

SECTION 1400 - PORTLAND CEMENT CONCRETE PAVEMENT

1401 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct portland cement concrete pavement.

1402 MATERIALS. Except as modified herein, all materials used for construction of portland cement concrete pavement shall conform to the requirements stipulated in applicable sections of this Technical Specification for Public Improvement Projects of the City of Gardner.

a. Concrete. The concrete for the use in construction of portland cement concrete pavement shall conform to the concrete specifications listed in Section 2000.

b. Reinforcing Steel.

Bars: Bars shall conform to ASTM A615, A616, and A617.

Welded Steel Wire Fabric: ASTM A185.

Supporting Elements: Representative samples of supporting elements shall be submitted and approved by the engineer prior to their use in the project.

c. Expansion Joint Fillers. Expansion joint fillers shall conform to ASTM D994, D1751 or D1752.

d. Joint Sealing Compound. Joint sealing compounds shall meet Federal Specification TT-S-1543 and have the following minimum properties:

Durometer, Shore A	15-25	ASTM D 2240
Tensile stress @ 150% Elongation, psi	45 max.	ASTM D 412 Die C
Elongation, %	1200 min	ASTM D 412

e. Curing Membrane. All material to be used or employed in curing portland cement concrete must be approved by the engineer prior to its use. It shall be of the liquid membrane type and shall conform to ASTM C309.

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

- A. Grading and Subgrade Preparation. All excavation or embankment required shall be as defined in Sections 1100--*Grading* and 1200--*Subgrade Preparation* of these technical specifications.
- B. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than 1/4 inch in horizontal and vertical alignment for each 10 feet in length.
  - 1. Material & Size. Forms shall be made of metal and shall have a height equal to or greater than the prescribed edge thickness of the pavement slab.
  - 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 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 must be equipped with mechanical internal vibrators, and be capable of placing the portland cement concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances.

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 specifications.

- A. Expansion Joints. Expansion joints shall be placed at all locations where shown on the plans and standard details or as directed by the engineer.
  - 1. General. Expansion joints shall extend the entire width of the pavement and from the sub-grade to one inch below the surface of the pavement or the material will have a suitable tear strip provided to allow for the application of the joint sealer.

Under no circumstances shall any concrete be left across the expansion joint at any point.
  - 2. Material. Expansion joints shall be formed by a one piece, one inch thick preformed joint filler cut to the configuration of the correct pavement section.

3. Stability. Expansion 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 expansion 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 which 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 painted in accordance with the directions shown on the Plans, and then thoroughly coated with hard grease, or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. As an option, a dowel sleeve of the dimensions shown on the plans or standard drawings may be used in lieu of grease.

B. Contraction Joints. Contraction joints shall be of the type and dimensions and at the spacing shown on the plans or standard drawings.

1. Templates. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined for tooling joints.
2. Sawing. Sawed contraction joints shall be cut by means of wet sawing with an approved concrete saw. The joints shall not be sawed until the concrete has hardened to the extent that tearing and ravelling is precluded.

All joints shall be sawed during the initial curing period and the sawing shall begin before the pavement starts shrinking and before uncontrolled cracking takes place.

Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete or the removal of the curing media and the cutting of the joints. In no case shall the pavement be left overnight without having the joints sawed.

The standard contraction joint configuration is a **1/8"-3/16"** wide joint sawed to a depth of **1/3** the thickness of the slab. Material created by sawing shall be flushed from the pavement before it has had time to dry or set. The spacing shall be as shown on the plans but should generally not exceed 12 feet.

The joint shall be thoroughly cleaned by approved methods prior to the placing of the joint material. This is accomplished by sand-blasting the dry joint in two passes, one for each joint face. This sand, as well as dust and dirt deposited by wind and traffic, must be blown out of the joint and away from the area around it using a high-pressure air blast prior to placing the joint material.

3. Pre-molded Strip Joints. Pre-molded strip joints shall be of the proper dimensions as shown on the plans and standard drawings and shall be secured at the proper location so as not to be disturbed by the finishing of the concrete.

C. Longitudinal and Construction Joints. Longitudinal joints or construction joints 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".
2. Longitudinal Construction Joints. Longitudinal construction joints (joints between construction lanes) shall be keyed joints or shall be constructed with tiebars. Joint configuration shall conform to the dimensions shown on the plans or standard drawings.
3. Transverse Construction Joints. Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever concrete placement is suspended for more than 30 minutes or for such a time that the concrete has begun to take its initial set. No construction joint shall be placed within ten (10) feet of an expansion, contraction, or other construction joint.
4. Tiebars. Tiebars shall be of deformed steel of the dimensions specified by the plans or standard drawings. Tiebars shall be supported in the proper position and at the specified spacing and be firmly secured so as not to be disturbed by the construction procedure. They shall be free from dirt, oil, paint, grease, loose mill scale, and thick rust which could impair bond of the steel with the concrete.

1405 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* of these technical specifications and as specified herein.

A. Concrete 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 and other special metal parts 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 along the forms or sides and along expansion and key type longitudinal joints. Attachments on finishing machines to vibrate the concrete adjacent to forms and longitudinal joints 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 edge. Over vibrating will not be permitted as it will cause segregation. Insufficient vibrating can cause honeycomb. Honeycomb in the edge may be cause for rejection of the pavement.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

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 and isolated using expansion joint material. The minimum size of a boxed out section shall be two feet by two feet.

Concrete shall not be allowed to extrude below the forms.

- B. Concrete Finishing. The pavement shall be struck off and consolidated with a mechanical finishing machine or by hand-finishing methods.

When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the exact elevations as shown on the plans. A depth of at least 2 inches of concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the least possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated by a vibrating screed to the exact elevation as shown on the plans. 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.

1. Longitudinal Floating. After the concrete has been struck off and consolidated, it shall be further smoothed by means of a mechanical longitudinal float or float finishers using a longitudinal hand float. If a longitudinal hand float is used, it shall be operated from foot bridges spanning the pavement and shall be worked with a wiping motion parallel to the centerline, and passing from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than 1/2 of the length of the float. The float shall not be less than 12 feet in length and 6 inches in width, and shall be properly stiffened and provided with handles at each end. This operation may be eliminated if specified tolerances can be attained by some other approved method.

In cases where the longitudinal floating operation has been eliminated, the pavement shall be scraped with a straight edge 10 feet long, equipped with a handle to permit it to be operated from the edge of the pavement. The longitudinal float and straightedge shall be operated so that any excess water and laitance are removed from the surface of the pavement. After the scraping operation, the surface of the pavement shall be within the specified tolerances.

2. Straightedging. While the concrete is still plastic, the slab surface shall be tested for smoothness with a 10-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be placed on the surface parallel to the centerline of the pavement and at not more than 5 foot intervals transversely. After each test the straightedge shall be moved forward one-half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall be smoothed with a float not less than 3 feet long and not less than 6 inches wide, and again straightedged. The pavement surface shall have no depression in which water will stand.
3. Edging. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans or standard details.
4. 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 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 curb shall have the same final finish as the pavement.

The final surface of the concrete pavement and curb 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.

- C. Curing. Curing shall conform to the requirements set forth in Section 2000 - Concrete with the exception that water proof paper, or polyethylene sheeting, shall not be acceptable as curing methods for concrete pavement. The use of straw or burlap for curing shall be as approved by the engineer.

As soon as practical after the concrete is finished it shall be cured with one of the acceptable methods. If a liquid curing membrane is used, it shall be according to the manufacturer's directions.

A nozzle producing a uniform mist pattern will be used on all spray equipment when applying the liquid curing membrane. Rate of application to the pavement shall be (1 gallon/175 ft) with a wet thickness of 6 to 10 mils.

If the forms are removed from finished concrete pavement within a period of 72 hours or if a slip form paving machine has been used, these surfaces shall also be cured.

- D. Protection. The contractor shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the city. Concrete pavement which is not acceptable to the engineer because of damage or defacement, shall be removed and replaced, or repaired to the satisfaction of the engineer, at the expense of the contractor.

All vehicular traffic shall be prohibited from using the new concrete pavement until it has attained the proper strength. The concrete pavement shall not be opened for light traffic until the concrete is at least 72 hours old and has attained a minimum compressive strength of 3000 pounds per square inch. The pavement shall not be opened to all types of traffic until the concrete is at least 120 hours old and has attained a minimum compressive strength of 3500 pounds per square inch. If high early strength concrete is used, the pavement may be opened to all types of traffic when the concrete has attained a compressive strength of 3500 pounds per square inch.

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

- 1406 BACKFILL. A minimum of 24 hours shall lapse before forms are removed and 5 days shall lapse before pavement shall be backfilled unless otherwise approved by the engineer.

Backfill shall be accomplished in accordance with Sections 1100--*Grading* and 1200-*Subgrade Preparation*.

The contractor shall be responsible for the repair of any existing street pavement disturbed by the construction to the satisfaction of the engineer.

- 1407 JOINT SEALING AND CLEANUP. **All joints shall be sealed with an approved joint sealer applied in accordance with the manufacturer's directions and city specifications, standards and design criteria.** The joints shall be sealed within 7 days of the placement of the concrete and prior to the opening of the pavement to traffic.

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

- 1408 CONCRETE CURB. Concrete curb will be constructed as shown on the plans unless otherwise approved by the city engineer. The three options available for concrete curb are as listed below and detailed in Standard Details 20-1 through 20-3.

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

Steel curb forms shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections.

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 4 feet in length.

The finished surface of the curb and gutter shall be checked by the use of a 10 foot straightedge and corrected if necessary. Where grades are flat and while the concrete is still plastic, the drainage of the gutter should be checked with a 4 foot level.

- B. Separate Curb and Gutter with Tiebars. Separate curb and gutter may be poured prior to pouring the remaining pavement. Tiebars 5/8 inches (5/8") in diameter and 24 inches (24") long shall be cast in the curb and gutter at 30-inch centers as shown on the standard details.
- C. Separate Curb and Gutter with Keyway Separate curb and gutter may be poured prior to pouring the remaining pavement. A keyway of the configuration and dimensions shown on the standard details shall be cast in the curb and gutter section.

1409 SURFACE TOLERANCES. Concrete pavement shall have a surface tolerance in all directions of 1/4 inch in 10 feet when checked with a 10-foot straightedge.

1410 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, and where 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 tiebars or keyway may remain if in good condition) to a longitudinal joint, or between longitudinal joints, and on each side of the deficient measurement until no portion of the exposed cross sections are more than 2/10-inch (2/10") deficient, except that there shall not be less than 5 linear feet (5') of pavement removed. If there remains less than 10 feet (10') of acceptable pavement between the section that has been removed and a transverse contraction, expansion, or construction joint, the contractor shall remove pavement to the joint.