for overall safety of the traffic and the general public.

On those sections of the pavement to be opened to traffic, all joints shall first be sealed and the pavement cleaned. Unless otherwise shown on the Plans, stable material shall be placed against the pavement edges before permitting vehicles thereon.

After the concrete in any section of pavement is seven (7) days old, such section of pavement may be opened to all traffic as directed by the Engineer. When Type II cement is used one (1) additional day shall be required for a total of eight (8) days. For those sections of the pavement to be opened to traffic, all joints shall first be sealed, the pavement cleaned, stable material placed against the pavement edges unless otherwise shown on the Plans and all other work performed as required for the safety of traffic. Such opening, however, shall in no manner relieve the Contractor from his responsibility for overall safety of the traffic and the general public.

## 360.13. MEASUREMENT.

This Item will be measured by one of the following methods:

**(1) Measurement by the Square Yard.** When provided under this item, concrete pavement will be measured by the square yard of surface area of completed and accepted work. When concrete pavement is to be measured by the square yard and monolithic curb is required, monolithic curb will be considered as part of pavement. Surface area of the pavement will be computed by measuring dimensions to the back of monolithic curb.

If curb and gutter is poured separately, it shall be measured and paid in accordance with Item 529, "Concrete Curb, Gutter, and combined Curb and Gutter". Gutter, Alley Apron, Driveways, and Sidewalks and will not be included in the area of concrete pavement.

**(2) Measurement by the Cubic Yard.** When provided by this Item, concrete pavement, including monolithic curb when required, will be measured by the cubic yard computed on the basis of design depth of concrete pavement shown on the Plans.

## 360.14. PAYMENT.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for this Item. This price shall be full compensation for furnishing concrete; for placing and adjusting forms; for furnishing and installing all reinforcing steel; for furnishing all materials for sealing joints and placing longitudinal, expansion and weakened-plane joints, including all steel dowel caps and load transmission devices required; for mixing, placing, finishing, curing and sawing concrete; for cleaning and sealing concrete joints; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.