

**Subsection 4.13
Concrete Pavement**

I. Scope: Construct hydraulic cement concrete pavement with or without curbs on the concrete pavement.

II. Materials

A. General: Provide hydraulic cement concrete in accordance with Subsection 4.07 "Concrete,"

B. Steel Reinforcement: Provide deformed steel for bar reinforcement in accordance with Subsection 4.12 "Reinforcing Steel."

1. Dowels. Provide smooth straight dowels of the size shown on the plans, free of burrs and conforming to Subsection 4.12 "Reinforcing Steel." Coat dowels with a thin film of grease, wax, silicone or other approved de-bonding material. Provide dowel caps on the lubricated end of each dowel bar used in an expansion joint. Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of the expansion joint.

2. Tie Bars: Provide straight deformed steel tie bars. Provide either multiple-piece tie bars or single-piece tie bars as shown on the plans. Furnish multiple piece tie bars in accordance with Subsection 4.12 "Reinforcing Steel."

3. Supports: Chairs for holding tie rods, bars, and other structural members in correct position while the concrete is being placed shall be made of material approved by the Engineer prior to use.

C. Curing Materials: Provide Type 2 membrane curing compound conforming to DMS-4650, Hydraulic Cement Curing Materials and Evaporation Retardants." Provide insulating blankets for curing fast track concrete pavement with a minimum thermal resistance (R) rating of 0.5 hour-square foot F/BTU. Use insulating blankets that are free from tears and are in good condition.

D. Epoxy: Provide Type III, Class C epoxy in accordance with DMS-6100, "Epoxies and Adhesives," for installing all drilled-in reinforcing steel. Submit a work plan and request approval for the use of epoxy types other than Type III, Class C.

E. Evaporation Retardant: Provide evaporation retardant conforming to DMS-4650, Hydraulic Cement Curing Materials and Evaporation Retardants."

F. Joint Sealants and Fillers: Provide Class 5 or Class 8 joint sealant materials and fillers unless otherwise shown in the plans in accordance with DMS-6310, "Joint Sealants and Fillers."

G. Water: Water usage shall conform to Subsection 3.04 "Requirements for Water Usage."

III. Equipment

Furnish and maintain all equipment in good condition. Use measuring, mixing, delivery equipment conforming to the requirements of Subsection 4.07 "Concrete."

A. Placing, Consolidating, and Finishing Equipment: Provide approved equipment that uniformly distributes the concrete with minimal segregation and provides consolidated concrete pavement with a smooth finish conforming to lines and grade. Provide approved finishing floats capable of producing a uniformly smooth pavement. Provide equipment that is capable of applying a fine, light water fog mist.

B. Forming Equipment: Provide vibrators capable of adequately consolidating the concrete over the entire width and depth of the pavement and in accordance with the manufacturer's recommendations. **Forming Equipment:** Provide metal forms of sufficient cross-section, strength, and rigidity to resist bowing or failure during placement. Provide 3 stakes per 10 foot form. Use forms that are free from detrimental kinks, bends, or warps that could affect ride quality or alignment. Provide flexible or curved metal or wood forms for curves less than 100-foot radius or less. Inside forms for the curb shall be of approved material and shall be of such design as to provide the curb required and shall be rigidly attached to the outside forms. Face forms on curb radii may be omitted if a true section and an accurate flow line can be obtained by other methods.

C. Texturing Equipment

1. **Carpet Drag:** Provide a carpet drag mounted on a work bridge or a manual moveable support system. Provide a single piece of carpet of sufficient transverse length to span the full width of the pavement being placed and adjustable so that a sufficient longitudinal length of carpet is in contact with the concrete being placed to produce the desired texture. Obtain approval to vary the length and width of the carpet to accommodate specific applications.

2. **Tining Equipment:** Provide tined equipment with steel tines with a cross-section approximately 1/32 inch thick x 1/12 inch wide. Tine spacing will be approximately 1 inch, center to center apart.

3. **Curing Equipment:** Provide a device for applying curing compound using mechanically pressurized spraying equipment with atomizing nozzles. Equipment must be able to maintain the required uniform rate of application over the entire paving area.

4. **Sawing Equipment:** Provide power driven concrete saws to saw joints

shown on the plans.

IV. Construction Methods: The Contractor shall design, produce, transport, and place the class of concrete in accordance with requirements of this Subsection. The Contractor will perform quality assurance (QA) testing at the scope and frequency outlined in Table 1. QA testing conducted by the Contractor will be submitted to the ODR for review to determine payment and make acceptance decisions. The Contractor may perform quality control (Q/C) testing. The Contractor is allowed to submit Q/C testing to the ODR. The ODR reserves the right to take additional Q/A tests.

**Table 1
Concrete Testing Frequency**

Test For	Test Number	Sampling Location	Frequency of Testing	Remarks
Compressive Strength	Tex-418-A	At point of placement	4 cylinders for each 1500 SY or fraction thereof	Sampling shall be in accordance with Tex-407-A. 2 cylinders shall be tested at 7 days and if the average is below the design strength as defined in Table 1 of Subsection 4.07 "Concrete", the remaining 2 cylinders shall be tested at 28 days. If the average value of the 2 cylinders broken at 7 days the 2 remaining cylinders are not required to be tested.
Slump	Tex-415-A	At point of placement	First load of the day and when cylinders are taken.	ODR may require additional slump tests on loads that appear to have slump outside of specification.
Entrained Air	Tex-416A or Tex-414-A	At point of placement	First load of the day and when cylinders are taken.	
Temperature	Tex-422-A	At point of placement	First load of the day and when cylinders are taken.	

A. Subgrade Preparation: Subgrade shall be excavated and shaped to line, grade, and cross section. If dry, the subgrade shall be sprinkled lightly immediately before concrete placement.

The subgrade shall be excavated to the correct elevation. Any fill required shall be furnished by the Contractor and approved by the Project Representative. The subgrade in fill areas shall be brought to correct elevation by placing like soil or flexible base in layers not to exceed 4 inches in depth. Each layer shall be brought to ± 2% of optimum moisture and compacted to a density of 95% of Standard Proctor in the upper 6 inches of subgrade as detailed in Subsection 4.02 "Earthwork." In alleys the Contractor shall excavate around and take precautions to protect all existing improvements. All obstructions and improvements that must remain where concrete pavement is placed shall be wrapped with 2 layers of 15 pound roofing felt to the level of the top surface of the slab. Any damage to an existing improvement caused by the Contractor shall be repaired.

Excavated material from alley apron construction shall be removed within 24 hours after

subgrade preparation.

B. Forming: Forms shall remain in place at least 12 hours after placement of concrete. Forms shall be oiled with light oil before each use and forms which are to be re-used shall be cleaned immediately after use and maintained in good condition.

C. Reinforcing: The reinforcing steel bars and/or dowels shall be of the correct size and dimension and shall be placed and secured in position as shown on the plans.

D. Concrete: Concrete shall be satisfactorily mixed, placed in the forms to the depth specified, spaded, and tamped until thoroughly compacted. The top surface shall be finished with a wooden float to a gritty texture.

Should a chute be used in placing concrete, the slope of the chute and the delivery end of the chute shall be such that the concrete will flow without separation. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each run. The flushing shall discharge outside the forms.

Concrete slump shall not exceed 1 inch for slip form paving and shall not exceed 4 inches for formed paving.

All concrete surfaces shall be reasonably true and even, free from pockets, depressions or projections, and given a steel trowel finish and then a light brush finish.

All concrete shall be properly cured by being kept moist for 3 days with wetted burlap or mats, or by an approved process. Concrete may be cured by applying a liquid membrane coating (curing compound) to all exposed surfaces.

Concrete shall be deposited that requires minimum rehandling and obtain a uniformly dense section, free of honeycombs, and conforming to line, grade, and cross section.

In general, the consistency of the concrete mixture shall be such that:

1. The mortar will cling to the coarse aggregate;
2. The concrete is not sufficiently fluid to segregate when transported to the place of deposit;
3. The concrete, when dropped directly from the discharge chute of the mixer, will flatten out at the center of the pile; but the edges of the pile will stand up and not flow;
4. The mortar will show no free water when removed from the mixer;
5. The concrete will settle into place when deposited in the forms; and when transported in metal chutes at an angle of 30° with the horizontal, it will slide and

will not flow into place;

6. The surface of the finished concrete will be free from laitance or a surface film of free water;
7. Slump shall not exceed 4 inches. Unless otherwise approved.

Other concrete placement methods such as a slip form machine for curb and gutter is allowable if the concrete can meet these specifications.

Shrinkage Crack Control: Concrete shall be below the allowable temperature as determined by the Contractor by using ACI 305 chart (modified). The rate of evaporation of water from the concrete shall not exceed 0.15 pounds per square foot per hour. The Contractor shall keep a log of air temperature, relative humidity, wind velocity and allowable concrete temperature for each day he places concrete. The log shall be readily available for review by the Project Representative. For air temperature, relative humidity and wind speeds other than what is listed, the next highest temperature shown, next lowest relative humidity, and next highest wind velocity interval shall be used to determine acceptable concrete temperature.

Contractor is to inform the concrete supplier of the temperature requirements prior to delivery to the project. The concrete temperature limit shall not be exceeded at least until fifteen minutes after surface finishing. Appropriate curing methods shall be used to prevent shrinkage cracks in conjunction with these concrete temperature requirements.

Concrete shall not be poured when wind or weather conditions are such that dirt, sand, or debris enters the concrete. No concrete will be placed when wind speeds exceed 25 miles per hour. The concrete shall be protected to maintain temperatures of not less than 50°F for 5 days after placement. If aggregate and water are heated, they shall not be heated above 175°F. Concrete shall not be placed when ambient temperature is less than 40°F. It shall be the responsibility of the Contractor to anticipate as nearly as possible changes in weather conditions which would affect the placement and protection of the concrete and to be prepared to protect freshly placed concrete when sudden changes in the weather make such protection necessary.

E. Sawing: Saw joints to the depth shown on the plans as soon as sawing can be accomplished without damage to the pavement regardless of time of day or weather conditions. Some minor raveling of the saw-cut is acceptable. Use a chalk line, string line, or other approved method to provide a true joint alignment. Provide enough saws to match the paving production rate to ensure sawing completion at the earliest possible time to avoid uncontrolled cracking. Promptly restore membrane curing damaged by sawing.

F. Horizontal and Vertical Control: All forms for concrete work shall be inspected and checked by the Project Representative to insure their compliance with established lines and grades before any concrete is poured. The Contractor shall notify the appropriate department at least four hours prior to pouring of any concrete to have forms checked. No concrete is to be poured until the Project Representative accepts the forms, foundation conditions, amount, size, and location of reinforcement.

The ODR will check thickness, pavement that has deficiencies greater than .02 inches will be subject to removal.

G. Protection: The Contractor shall provide and maintain all necessary barricades and sufficient lights, signals, signs, watchmen, and any and all other things necessary for the protection of the work and for the safety of the public.

The Contractor must protect his work against weather, vandals, and any and all things that may mar the finish, surface, or the appearance of the concrete. Any damage to the surface is cause for rejection of all concrete between the expansion joints on either side of the damaged surface.

Testing for early opening is the responsibility of the Contractor. Results will be submitted to the ODR.

H. Backfill and Repair of Damaged Concrete in Alley Pavement: The area between the alley slab and the property line shall be filled and or shaped as required to obtain the specified cross section and to provide a smooth, even slope from the edge of the alley slab to the property line. Backfill between the alley slab and the property line shall be compacted to a density at least that of the adjacent undisturbed soil. No blading will be permitted on the concrete alley pavement.

Only damage of a very minor nature shall be repaired by approved patching. Any substantial damage to the concrete alley pavement is cause for rejection of that section of pavement between expansion joints on either side of the damaged area, and the damage shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

V. Measurement: Concrete pavement will be measured by the square yard of concrete paving depth shown on the plans.

VI. Payment: The work performed and materials furnished as prescribed by this item and measured as provided will be paid for at the unit price bid. The prices shall each be full compensation for preparing the subgrade; for furnishing and placing all materials, including all reinforcement and expansion joint materials; for furnishing, placing, shaping and tamping backfill; and for all manipulation, labor, tools, equipment, and incidentals necessary to complete the work.

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