

SECTION 02651

PLAIN AND REINFORCED PORTLAND CEMENT CONCRETE PAVEMENTS

02651.01 GENERAL

A. Description

Plain and reinforced Portland cement concrete pavements shall include, but not necessarily be limited to, the construction of Portland cement concrete pavements on a prepared subgrade or base in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Subgrade preparation; Section 02610.
2. Chemically treated subgrade; Section 02611.
3. Aggregate base and subbase courses; Section 02621.
4. Stabilized aggregate base course; Section 02622.
5. Soil-cement base course; Section 02623.
6. Portland cement concrete; Section 03310.

C. Quality Assurance

1. Materials

The County Engineer will inspect all material and equipment to ensure compliance with the Contract Documents.

2. Field Tests

- a. Concrete Tests

The Contractor will conduct normal concrete job control tests, i.e., slump and air content, on the plastic concrete and will prepare test cylinders in accordance with Section 03310.01.

- b. Forms

The County Engineer will inspect all forms prior to the placing of concrete in accordance with Section 02651.03.

- c. Finished Surface

The finished surface of the slab shall be checked in the longitudinal and transverse directions with a 10 foot straightedge, equipped with a 1/8 inch high block on each end. (For slabs on vertical curves, the longitudinal checking template shall be advanced longitudinally in steps not greater than 5 feet). If any portion of the slab deviates more than the 1/8 inch tolerance previously stipulated, the corrective work shall be done at the Contractor's expense. Any slabs which are found to have less thickness than that shown on the Plans may be rejected. Also see Section 02651.03, Article L.

d. Thickness Tolerance

- 1) Slab thickness shown on the Plans shall not be reduced, and no deviation greater than 1/8 inch from the road surface diagram on the Plans will be permitted. Furthermore, the surface shall not deviate in a longitudinal direction more than 1/8 inch per 10 feet from a straight line for tangent grades. For roadways on vertical curves, the deviation (from the curve specified) shall not exceed 1/8 inch per 10 feet in a longitudinal direction.
- 2) After the paving is placed and before final acceptance, the thickness will be determined by the use of cores cut from the paving. The Contractor shall retain a Professional Engineer registered in the State of Maryland for all sampling and testing. All results shall be submitted to the County Engineer before Final Completion Acceptance. Coring shall be as specified in MSMT T552. Cores shall be spaced every 500 feet for each lane unless otherwise specified or directed by the Engineer with the concurrence of the County Engineer.
- 3) The County will not be liable for excess thickness. When the thickness of a pavement is deficient by more than 1.00 inch, the full section between limits established by the County Engineer shall be removed and replaced by the Contractor at the Contractor's expense. Core drilling and repairing of the replaced pavement shall be at the Contractor's expense.

D. Submittals

1. Shop Drawings

Shop drawings for Portland cement concrete shall be submitted as specified in Section 03310.01.

2. Certified Load Tickets

Certified load tickets shall be furnished by the Portland cement concrete producer and delivered to the County Engineer. The certified ticket shall state that all materials comply with pertinent specifications and the mix is proportioned in accordance with the specified mix design.

3. Certified Test Results

a. High Range Water Reducing Admixture

The manufacturer shall supply the actual laboratory test results conducted in accordance with these specifications. For control purposes, the manufacturer shall also furnish curves giving the fluid ounces of high range water reducer per 100 pounds of cement as related to water reduction and strength gain for 12 hours when used with a cement factor of a minimum of 700 pounds.

b. Joint Filler

The manufacturer shall submit a complete certified analysis for all hot applied joint fillers.

c. Epoxy Resin Adhesives

The Contractor shall provide a certificate containing the pot life and actual test results showing the material meets the requirements of the specification. Should the manufacturing process or materials change, a new sample and certification are required for approval of the system.

d. Waterstops

The Contractor shall furnish without charge a test sample for each lot or shipment of waterstop. The supplier of the waterstop shall furnish a certified copy of the actual test results showing that the material meets the specification requirements.

e. Bituminous Sealer

The supplier shall furnish a certified copy of the test results showing that the bituminous sealer meets the following requirements:

<u>Test and Method</u>	<u>Specification Limits</u>
Residue by evaporation, nonvolatile matter, ASTM D 2939, % min.	70
Inorganic filler on ignition, ash content, ASTM D 2939, %	15-45

02651.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for Portland cement concrete pavements.
2. The Contractor may obtain water from the County's potable water system in accordance with current County policies and procedures. The Contractor shall contact the Department of Fiscal Services, Meter Section, for requirements. A

backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

1. The Contractor may cure the finished concrete slab by any one or more of the methods specified in Section 02651.03, Article M.
2. The Contractor may use either hot or cold applied joint sealing compound. The Contractor shall designate the Contractor's selection by letter and shall use the chosen material for the entire Contract.

C. Detailed Material Requirements

1. Aggregate Gradations

TABLE 02651-1

Mass Percent Passing

Sieve Sizes U.S. Standard	TEST METHOD T27			AASHTO M 6
	<u>No. 57</u>	<u>No. 67</u>	<u>No. 7</u>	<u>FA, PCC</u>
1 ½ inch	100	-	-	-
1 inch	95-100	100	-	-
¾ inch	-	90-100	100	-
½ inch	25-60	-	90-100	-
⅜ inch	-	20-55	40-70	100
No. 4	0-10	0-10	0-15	95-100
No. 8	0-5	0-5	0-5	-
No. 16	-	-	-	45-80
No. 50	-	-	-	10-30
No. 100	-	-	-	2-10

For aggregate physical property requirements refer to Table 901B of the "MSHA Standard Specifications for Construction and Materials, (1993)".

2. Fine Aggregate

Fine aggregate shall meet the gradation requirements contained in Table 02651-1 and shall be in accordance with the quality requirements of AASHTO M 6 Class B.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO T27, No. 57, 67, or 7, Table 02651-1.

4. Portland Cement

Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

5. Water

Water shall be as specified in Section 02611.02.

6. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, liquid membrane-forming compounds, or cotton mats.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White opaque burlap polyethylene sheeting shall have a finished product weight of not less than 10 ounces per square yard. For white opaque polyethylene film, requirements for tensile strength and elongation are waived.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than plus or minus 0.3 pounds per gallon from the original source sample.

d. Cotton Mats

Cotton mats shall consist of a filling material of cotton bats or bats covered with unsized cloth and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

The covering shall be either cotton cloth, burlap, or jute having the following properties:

- 1) Cotton cloth covering shall weigh not less than 6.0 ounces per square yard and shall have an average of not less than 32 threads per inch in warp and not less than 28 threads per inch in filling. The raw material used in the manufacture of the cotton cloth shall be raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof.
- 2) Burlap or jute covering for cotton mats shall weigh not less than 6.4

ounces per square yard and shall have not less than 8 threads per inch of warp and not less than 8 threads per inch of filling. It shall be the grade known commercially as "firsts" and shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability.

The filling material for the mats shall be cotton bat, or bats made of raw cotton, cotton waste, cotton linters, or combinations thereof, and shall weigh not less than 12 ounces per square yard.

Mats shall have a suitable flap extending along one longitudinal edge of the mat. The length of mats shall be 2.5 feet greater than the width of pavement slab to be cured.

The cotton filling material in the form of a bat or bats shall be held in place between the coverings by sewing or tufting. The sewing or tufting shall be sufficiently loose to permit substantially all of the surface of the mat to come in contact with a flat surface when in use but not so loose to permit the filling material to shift.

7. Joint Materials

a. Joint Fillers

The hot applied material shall be in accordance with AASHTO M 173. Manufacturers' recommendations regarding pouring temperature will be used when testing this material. If a range of temperatures is recommended, the midpoint will be used as the pour point. The cold applied type shall meet the requirements of ASTM D 1850. One sample per each 50 containers, or fraction thereof, shall be required for either type of material.

b. Preformed Joint Fillers

Preformed joint fillers shall conform to AASHTO M 153. The bituminous fiber type shall be in accordance with AASHTO M 213, with the bitumen content determined by MSMT 408 or AASHTO T 164. The weathering test shall be deleted for either type of material.

c. Roofing Paper

Roofing paper to be used in expansion joints shall be composed of roofing felt saturated and coated on both sides with an asphaltic material. It shall not weigh less than 39.8 pounds per 100 square feet and shall not crack when bent 90 degrees over a ½ inch radius at room temperature.

d. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be natural rubber, suitable synthetic rubber, or a combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins

mechanically blended with polyvinyl.

The waterstop shall be of the shape and dimensions shown on the Plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

<u>Test and Method</u>	<u>Specification Limits</u>
Tensile Strength, ASTM D 412, min	2000 psi
Elongation at Break, ASTM D 412, % min	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55 ± 5
Hardness, PVC, Type A Durometer, ASTM D 2240	75 ± 5

- e. Prefomed Polychoroprene Elastomeric Compression Joint Seals

Roadway seals for concrete pavement shall conform to AASHTO M 222. Force deflection shall conform to AASHTO M 220.

- f. Lubricant-adhesive

The lubricant-adhesive shall be compatible with the prefomed joint seals and concrete and unaffected by normal moisture. The County Engineer will determine that consistency is suitable at the time of installation.

<u>Test and Method</u>	<u>Specification Limits</u>
Solids, ASTM D 553, % min	22
Film Strength, ASTM D 412, psi min	2000
Elongation, ASTM D 412, % min	250

No lubricant-adhesive shall be used after nine months from the date of manufacture. Each container shall be plainly marked with the manufacturer's name or trademark, lot number, and date of manufacture.

- g. Load Transfer Assemblies

Load transfer assemblies, including ends, shall be epoxy coated and constructed in accordance with the Standard Details.

- h. Silicone Joint Sealant

Silicone joint sealant shall be a low modulus, one component compound which may or may not require a primer for bonding to concrete. If a primer is required, it shall be as recommended by the sealant manufacturer and shall be placed on the joint faces following the insertion of the back-up

material. Each container of silicone joint sealant shall have a minimum shelf life of six months. Material more than six months old shall be retested.

Silicone joint sealant, when tested at 73±3 F and 45-55 relative humidity, shall meet the following requirements:

<u>TEST PROPERTY</u>	<u>TEST METHOD</u>	<u>SPECIFICATION LIMITS</u>
Shore A Hardness	ASTM D 2240	10-25 at 7 Days
Tensile Strength @ 150% Elongation	ASTM D 412 Die C	45 psi MAX.
Adhesion in Peel	Fed. Spec. TT-S-00230	20 lb/in. min.
Flow	AASHTO T 187	0.3 in. max.
Tack-Free Time	ASTM D 2377	20-75 minutes
Elongation, % min.	ASTM D412 Die C	700

8. Graphite Grease

Graphite grease shall be a smooth homogeneous mixture of mineral oil and a water insoluble soap containing a minimum of 6% of colloidal graphite by weight.

The colloidal graphite used in the manufacturer of the grease shall contain at least 80% graphite carbon. The fineness shall be such that the grease will leave a continuous protective film of graphite when applied.

The consistency of the graphite grease shall meet the requirements of the National Lubricating Grease Institute, Grade 2.

9. Epoxy Adhesives

Epoxy resin bonding material shall consist of a thermosetting epoxy resin and a hardener. The individual components or mixed epoxy shall not settle or skin and contain no volatile solvents, lumps, or foreign materials. The epoxy shall conform to ASTM C 881.

Each container shall be clearly labeled with the manufacturer's name, batch number, component designation, mixing ratios by volume, gel time, date manufactured, and directions for use. In addition, each container shall be labeled showing the epoxy system type, grade, class, and color.

10. Fine Aggregate for Epoxies

Fine aggregate for epoxies will be tested in accordance with AASHTO T 27. The grading shall yield 100% passing the No. 8 sieve and a maximum of 1% passing the

No. 200 sieve. Aggregate shall be dry.

11. Steel Reinforcement

All items specified in this Section shall be of domestic manufacturer.

a. Bar Reinforcement

Bar reinforcement shall consist of deformed bars conforming to AASHTO A615, Grade 60. Deformed bars shall be epoxy coated when specified in the contract documents. Epoxy powder shall conform to Section 917.02 of the "MSHA Standard Specifications for Construction and Materials, (1993)".

b. Plain Reinforcement

Tie or dowel bars shall be plain round steel bars conforming to AASHTO A615, Grade 60, or ASTM A 36. Bars shall be epoxy coated when specified in the contract documents. Epoxy powder shall conform to Section 917.02 of the "MSHA Standard Specifications for Construction and Materials, (1993)".

Sleeves for dowel bars shall be of sheet metal capable of sliding over $2 \pm 1/4$ inch of the dowel and shall have a closed end with a stop to hold the end of the sleeve at a minimum distance of 1 inch from the end of the dowel bar.

c. Welded Steel Wire Fabric

Welded steel wire fabric shall be in accordance with AASHTO M 55. Fabric used in pavement construction shall be furnished in flat sheets. When galvanizing is specified, the fabric shall be galvanized after fabrication.

d. Welded Deformed Steel Wire Fabric

Welded deformed steel wire fabric shall be in accordance with AASHTO M 221.

e. Fabricated Steel Bar Mats

Fabricated steel bar mats shall consist of steel conforming to AASHTO A184.

f. Cold Drawn Steel Wire

Cold drawn steel wire for concrete reinforcement shall be in accordance with AASHTO M 32.

g. Tie Devices

Tie devices for use in securing contiguous traffic lanes of Portland cement concrete pavement or a traffic lane and concrete curb or combination curb and gutter shall be of malleable iron or steel. The tie devices shall meet the dimensions specified and produce a frictional force of at least 160 pounds

per foot per foot of spacing when tested in accordance with MSMT 512.

12. Proportioning

Proportioning shall be as specified in Section 03310.

02651.03 EXECUTION

A. General

1. Equipment necessary for handling materials and performing the work will be approved by the County Engineer as to design, capacity, and mechanical condition. The equipment shall be at the job site sufficiently ahead of the start of construction operations to be examined thoroughly and approved. The equipment and methods used shall provide means to obtain the prescribed weights within the allowable tolerances, to obtain the consistency specified with a minimum amount of water, to obtain proper placing of the mixture in a condition of maximum density with no segregation, and to finish and cure the pavement in accordance with the requirements herein.
2. No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate and approved artificial lighting system is operated.
3. Weather

Concrete placement shall begin only when the air and surface temperature is 40°F and rising and discontinued anytime the temperature falls below 40°F. This requirement may be waived for incidental concrete construction.

No cement or aggregates containing frost, frozen lumps, or crusts of hard material shall be used. No concrete shall be placed on a frosted or frozen subgrade.

If the concrete will be exposed to the direct rays of the sun and the air temperature is over 70°F, the forms, reinforcing steel, and base shall be sprinkled with cool water just before concrete placement.

B. Conditioning of Subgrade

After the subgrade has been brought to line and grade and immediately prior to placing the forms, the foundation shall be conditioned and trimmed to the exact shape, grade, and cross section required by the Plans. Such conditioning and shaping shall be to the proposed width between side forms plus 1 foot wider on each side. The foundation shall be compacted by rolling at least 1 foot wider on each side than the proposed width of the concrete. The use of a fine grading machine of an approved type will be permitted in which event the forms can be placed directly on the prepared subgrade in advance of the exact conditioning and trimming.

C. Forms

Side forms shall be made of steel not less than 7/32 inch thick having a depth equal to the edge thickness of the pavement. Built-up forms shall not be used. Forms shall be free

from warp and of sufficient strength to resist all loads applied in the paving process. Forms shall have a base equal to their height and a flat flanged tread or top surface not less than 2 inches wide. They shall be not less than 10 feet long except for installation along curves with a radius of less than 200 feet. When the curve radius is less than 200 feet, the forms shall not be more than 6 feet long or the forms shall be curved. Stake sockets to accommodate a 1 inch diameter steel stake shall be provided, and there shall be at least three such sockets in each section of form 10 feet or more in length and at least two such sockets in each section of form less than 10 feet long. Each section of form shall be provided with a positive locking device which will secure it tightly to the adjoining section.

Forms for keyways shall be of metal or plastic and shall be rigidly and permanently fastened to the road form by bolting or welding. They shall be the full length of the road form to which they are attached, of the size and shape specified and sufficiently strong to maintain their original size and shape at all times.

Holes shall be provided through both forms and keyways to accommodate tie bars or dowels when such are required. They shall be the proper size and at the spacing and location as required for the tie bars specified.

When tested with a straightedge, no forms shall show a variation of more than 1/8-inch per 10 foot length from the true plane of the top, and the face shall not vary from a true plane more than 1/4-inch per 10 foot; and this allowable variation shall not be exceeded for shorter forms such as used on curves. Forms that are bent, deformed, or broken in any way shall be immediately removed from the paving site; and if repaired, they shall not be used until they have been accepted by the County Engineer.

Forms shall be joined neatly and tightly and staked securely with stakes in every socket. All wedge locks or other stake fastening devices shall be tight. All locking devices at form joints shall be driven up fully so as to produce a smooth fitting rigid joint. Forms shall maintain proper grade and alignment under all working conditions. The entire base of the forms shall bear directly and in full contact with the finished foundation. Building of pedestals of earth or other materials upon which to rest the forms is not permitted. Grade controls shall be set at intervals not to exceed 25 feet. Forms shall be set to final line and grade at least 400 feet in advance of the point of placing concrete and shall be thoroughly cleaned and coated with form release compound before concrete is placed. After forms have been set, the top surface or tread shall be checked for trueness; and any variations from a smooth and uniform surface shall be corrected.

The County Engineer may approve wooden forms for use in exceptional cases, such as on curves of very short radius or when a nonstandard length of straight form is required. They shall be the full depth of the pavement edge, of a design and construction acceptable to the County Engineer, and shall be rigidly braced and held to the proper line and grade.

D. Final Check

Following the placement of the forms, an approved scratchboard shall be used as a final check, and any deviations shall be corrected. When corrections necessitate the addition or removal of material, this material shall be rolled with a roller weighing not less than 500 pounds. Following such correction, the scratchboard shall again be used. When the foundation is dry, it shall be sprinkled with as much water as can be readily absorbed immediately in advance of placing concrete.

E. Placing Concrete

The concrete shall be deposited on the grade in such manner as to require as little rehandling as possible. Unless truck mixers, truck agitators, or nonagitator hauling equipment is equipped with means for discharge of concrete without segregation of the materials or displacement of the underlying material, the concrete shall be unloaded into an approved spreading device and mechanically spread in such manner as to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes.

Where concrete is to be placed adjoining a previously constructed lane of pavement, mechanical spreading and finishing equipment may be operated upon the existing lane of pavement, that lane shall have attained the specified split tensile strength of 300 psi. The wheels of the finishing machine, which rests on the previously completed concrete, shall be flat, without flanges; and the inside edge of the tread of the wheels shall not operate so close to the edge of the slab as to cause spalling or damage. The tread of the wheels on the opposite side, which operate on the steel side forms, shall have flanges on both sides. The tread of the wheels shall not be less than 3-inches wide.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of immersion type vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, underlying material, or a side form. In no case shall the vibrator be operated longer than 5 seconds in any one location.

Following the placement of the concrete, it shall be struck off to be in accordance with the cross section shown on the Plans. Should any concrete material fall on or be worked into the surface of a completed slab, it shall be removed immediately by approved methods.

F. Reinforcement

When reinforcement is required, it shall be placed as shown on the Plans. All dowel bar assemblies for lateral joints, if required, shall be installed in place on finished subgrade ahead of the placement of the slab reinforcement and concrete. The portion of each dowel intended to slip shall be thoroughly coated with asphalt, grade MC-70, material or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel.

All reinforcing metal shall be kept clean and free from foreign material that will prevent the proper bond with the concrete. Welded sheet fabric and welded or clipped bar mats shall be furnished in flat sheets and shall be handled carefully during the placing and kept straight.

The reinforcement shall be placed so that the extreme longitudinal member will be located not more than 3 inches from the edges of the slab section, and the ends of all longitudinal members shall extend to within 2 inches of the ends of the slab sections. Adjacent sheets of welded fabric and welded or clipped bar mats shall be lapped not less than 12 inches when the lap is made at a right angle to the center line of the pavement. When sheets are permitted to be lapped parallel to the center line, the lap shall be not less than 12 inches. The wire fabric or bar mats shall be wired together at all laps. The spacing between the wiring shall not exceed 24 inches.

Reinforcement for multiple lane construction shall consist of bar mats or sheets of welded wire mesh of the same weight and size as though the paving were constructed in single lane widths, and these mats or sheets shall be installed so as to leave an unreinforced longitudinal gap 6 inches wide, parallel to and centered on the lane lines, as indicated on the Plans.

When installing welded wire fabric, or welded or clipped mats of reinforcing bars, one of the following methods shall be used:

1. The concrete shall be placed in two layers. The entire width of the bottom layer shall be struck to such length and depth so that the wire fabric or bar mat can be laid full length on the concrete in its final position and to its proper elevation below the finished roadway surface, as indicated in the Plans. After the steel has been placed, the top layer of concrete shall be placed and struck off at once before the bottom layer becomes nonplastic.

When wire fabric is specified and the slip-form method of paving is used, the only approved manner of placement will be this method.

2. The concrete shall be placed in one layer. The wire fabric or bar mats shall be placed in the plastic concrete by approved mechanical or vibratory means after the concrete has been spread. After the initial set of the concrete, the wire fabric or bar mats shall be at proper elevation below the finished grade, as indicated on the Plans.

Tie bars for longitudinal construction joints may be placed in metal chairs or machine placed so that upon the initial set of the concrete they shall be at a proper alignment depth and spacing, and shall be at right angles to the center line of the pavement. Metal chairs or machine placement devices shall be approved by the County Engineer prior to use.

When using the slip-form method of paving, tied reinforcing bars or prefabricated mats may also be installed ahead of the placement of concrete by being supported on chairs set upon the underlying material. Reinforcement installed in this manner shall be in place for a distance ahead of the paver equal to at least 500 feet or a 2 hour run of the paver before any paving may begin. Paving shall be stopped and a bulkhead construction joint shall be installed whenever it comes to within 100 feet of the end of such steel placement. All reinforcement shall be adequately secured against displacement or movement.

G. Slip-Form Paving

The Contractor may elect to use the slip-form method of constructing the concrete pavement, which must be approved at least 30 days prior to the start of any such operations. If the slip-form method is used, a compacted foundation widening shall extend a minimum of 4 inches beyond the outermost edge of any wheel or crawler tracks that are to be operated on it. No additional compensation will be allowed for the extra width. All fine grading on widened track area of the foundation under the pavement slab, shall be done by machine methods. The machine used for this work shall be automatically controlled for alignment and grade by sensors activated by preset string or wire lines on both sides and supported at intervals not in excess of 25 feet.

A close tolerance on the surface of the foundation is essential in order to get a pavement which is smooth and of uniform and correct thickness. Any corrections to the foundation

during fine grading operations, either under the pavement area or the track area or both, involving either the addition or removal of material, any disturbance of the material or change in its density, such as scarifying, blading, etc., shall always be followed by additional rolling.

The fine grading of the foundation shall be completed for a distance ahead of the paver of at least 1000 feet before any paving may begin. Paving shall be stopped whenever it comes to within 200 feet of the farthest point to which fine grading of the foundation is completed and a bulkhead construction joint installed.

The concrete pavement slab shall be shaped, consolidated, and finished by an approved slip-form paver. This machine shall be self-propelled, on crawler tracks, and no other tractive force or effort, other than that which is provided and controlled by the paving machine itself, shall be applied. The slip-form paver shall be capable of being automatically controlled for both alignment and grade by sensors activated by a preset string line or other acceptable methods. When placing concrete adjacent to an existing pavement, the portion of the equipment which is supported on the existing pavement shall be equipped with rubber tired wheels or protective pads on crawler treads, either of which shall be sufficiently offset laterally so as to run far enough from the edge to prevent damage to the existing pavement.

The slip-forms shall be of a length sufficient to prevent harmful slumping or sagging of the sides and top edges of the pavement slab being cast. They shall be spaced and braced to a uniform and constant width by means of adequate cross-bracing frames. They shall also be held rigidly vertical. Tie bars and keyways which may be required in the slip joined edge shall be placed and secured in proper position in the concrete before the edge of the pavement slab is free of the slip-form.

In the event that slumping or sloughing occurs behind the machine or any other defects occur which, in the opinion of the County Engineer, cannot be corrected to permissible tolerances, or if the reinforcing materials or load transfer units are displaced by action of the machine, the County Engineer will halt paving operations until proper corrective action has been taken.

Paving found to be defective in surface smoothness, thickness, edge slumping, strength or any other characteristics shall be removed and replaced if in the opinion of the County Engineer the defects cannot be satisfactorily resolved.

H. Sequence of Operations

The sequence of operations shall be placing, strike off and consolidating, floating and removal of laitance, straightedging, final surface finishing, and curing. Work bridges or other devices necessary to provide access to the pavement surface for the purpose of finishing straightedging, and making corrections as hereinafter specified, shall be provided by the Contractor.

I. Machine Finishing

The finishing machine shall be an approved type of screed machine having two transverse screeds. A mechanical spreader of an approved type and design will be required which will move the volume of freshly deposited concrete transversely, thereby accomplishing the necessary spreading of the material. Special attention shall be given to spading or vibrating

the concrete adjacent to roadway forms and joints, but the concrete shall not be subjected to excessive vibration such as might produce segregation of its various components. When hand methods are permitted in lieu of the mechanical spreading, not less than three men shall be at work at all times leveling, spading, and spreading the concrete in front of the finishing machine. Rakes shall not be used for handling concrete. The screed shall be adjusted so as to produce a complete concrete pavement of the crown and cross section indicated on the Plans. An experienced operator shall be employed to operate the finishing machine.

Following the transverse finishing machine, the concrete shall be screeded longitudinally with a power operated longitudinal finishing machine of an approved type. This longitudinal screed shall be worked with a side to side motion so as to level any irregularities in the surface. The width of the working face of the screed shall not be less than 6 inches.

In lieu of the longitudinal screed, an approved model of a chevron or "V" type finishing float or of a combination finishing float of the lateral type may be used. Such devices shall have the float suspended from a frame so that it does not ride directly on the forms, and the float shall be nonreciprocating. Any such float shall be preceded by at least one additional reciprocating screed.

Following the longitudinal screed or finishing float, a scraping straightedge, 10 foot in length, equipped with a long handle, shall be used for removing any accumulation of excess mortar or inert material from the surface and bringing the pavement to the correct plane.

When the finishing machine is run back over previously placed concrete after the concreting operation has been suspended for a sufficient time to permit the concrete to set, the finishing machine shall be supported by steel strips not less than 2 feet long placed on the forms in such a manner that the wheel flanges will not touch or damage the concrete. In operating all surface finishing equipment, the least number of passes is desirable in order that over manipulation may be avoided.

J. Texturing

The concrete roadway surface shall be given a final textured finish. Any free water on the surface prior to the commencement of the texturing operation shall be removed by a burlap drag. The textured finish shall have transverse corrugations that are variably spaced from 5/8 inch to 7/8 inch apart. Each corrugation shall be tined 1/8-inch wide and 1/8-inch deep. A 2-inch space shall be provided between passes of the texturing device and a 3-inch space provided between the last corrugation and the center line of all transverse joints.

The texturing shall begin when the concrete surface is of such a plasticity as to allow texturing to the depth specified but dry enough to prevent the plastic concrete from flowing back into the grooves being formed. Care shall be exercised to avoid overlaps and the tearing of the concrete in the texturing operation. Texturing on open sections will be uniform for the full width of pavement. On closed sections, the last 12 inches of the roadway adjacent to the curb shall be left untextured to facilitate drainage. The completed textured finish shall be uniform in appearance.

After the texturing has been completed and the concrete has taken its initial set, and edging tool with 1/4 inch radius shall be used along each edge of the surface to prevent chipping of the edges in the removal of the forms. The longitudinal edge of any concrete surface adjoining previously placed pavement shall also be tooled in the same manner to avoid

subsequent spalling. The edging of the joints shall be done at the same time and shall be done from the bridges. Particular care shall be taken to keep the surface of the concrete in the same plane on both sides of each joint wall thus edged.

K. Hand Finishing

Where permitted by the County Engineer, hand finishing may be substituted for a finishing machine, according to the following method:

The surface of the concrete shall be struck off immediately after placement and leveled by means of an adjustable steel template 10 inches wide and 2 feet longer than the width of the pavement. A second adjustable steel template 8 inches wide and 2 feet longer than the width of the pavement shall be used directly behind this template. The templates shall be moved forward with a combined longitudinal and side to side motion fully resting at all times on the forms. During the operation, the distance between the two templates shall at no time exceed 10 feet. The templates shall be used until a true surface is obtained. While the concrete is being struck off with the first template, three or more men shall be at work leveling, spading, and tamping the concrete in front of the template.

After the concrete has been struck off with hand templates, finishing operations will be continued as specified for machine finishing.

L. Surface Check

The entire surface shall be checked with an approved metal straightedge 10 feet in length following the belting, and any deviation from the general surface shall be corrected at once. The surface shall be checked again after the expiration of the curing period. The 10 foot straightedge shall be equipped with blocks at each end exactly 1/8 inch in height, so as to support the checking edge above the concrete pavement. The straightedge shall be placed at several points across the pavement parallel to the center line and shall be advanced in 5 foot increments. If at any point the concrete touches the straightedge when supported on blocks, the high spot shall be corrected by grinding or rubbing the surface. This grinding or rubbing shall be conducted carefully so as to avoid loosening coarse aggregate or otherwise damaging the slab.

Deviations which cannot be corrected by grinding or rubbing shall be removed and replaced by and at the expense of the Contractor, and in no case shall such section to be removed be less than full width of the traffic lane in which the deviation occurs and the entire length of the slab between joints.

The surface shall not deviate from a straight line or vertical curve transversely or longitudinally more than 1/8-inch per 10 foot.

M. Curing

Concrete curing for a period of 72 hours immediately following the placement operations shall be accomplished by one or more of the following methods. If at any time during the curing period the ambient temperature falls below 40^of, insulated blankets shall be used to maintain the concrete temperature above 40^of. Insulated blankets shall not be used in lieu of the curing material. The contractor shall provide a sufficient number of high/low thermometers to monitor the temperature of the concrete. The Contractor may select the method to be used.

Regardless of the method selected, it shall be maintained continuously throughout this period at the expense of the Contractor.

1. White-pigmented liquid membrane-forming curing compound shall be applied to the finished surfaces by means of approved automatic spraying machine as soon as the free water has disappeared. The spraying machine shall be self-propelled and shall ride on the side forms of previously constructed pavement, straddling the newly paved lane. The machine shall be equipped with one or more spraying nozzles which can be controlled and operated so as to completely and uniformly cover the pavement surface with the required amount of curing compound. The curing compound in the storage drum being used for the spraying operation shall be thoroughly and continuously agitated during the application. Spraying pressure shall be sufficient to produce a fine spray and cover the surface thoroughly and completely with a uniform film. Spray equipment shall be maintained in first class mechanical condition, and the spray nozzle shall be provided with an adequate wind guard. The curing compound shall be applied with an overlapping coverage which will give a two-coat application at a coverage of not more than 200 square feet per gallon for both coats.

The application of curing compound by hand operated pressure sprayers will be permitted only on odd widths or shapes of slabs and on concrete surfaces exposed by the removal of forms, as authorized by the County Engineer. When application is made by hand operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, coherent film that shall not check, crack, or peel and shall be free from pin holes and other imperfections. If pin holes or discontinuities exist, an additional coat shall be applied within 30 minutes to the affected areas.

Concrete surfaces which are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above, at no additional cost to the County.

Necessary precautions shall be taken to insure that none of the curing compound enters joints which are to be sealed. Rope of moistened paper, fiber, or other suitable material shall be used to seal the top of the joint opening, and the concrete in the region of the joint shall be sprayed with curing compounds immediately after the rope seal is installed. Other methods of protecting the joints may be used when approved by the County Engineer.

Approved standby facilities or approved alternate methods for curing concrete pavement shall be provided at a readily accessible location at the site of the work for use in event of mechanical failure of the spraying equipment or any other conditions which may prevent correct application of the membrane curing compound at the proper time. In the event of a failure of the regular spraying equipment, the standby or alternate curing method shall be used only on the remaining portion of the paving already placed and the paving operations suspended.

Concrete surfaces to which membrane curing compounds have been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic, except as required for joint sawing operations and surface tests, and from any other cause which will disrupt the continuity of the membrane.

Any area covered with curing compound which is damaged by subsequent construction operations within the curing period shall be resprayed.

2. Burlap shall be placed as soon as it may be done without injury to the concrete. It shall be overlapped in half widths of strips so as to provide a double thickness throughout its coverage. It shall be saturated prior to placement and placed wet. It shall be kept wet continuously throughout the curing period.
3. Cotton mats shall be placed as soon as it may be done without injury to the concrete. The mats shall be saturated prior to placement and placed wet. They shall be kept wet continuously throughout the curing period.
4. Waterproof paper or white polyethylene sheeting shall be placed as soon as it may be done without injury to the finished concrete. Sheeting units shall be lapped a minimum of 12 inches and extended to outside the forms. All edges or laps shall be held in place securely by a continuous windrow of earth or some other approved means. It is required with either sheeting material that it be maintained in close proximity to the surfaces of the pavement,

N. Form Removal

Unless otherwise provided, forms shall not be removed before concrete has set at least 12 hours. Forms shall be removed carefully so as to avoid damage to the pavement.

If the curing period has not expired, the sides of the slabs requiring no repair shall continue to be cured by one of the approved methods for the unexpired time.

Any damaged edges or honeycombed areas shall be repaired immediately and cured for 72 hours.

O. Joints

Joints shall be constructed of the type and dimensions and at locations indicated by the Plans. All joints shall be constructed perpendicular to the surface of the pavement. Care shall be exercised to maintain the surface of the concrete in the same plane on each side of the joint. All joints shall be protected from the intrusion of injurious material.

Longitudinal joints shall be created by full depth forming of individual lane widths or by sawing of multi-lane monolithic widths. No single lane width shall exceed 16 feet.

Longitudinal tie bars of a type specified must be submitted for test and approved prior to use. The Contractor shall provide the County Engineer with a statement designating the source of supply, type, and proposed spacing of the tie bars. No material is to be used or installed prior to written acceptance by the County Engineer.

When adjacent lanes of pavement are constructed by full depth forming, a screw type tie device shall be used. When the longitudinal joint is created by developing a plane of weakness, deformed bars of appropriate grade, size and spacing will be permitted. The method of placement shall also be established and approved prior to the commencement of paving. Where the slip-form paving method of placement is elected, the required deformed steel tie bars shall be placed and secured in their proper final position in the concrete before the edge of the pavement slab is free of the slip-form.

Contraction joints shall be constructed at locations and spacing as specified or shown on the Plans. In the case of placement adjacent to existing pavement, a match of existing joint spacing and type shall be made. Contraction joints shall contain load transfer dowels supported by a device as specified or shown on the Plans. Dowels shall be maintained parallel to the surface and longitudinal joint or center line of the pavement.

The creation of a weakened plane joint by sawing shall be done in the following manner. Initially, accurate markings shall be made to reference the proper point over the load transfer devices to serve as a guide during the sawing operations.

Power concrete saws shall be equipped with suitable blades, guides, and depth controls, capable of marking a straight and perpendicular cut of not less than the prescribed depth. Sufficient equipment shall be on hand for the volume of sawing to be done and to insure against mechanical failure. A minimum of two saws in operating condition shall be maintained at the job site.

It is the responsibility of the Contractor to have sawing done at the time which will positively control cracking yet not cause excessive raveling of the surface aggregate. Sawing shall commence as soon as possible after finishing has been completed and curing begun. In no event shall sawing of contraction joints commence later than 8 hours after placement of pavement.

Sawing shall be completed in 24 hours in the case of contraction joints and 84 hours in the case of longitudinal joints after placement of the pavement involved. Sealing shall be done as soon as possible since no traffic will be permitted to use the pavement until after the sealing operations are completed.

All dummy contraction and dummy longitudinal joints shall be sawed except where gravel aggregate is used. These gravel aggregate joints shall be tooled or formed as sawing will not be permitted.

Contraction joints created by methods other than above will be permitted only when approved by the County Engineer in writing.

The width and depth of the created joint shall be as specified or as shown on the Plans.

When concrete placement is interrupted longer than 45 minutes, or at the end of a day's run, a bulkhead or header form shall be placed. This form shall be of a type which when stripped will not disturb the dowel assembly. Bulkhead joints may preferably be made at normal contraction joint but shall not be set so as to result in a slab of less than 10 feet in length.

An edging tool with a 1/4 inch radius shall be used along the bulkhead across the surface of the pavement. When work is resumed, the freshly laid surface shall match the previously placed pavement.

P. Sealing Joints

All joints, lateral, longitudinal, and between surfacing and curb and gutter shall be sealed before any traffic is allowed on the surfacing.

Prior to placement of any joint sealing materials, the joints shall be cleaned of dirt or other

foreign material. Joints may be cleaned with compressed air jets provided that the air in such jets is entirely free of oil or water. No joints shall be filled when there is any free water in or adjacent to the joints. Joint walls and all surfaces to which the sealing material is to adhere shall be surface dry for at least 3 hours prior to sealing.

The County Engineer will inspect the joints immediately prior to the placement of the sealing compound, and no sealing material shall be used until the joints have been approved as being clean in accordance with the foregoing provisions.

The sealing of the joints shall be done in a neat, workmanlike manner.

Joints formed by pouring one slab against the other and transverse construction joints formed as a result of sequential daily pours shall be sawed a minimum of 1 inch deep and 3/16 to 5/16 inch in width and sealed.

Cold applied joint sealing compound shall be applied with approved pressurized equipment only.

Hot applied joint sealing compound shall be heated and applied with devices approved by the County. Hot poured joint sealing material shall not be placed when air temperature is less than 50°F unless approved by the County Engineer.

Sufficient sealing material shall be placed in the joints so that upon completion of the work the surface of the sealing compound shall not be more than 1/8 inch below the level of the pavement surface. Extreme care shall be exercised in the sealing of joints to make them impervious to water and to prevent excessive spreading of the sealing compound over the surface of the pavement.

All sawed joints, except the longitudinal construction and the transverse construction joint sawed 1 inch deep, shall be sealed with preformed elastomeric compression seals.

After the joints are constructed and all foreign material has been removed, the joint grooves shall be inspected for spalling. Any spalling which increases the specified size of the joint groove beyond the following limits shall be repaired by patching with epoxy mortar:

1. spalls over 1/4 inch wide and over 1/2 inch below the surface of the pavement;
2. spalls over 1/4 inch wide and 2 inches or more in length, regardless of the depth of spall below the surface of the pavement.

The epoxy mortar shall be composed of an epoxy adhesive and sand.

Patching of spalls shall be done only when the air and pavement temperatures are over 50°F and rising. The concrete shall be cleaned and dry at the time of placing the epoxy adhesive mortar. After the epoxy adhesive is thoroughly mixed, the dry sand shall be blended into the mixture to give an epoxy mortar of stiff or trowelable consistency. All loose concrete shall be removed from the spalled area and the surface thoroughly cleaned by sandblasting. A suitable insert shall be placed in the joint groove or against the pavement edge to form the face of the spalled patch. After cleaning, the spalled surface shall be primed with a brush application of freshly mixed epoxy adhesive. Immediately after priming, the epoxy mortar of troweling consistency shall be placed in the spalled area and finished as the original pavement surface. Dry sand shall be sprinkled onto the fresh epoxy mortar

surface to eliminate any gloss. After the epoxy mortar has cured sufficiently to prevent damage during sealing operations, the insert shall be carefully removed using an abrasive blade to bring the repaired section to the proper width.

After the final cleaning of the joints, the preformed elastomeric compression seal as shown on the Contract Drawings shall be placed in the joint grooves by a machine of an approved design. The machine shall apply the lubricant-adhesive to the sealer or sides of the joint and compress the material before placing the material in the joint grooves. The lubricant-adhesive shall be applied evenly to both sides of the sealer. Care shall be taken to assure that the proper amount of lubricant-adhesive is used. The joint sealer shall be free from any curling or twisting during the installation in the joint grooves. All longitudinal joints shall be sealed first, followed by the sealing of the transverse joints.

Prior to installation of the transverse joint sealer, the longitudinal sealer shall be cut to permit installation of the transverse sealer. No gaps will be permitted at any intersections of longitudinal and transverse joint sealer. Splicing of transverse joint material will not be permitted. The transverse joint sealer shall be installed extending approximately 1 inch beyond the edges of the pavement. Extreme care must be taken in the installation of joint sealers to prevent stretching during installation. Provisions shall be made for determining the length of the sealer in a given length of joint. If stretching occurs in excess of 5 percent, the seal shall be removed and replaced. Any lubricant-adhesive on the top of the installed joint shall be carefully removed. The method of joining longitudinal joint sealer will be approved by the County Engineer.

Q. Protection of Pavement

The Contractor shall erect and maintain suitable barricades and employ watchpersons, as required, to exclude traffic from the newly constructed pavement for the period herein prescribed. These barriers shall be arranged so that they will not interfere with or impede public traffic on any lane intended to be kept open, and necessary signs shall be maintained by the Contractor clearly indicating the open lanes to the public. When it is necessary to provide for traffic across the pavement, the Contractor shall construct at the Contractor's entire expense immediately after the finishing of the concrete the necessary bridges over the pavement, clear of the forms and at least 3 inches clear of the concrete and sufficiently strong to carry the traffic. The Contractor shall maintain these bridges for a period of 3 days after which time the Contractor can remove same and cover the concrete with a 6 inch mat of earth which must be maintained for the full depth until the concrete has attained the required strength.

The Contractor shall have on hand at the paving site sufficient plastic or curing paper to cover at least 6000 square feet of freshly laid pavement as a protection against sudden thunder showers or heavy downpours of rain.

The Contractor shall protect the pavement against damage from all causes, including public traffic or traffic produced by the Contractor's own equipment or employees.

Heavy grading equipment shall not be operated on the finished pavement at any time, except that the County Engineer may grant special permission for the equipment to cross over the pavement at designated locations; and at those locations, the pavements shall be covered with a layer of earth free from rocks and large stones and having a minimum thickness of 6 inches. The grading equipment shall be operated only on the earth covered sections. The construction and use of the crossings will not be permitted until after the

pavement concrete has attained the strength required.

Any part of the pavement damaged by traffic or other causes prior to its final acceptance shall be repaired or replaced by and at the expense of the Contractor in a manner satisfactory to the County Engineer.

R. Opening to Traffic

The pavement may be used for vehicular traffic after having attained a splitting tensile strength of 300 psi. Testing of field samples shall conform to AASHTO T23.

02651.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02651.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Plain or Reinforced Portland Cement Concrete Pavements

RESERVED FOR FUTURE USE

SECTION 02652

CONTINUOUSLY REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

02652.01 GENERAL

A. Description

Continuously reinforced Portland cement concrete pavements shall include, but not necessarily be limited to the construction of continuously reinforced Portland cement concrete pavements on a prepared subgrade or base in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Subgrade preparation; Section 02610.
2. Chemically treated subgrade; Section 02611.
3. Aggregate base and subbase courses; Section 02621.
4. Stabilized aggregate base course; Section 02622.
5. Soil-cement base course; Section 02623.
6. Plain and reinforced Portland cement concrete pavements; Section 02651.
7. Portland cement concrete; Section 03310.

C. Quality Assurance

1. Materials

The County Engineer will inspect all materials and equipment to ensure compliance with the Contract Documents.

2. Field Tests

- a. Concrete Tests

The Contractor will conduct normal concrete job control tests, i.e. slump and air content, on the plastic concrete and will prepare test cylinders in accordance with Section 03310.01.

- b. Forms

The County Engineer will inspect all forms prior to the placing of concrete

in accordance with Section 02651.03.

c. Finished Surface

The finished surface of the slab shall be checked in the longitudinal and transverse directions with a 10 foot straightedge, equipped with a 1/8 inch high block on each end. (For slabs on vertical curves, the longitudinal checking template shall be advanced longitudinally in steps not greater than 5 feet). If any portion of the slab deviates more than 1/8 inch tolerance previously stipulated, the corrective work shall be done at the Contractor's expense. Any slabs which are found to have less thickness than that shown on the Plans may be rejected. Also see Section 02651.03, Article L.

d. Tolerance of Thickness

After the pavement is placed and before final acceptance, the thickness will be determined by use of cores cut from the pavement. Also see Section 02651.01.C.2.d.2.

The County will not be liable for excess thickness. When the thickness of a pavement is deficient by more than 1.00 inch, the full section between limits established by the County Engineer shall be removed and replaced by the Contractor at the Contractor's expense. Core drilling and repairing of the replaced pavement shall be at the Contractor's expense.

D. Submittals

1. Shop Drawings

- a. Shop drawings for Portland cement concrete shall be submitted as specified in Section 03310.01.
- b. The Contractor shall submit shop drawings in accordance with the "General Provisions" for all chairs or high chair bars the Contractor intends to use.

2. Certificate of Compliance

Certified load tickets shall be furnished by the Portland cement concrete producer and delivered to the County Engineer. The certified ticket shall state that all materials comply with pertinent specifications and the mix is proportioned in accordance with the specified mix design.

3. Certified Test Results

a. High Range Water Reducing Admixtures

The manufacturer shall supply the actual laboratory test results conducted in accordance with these specifications. For control purposes, the manufacturer shall also furnish curves giving the fluid ounces of high range water reducer per 100 pounds of cement as related to water reduction and strength gain for 12 hours when used with a cement factor of a minimum of 700 pounds.

b. Joint Filler

The manufacturer shall submit a complete certified analysis for all hot applied joint fillers.

c. Epoxy Resin Adhesives

The Contractor shall provide a certificate containing the pot life and actual test results showing the material meets the requirements of this specification. Should the manufacturing process or materials change, a new sample and certification are required for approval of the system.

d. Waterstops

The Contractor shall furnish without charge a test sample for each lot or shipment of waterstop. The supplier of the waterstop shall furnish a certified copy of the actual test results showing that the material meets the specification requirements.

e. Bituminous Sealer

The supplier shall furnish a certified copy of the test results showing that the bituminous sealer meets the following requirements:

<u>Test and Method</u>	<u>Specification Limits</u>
Residue by evaporation, nonvolatile matter, ASTM D 2939, % min	70
Inorganic filler on ignition, ASTM D 2939, ash content %	15-45

02652.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for continuously reinforced Portland cement concrete pavements.
2. The Contractor may obtain water from the County's potable water system in accordance with current County policies and procedures. The Contractor shall contact the Department of Fiscal Services, Meter Section, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

1. The Contractor may make such substitutions as permitted in Section 02651.02.
2. The Contractor may select either deformed steel bar mats, loose deformed steel bars, or welded deformed steel wire fabric for reinforcement.

C. Detailed Material Requirements

1. General

Materials shall meet the requirements of Section 02651.02.

2. Reinforcement

All reinforcement shall be fabricated, lapped, and tied as shown on the Plans and shall consist of:

a. Deformed Steel Bar Mats

Deformed steel bar mats conforming to Section 02651.02.C.11.e. The longitudinal bars shall be No. 5, Grade 60, and the transverse bars shall be No. 4, Grade 60.

b. Loose Deformed Steel Bars

Loose deformed bars conforming to Section 02651.02.C.11.a. The longitudinal bars shall be No. 5, Grade 60, and the transverse bars shall be No. 4, Grade 60. The longitudinal bars shall have a minimum length of 40 feet.

c. Welded deformed steel wire fabric conforming to Section 2651.02.C.11.d.

3. Chairs

Chairs or high chair bars shall be designed to support the reinforcement in position without deflection or displacement during the placing and consolidation of the concrete. Chair bases shall have sufficient bearing to prevent overturning or penetration into the subgrade. The design of the chairs shall not impede the placing of the concrete. The Contractor shall obtain the County Engineer's approval for the type of chair or high chair bar the Contractor intends to use.

02652.03 EXECUTION

A. General

The construction shall be in accordance with Section 02651.03 except as modified hereafter.

B. Placing Reinforcement

The reinforcement shall be preset on chairs or high chair bars with the transverse members placed down. Placement of the longitudinal bars shall be within the tolerances shown on the Plans when measured from the top of the pavement to the bottom of the bar.

Rust, mud, oil, or other coatings which may reduce bonding shall be removed before placing the concrete. The reinforcement shall be handled with care to keep it flat and free from distortions. Loose steel bars shall be free from kinks or bends that may prevent them from being properly assembled or installed.

Chairs and high chair bars shall not be set so close to the longitudinal bars as to make placing and consolidation of the concrete through the space difficult. Welding of chairs to the transverse bars will be permitted. If the support system does not hold the reinforcement within the specified tolerances, the Contractor will be required to increase the number of chairs or take other steps to assure proper positioning of the steel.

C. Placing Concrete

Concrete shall be placed in one lift, and care shall be exercised to consolidate it for the full depth.

The concrete shall be internally vibrated over its full width and depth by immersion vibrators mounted at intervals, not to exceed 30 inches center to center, across the full width of the slab being placed. The vibrators shall be operated at a frequency and an amplitude sufficient to be perceptible on the surface of the concrete more than 1 foot in any direction and shall be equipped to provide variable controlled frequencies. The battery of vibrators shall advance longitudinally with the paving machinery. The vibrators shall be hinge mounted to facilitate riding up over any obstruction such as transverse joint assemblies, reinforcement, etc. The vibrators shall be set at a depth of 3 ½ inches from the top surface.

The County Engineer may require the surface to be vibrated with a pan-type vibrator or vibrating screed prior to the passage of the finishing screed.

All screeding and vibrating operations shall stop immediately whenever forward motion of the paving machinery is stopped.

D. Joints

No transverse expansion or contraction joints will be permitted in continuously reinforced pavement. Transverse construction of bulkhead joints shall be formed only at the end of any working period or when necessary to stop concreting operations for more than 30 minutes. They shall be formed with an approved header board in accordance with the cross section of the pavement, placed at right angles to the center line and perpendicular to the surface. Additional bars meeting the requirements of Section 02652.02 shall be furnished and installed as shown on the Plans. The pavement shall be finished to the header board without edging. These joints shall be made with extreme care and the bulkhead kept clean. The roadway reinforcement shall extend continuously through the joint. The reinforcement extending through the joint must be securely supported on chairs or wooden sills to prevent it from deflecting during paving operations and disturbing the fresh concrete. Adequate support is also necessary to prevent the concrete from being damaged when the header board is removed.

A minimum of 12 hours shall elapse before work is resumed. The bulkheads and all debris shall be removed, and the joint shall be cleaned before placing concrete against it.

E. Terminal Joints

Terminal joints shall be constructed as shown on the Plans.

02652.04 METHOD OF MEASUREMENT

A. Continuously Reinforced Portland Cement Concrete Pavement

RESERVED FOR FUTURE USE

B. Terminal Joints

RESERVED FOR FUTURE USE

A. General

RESERVED FOR FUTURE USE

B. Continuously Reinforced Portland Cement Concrete Pavement

RESERVED FOR FUTURE USE

C. Terminal Joints

RESERVED FOR FUTURE USE

SECTION 02660

SIDEWALKS

02660.01 GENERAL

A. Description

Sidewalk construction shall include, but not necessarily be limited to, the construction of Portland cement concrete, or bituminous concrete sidewalks as shown on the Plans on an approved surface, to the lines and grades, at the locations shown on the Plans and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Bituminous concrete pavement; Section 02641.
2. Portland cement concrete; Section 03310.

C. Quality Assurance

1. Quality assurance requirements for Portland cement concrete shall be as specified in Section 02651.01.
2. Quality assurance requirements for bituminous concrete shall be as specified in Section 02641.01.

D. Submittals

1. Submittals for Portland cement concrete sidewalk shall be as specified in Section 02651.01.
2. Submittals for bituminous concrete sidewalks shall be as specified in Section 02641.01.

02660.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for sidewalks.
2. The Contractor may obtain water from the County's potable water system in accordance with current County policies and procedures. The Contractor shall contact the Department of Fiscal Services, Meter Section, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Portland Cement Concrete

Portland cement concrete shall be Mix No. 2 as specified in Section 03310.

2. Form Release Compounds

Form release compounds shall effectively prevent the bond of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds will be tested in accordance with MSMT 503.

The flash point of the material shall not be less than 100⁰F when tested in accordance with AASHTO T 73.

3. Prefomed Joint Fillers

Prefomed joint fillers shall be as specified in Section 02651.02.

4. Curing Material

Curing material shall be as specified in Section 02651.02.

5. Bituminous Concrete

a. Bituminous concrete for sidewalks shall be manufactured in accordance with Section 02641.01.

b. Bituminous concrete shall be B.I. gradation meeting the requirements of Section 02641.02.

6. Welded Wire Fabric

Welded steel wire fabric shall be as specified in Section 02651.02.

7. Roofing Paper

Refer to Section 911.07 of the "MSHA Standard Specifications for Construction and Materials (1993)".

02660.03 EXECUTION**A. General**

1. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of forms. The foundation shall be shaped and compacted to a firm, even surface in accordance with the section shown on the Plans. All soft

and unsuitable material shall be removed and replaced with suitable material. Unless otherwise specified, the thickness shall be 4 inches.

2. The subgrade shall be compacted to 92% maximum density as determined by AASHTO T 180, Method A, after which it shall be accurately trimmed to the proper shape and required grade.

B. Portland Cement Concrete Sidewalks

1. Forms may be either steel or wood and shall extend to the full depth of the concrete. All forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without displacement. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal. Before concrete is placed against the forms, they shall be thoroughly cleaned and coated with a form release compound each time they are used. Forms shall not be stripped until the concrete has set for at least 12 hours, and every precaution shall be taken to avoid damaging the concrete.
2. Slip-form construction shall meet the requirements for the slip-form method specified in Section 02721.03 except that joint construction shall be in accordance with Paragraph 5 of this Article.
3. When the subgrade is dry, it shall be moistened with as much water as it can absorb. The concrete shall be mixed in accordance with Section 03310.03. Volumetric batching and continuous mixing will be permitted on this work. Concrete shall be deposited on the subgrade in successive batches to the full width of the sidewalk. It shall be thoroughly spaded along the edges and shall be tamped to eliminate voids. It shall be struck off with an approved screed to the elevation of the top of the forms and then be floated with a wooden float.
4. The surface shall have a broomed finish. No plastering of the surface will be permitted. All outside edges and all joints shall be edged with a 1/4 inch edging tool.
5. Joints shall be placed as indicated on the Plans. Dummy joints shall be formed by a jointing tool or other acceptable means and shall extend into the concrete at least 3/4-inches deep. Joints shall match as nearly as possible adjacent joints in curb or pavement. Expansion joint material shall extend the full depth of the concrete.
6. Concrete shall be cured in accordance with Section 02651.03. For cold weather protection refer to Section 520.03.02 of the "MSHA Standard Specifications for Construction and Materials (1993)". During the cure period, all pedestrian and vehicular traffic shall be excluded.

C. Bituminous Sidewalks

Bituminous sidewalks shall be constructed in accordance with the following requirements:

1. Bituminous concrete shall be placed in accordance with the requirements of Section 02641.03.
2. Compaction shall be accomplished by means of a roller approved by the County

Engineer. In areas inaccessible to the roller, a vibrating plate compactor or hand tamping will be permitted. In any case, the bituminous sidewalk material shall be uniformly compacted. Compactive effort shall start as soon as the bituminous concrete can be compacted without displacement. Compactive effort shall continue until the material is thoroughly compacted and all surface marks have disappeared.

3. Where the sidewalk is not adjacent to curbs or other structures, backfill material approved by the County Engineer shall be used to form an earth shoulder for the bituminous concrete for a width of 18 inches and/or in compliance with the typical cross section of improvement. This backfilling shall be done in accordance with the requirements of Section 02265.03.

02660.04 METHOD OF MEASUREMENT**A. Portland Cement Concrete Sidewalk**

RESERVED FOR FUTURE USE

B. Bituminous Concrete Sidewalk

RESERVED FOR FUTURE USE

02660.05 BASIS OF PAYMENT**A. General**

RESERVED FOR FUTURE USE

B. Portland Cement Concrete Sidewalk

RESERVED FOR FUTURE USE

C. Bituminous Concrete Sidewalk

RESERVED FOR FUTURE USE

SECTION 02670

CURB, COMBINATION CURB AND GUTTER, DRIVEWAY APRONS, AND MONOLITHIC MEDIAN

02670.01 GENERAL

A. Description

This work shall include, but not necessarily be limited to, the construction of concrete curb, concrete combination curb and gutter, driveway aprons, concrete monolithic median, and bituminous concrete curb to the lines and grades and at the locations shown in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Bituminous concrete pavement; Section 02641.
2. Portland cement concrete; Section 03310.

C. Quality Assurance

1. Quality assurance requirements for Portland cement concrete shall be as specified in Section 02651.01.
2. Quality assurance requirements for bituminous concrete shall be as specified in Section 02641.01.

D. Submittals

1. Submittals for Portland cement concrete curb, combination curb and gutter, driveway aprons and monolithic median shall be as specified in Section 02651.01.
2. Submittals for bituminous concrete curb shall be as specified in Section 02641.01.

02670.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for curb, combination curb and gutter, driveway aprons, or monolithic median.
2. The Contractor may obtain water from the County's potable water system in accordance with current County policies and procedures. The Contractor shall contact the Department of Fiscal Services, Meter Section, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

The Contractor may furnish either SN or ST gradation for bituminous concrete curb.

C. Detailed Material Requirements

1. Portland Cement Concrete

Portland cement concrete shall be Mix No. 2 as specified in Section 03310.

2. Reinforcing Steel

Reinforcing steel shall be bar reinforcement or welded steel wire fabric as noted in the Contract Documents. Bar reinforcement and welded steel wire fabric shall be as specified in Section 02660.02.

3. Preformed Joint Filler

Preformed Joint filler shall be as specified in Section 02651.02.

4. Form Release Compound

Form release compound shall be as specified in Section 02660.02.

5. Curing Materials

Curing materials shall be as specified in Section 02651.02.

6. Bituminous Concrete

a. Bituminous concrete for curbs shall be manufactured in accordance with Section 02641.01.

b. Bituminous concrete shall be SC aggregate gradation meeting the requirements specified in Section 02641.02.

02670.03 EXECUTION

A. Excavation

Excavation shall be made to the required depth and the subgrade shaped and adequately compacted at the required elevation. All soft and unsuitable material shall be removed and replaced with suitable material.

B. Concrete Curb, Combination Curb and Gutter, Driveway Aprons and Monolithic Median

Concrete curb, combination curb and gutter, and monolithic median may be constructed by either the slip-form or conventional fixed form method. Driveway aprons shall be constructed using fixed form method. The subgrade shall be compacted to 97 percent of the maximum dry density in conformance with T180, Method A.

1. Fixed Form Method

The conventional fixed form method shall use forms made of steel of an approved design, securely fastened and braced to prevent any movement during the placing of concrete. Forms shall extend to the full depth of the concrete. They shall be not less than 10 feet long. When installation is made along curves where the radius of the curb face is less than 200 feet, form sections shall be not more than 6 feet long; and flexible or curved steel or wooden forms shall be used. Both wooden and steel forms shall be properly designed, approved by the County Engineer, and installed so as to resist all working stresses without buckling or warping. The condition and the stability of the forms shall be such as will produce a concrete curb, combination curb and gutter, driveway aprons, or monolithic median that meets the required tolerance of deviations not exceeding $\frac{1}{4}$ inch in 10 feet in either grade or alignment. Before concrete is placed against the forms, they shall be thoroughly cleaned and coated with form release compound each time they are used.

a. Concreting

Volumetric batching and continuous mixing will be permitted on this work. When the subgrade is dry, it shall be moistened with as much water as it can absorb. Consolidation of concrete placed in the forms shall be by vibrating or other methods approved by the County Engineer. Except for curb face forms, the forms shall remain in place for a minimum of 12 hours; and every precaution shall be taken to avoid damaging the concrete. Curb face forms may be stripped as soon as the concrete will retain its shape.

b. Drainage Openings

Where indicated in the Contract Documents or directed by the County Engineer, drainage openings shall be provided through the curbing by means of inserts approved by the County Engineer of the size required. At entrances, sidewalk ramps, and elsewhere as directed by the County Engineer, curbs shall be depressed as indicated on the Plans or directed by the County Engineer.

c. Joints

Joints shall be constructed in 10-foot sections except where shorter sections are necessary for closures and conformity to expansion and contraction joints in contiguous concrete pavements. No section shall be shorter than 4 feet. The joints shall be formed by using plate steel templates which are $\frac{1}{8}$ inch to $\frac{3}{16}$ inch in thickness and shall have a width and depth equal to the unit cross section. The templates shall be set perpendicular to the grade and line of the unit specified. No intermediate templates or sections of templates will be permitted within the 10 foot section. Where stationary structures such as bridges, inlets, etc. are encountered, an expansion joint shall be constructed for the full depth using $\frac{1}{2}$ inch preformed expansion joint material. Expansion joints shall be constructed at a maximum of 100 feet, and at points of curvature, tangents and at locations coinciding with adjoining pavement joints. Expansion joints are not required when adjacent to a flexible pavement or away from any pavement. Only the joints in the

gutter portion of the combination curb and gutter and 1-inch up the face of all joints and expansion joints of monolithic medians shall be sealed.

d. Finishing

Concrete shall be struck off to the cross section specified after which it shall be finished, floated smooth and followed with a broom type textured finish. For the purpose of matching adjacent concrete finishes or for other reasons, the County Engineer may permit other methods of finishing. Plastering will not be permitted. All exposed edges shall be edged with a 1/4 inch edging tool except the face edge of curb shall have a 1-inch radius. When finished, the top surface of curbs and medians as well as the faces shall show no deviation from grade and alignment in excess of 1/4 inch in 10 feet. All honeycomb and damaged areas shall be repaired to the satisfaction of the County Engineer immediately after the removal of the forms.

2. Slip-Form Method

Slip-form construction shall meet the requirements for the slip-form method specified in Section 02721.03 except that joint spacing shall be in accordance with Item C of the previous paragraph.

3. Curing

Concrete shall be cured in accordance with Section 03310. It shall be protected from cold weather in accordance with Section 02651.03.

C. Backfill

After the forms have been stripped and any necessary repairs are satisfactorily completed, the spaces in front and back of the curb, combination curb and gutter, driveway aprons and median shall be backfilled to the required elevations using suitable material. It shall be consolidated to the satisfaction of the County Engineer. Backfilling shall be satisfactorily completed prior to any adjacent roadway rolling.

D. Bituminous Concrete Curb

Bituminous concrete curb shall be placed by a self-propelled automatic curb machine.

The machine shall form curbing that is uniform in texture, shape, density, and to a template as indicated in the Contract Documents.

The base upon which the curb is to be placed shall be clean, dry, and stable. It shall be tack coated with bituminous material of the type and amount as directed by the County Engineer.

When required, the curb shall be backfilled after it has sufficiently hardened to prevent damage. The backfill shall be consolidated by tamping or rolling.

02670.04 METHOD OF MEASUREMENT

A. General

RESERVED FOR FUTURE USE

B. Portland Cement Concrete Curb and Combination Curb and Gutter

RESERVED FOR FUTURE USE

C. Portland Cement Concrete Monolithic Median

RESERVED FOR FUTURE USE

D. Bituminous Concrete Curb

RESERVED FOR FUTURE USE

E. Portland Cement Driveway Aprons

RESERVED FOR FUTURE USE

02670.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Portland Cement Concrete Curb and Combination Curb and Gutter

RESERVED FOR FUTURE USE

C. Portland Cement Concrete Monolithic Median

RESERVED FOR FUTURE USE

D. Bituminous Concrete Curb

RESERVED FOR FUTURE USE

E. Portland Cement Concrete Driveway Aprons

RESERVED FOR FUTURE USE

SECTION 02680
PATCHING PAVEMENT

02680.01 GENERAL

A. General

Patching pavement shall include, but not necessarily be limited to, the removal of existing pavements with and in reasonably close conformity with the lines, grades, and typical sections shown on the Contract Documents or as directed by the County Engineer.

B. Related Work Included Elsewhere

1. Removal of existing pavement; Section 02160.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Subgrade preparation; Section 02610.
4. Bituminous concrete pavements; Section 02641.
5. Plain and reinforced Portland cement concrete pavements; Section 02651.

C. Quality Assurance

1. Quality assurance requirements for subgrade preparation shall be as specified in Section 02250.01 and Section 02610.01.
2. Quality assurance requirements for bituminous concrete pavement shall be as specified in Section 02641.01.
3. Quality assurance requirements for Portland cement concrete pavement shall be as specified in Section 02651.01.

D. Submittals

1. Submittals for aggregate base materials shall be as specified in Section 02621.01.
2. Submittals for bituminous concrete pavement shall be as specified in Section 02641.01.
3. Submittals for Portland cement concrete pavement shall be as specified in Section 02651.

02680.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for patching pavement.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Aggregate

Aggregate for pavement base shall meet the gradation requirements for ASTM D 2940, Graded Aggregate Subbase as specified in Section 02621.02.

2. Portland Cement Concrete

Portland cement concrete shall be Mix No. 7 as specified in Section 03310.

3. Bituminous Concrete

Bituminous concrete shall be as specified in Section 02641.02.

02680.03 EXECUTION**A. Preparation**

1. The existing pavement that has been designated for removal shall be broken and removed. During the removal, care shall be exercised to leave the undisturbed portion of the existing pavement with neatly trimmed vertical edges. The underlying subgrade shall be trimmed as directed, refilled if necessary, uniformly compacted, and brought to a suitable subgrade to receive the patch.
2. For trench patching, the existing pavement shall be cut back from the edge of the trench in a neat line in accordance with the appropriate Standard Detail.
3. Unless otherwise directed by the County Engineer, the removed pavement materials shall be disposed of off site by the Contractor.

B. Concrete Patches

Portland cement concrete patches shall meet the following requirements:

1. Forms shall be in accordance with the requirements of Section 02651.03, Article C and/or as directed by the County Engineer. Forms are to overlap the existing pavement on each side of the patch for a minimum of 1 foot and be securely fastened so as not to move when the concrete is placed.
2. Volumetric batching and continuous mixing will be permitted on this work.

3. When the subgrade is dry, it shall be sprinkled with as much water as can be readily absorbed immediately in advance of placing the concrete. The concrete shall be deposited on the subgrade in such a manner as to require as little handling as possible. The use of rakes to move the concrete is prohibited. Metal chutes shall be used in placing the concrete, and a free fall of more than 3 feet will not be permitted. The concrete shall be consolidated using tampers, spades, and other methods acceptable to the County Engineer. It shall be struck off by methods acceptable to the County Engineer. Unless otherwise specified, the final surface finish shall be textured using either burlap drag or the broom method. The edges of the patch shall be edged using a 1/4 inch edging tool.
4. Joints shall be constructed to coincide with those in the adjoining pavement and as may be specified in the "Special Provisions." Joints shall be sealed in accordance with Section 02651.03, Article P.
5. The placement of reinforcement shall meet the requirements of Section 02651.03 and 02652.03.
6. Concrete shall be cured in accordance with Section 02651.03, Article M.
7. Concrete shall be protected from traffic and meet the requirements of cold weather concreting in accordance with Section 02651.03.
8. Compressive strength requirements for opening the patches to traffic will be specified in the "Special Provisions."

C. Bituminous Concrete Patches

Bituminous concrete patches shall meet the requirements of Section 02641.03. The spreading, finishing, and compaction methods will be subject to the approval of the County Engineer.

02680.04 METHOD OF MEASUREMENT

A. General

RESERVED FOR FUTURE USE

B. Portland Cement Concrete Pavement Patch

RESERVED FOR FUTURE USE

C. Bituminous Concrete Pavement Patch

RESERVED FOR FUTURE USE

02680.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

PATCHING PAVEMENT

02680-4

B. Portland Cement Concrete Pavement Patch

RESERVED FOR FUTURE USE

C. Bituminous Concrete Pavement Patch

RESERVED FOR FUTURE USE