

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

400.00 BASES

401.00 GENERAL REQUIREMENTS FOR SURFACES

401.01 DESCRIPTION. This Section covers requirements common to all or designated types of surface construction.

401.02 MATERIALS. Materials as required for construction of the various surface types shall meet the requirements set forth in the appropriate Subsections of Section 700 – Materials. The particular Subsection is designated under materials for each surface type.

401.03 EQUIPMENT.

A. *Distributors and Supply Tanks.* The distributor shall be so designed, equipped, maintained and operated that bituminous material at uniform heat may be applied uniformly on variable widths of surface up to 26 feet at readily determined and controlled rates from 0.1-1.0 gallon per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.03 gallons per square yard.

Distributor equipment shall include a tachometer, pressure gauges, accurate volume metering devices or a calibrated tank, and thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

The distributor shall be equipped with a positive shut-off valve and fittings as needed to prevent the spray bar or other mechanisms from dripping bituminous material. Distribution of the bituminous material shall be so regulated, and sufficient material left in the distributor at the end of each application to insure a uniform distribution of bituminous material. In no case shall the distributor be allowed to blow. The angle of the spray nozzles and height of the spray bar shall be frequently checked and adjusted to insure uniform distribution of the bituminous material. Drilling, clogging, or streaking of the bituminous material is not an acceptable application of the material and corrective measures shall be taken by the Contractor before distribution is resumed.

A check of distribution rate and uniformity of distribution shall be made when directed by the Engineer.

Supply tanks shall meet the requirements of AASHTO M-156 Section 3.

B. *Compactors.* Rollers shall be steel wheel, pneumatic tire, vibratory or a combination of these types, as the Contractor may elect. They shall be in good condition, capable of reversing without backlash, and shall be operated at

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speeds slow enough to avoid displacement of the bituminous mixture. Vibratory rollers shall be equipped with amplitude and/or frequency controls specifically designed for compaction of the material on which it is to be used. The type, number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which crushes the aggregate will not be permitted.

401.04 CONSTRUCTION METHODS.

A. Tolerances. In order to provide a surface course or courses of acceptable smoothness, width and thickness, reasonable accurate control shall be maintained in placing, spreading, finishing and compacting of surface courses. The Contractor shall use equipment as may be required to provide acceptable construction within the prescribed tolerances.

		TOLERANCES	
SURFACE TYPE	SECTION	SURFACE	THICKNESS
Asphalt Surface (Hot Mix-Cold Laid)	405	3/16 inch in 10 ft.	Reasonable conformity w/the Plans
Plant Mix Asphalt Concrete Pavement	411	1/8 inch in 10 ft.	Same as Above
P.C. Concrete Pavement	414	1/8 inch in 10 ft.	See Section 414

All pavement will be subject to straightedge inspection during construction operations.

Testing with a 10-foot straightedge or other approved device for compliance with specified surface tolerances will be made by the Engineer at selected locations. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed the specified tolerance. Humps or depressions exceeding the specified tolerance shall be corrected in an acceptable manner.

B. Prime Coat. Prime coat shall meet the requirements of Section 408.

C. Tack Coat. Tack coat shall meet the requirements of Section 407.

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403.00 TRAFFIC BOUND SURFACE COURSE

403.01 DESCRIPTION. This work shall consist of a surface course composed of hard durable particles of sand, gravel, mine chats, crushed stone or disintegrated granite of the type shown on the Plans or in the Proposal, constructed on the prepared sub-grade in accordance with these Specifications and in reasonable close conformity with the lines, grades and typical cross-sections shown on the Plans or established by the Engineer.

403.02 MATERIALS. Materials shall meet the requirements specified in Subsection 703.03.

Materials to be used in driveways, detours and incidental areas may be selected by the Contractor provided it meets the requirements specified above.

403.04 CONSTRUCTION METHODS.

A. Preparation of Sub-grade. Prior to placing the surfacing material on the roadbed, the sub-grade shall have been completed according to the requirements of Method A of Section 310 (Sub-grade) of these Specifications for Types A, B and D, and Method B of Section 310 (Sub-grade) for Type C.

B. Hauling and Placing. The surfacing material shall be transported and delivered in approved vehicles.

The material shall be deposited in windrows on the shoulders. The Contractor shall be responsible for its uniform distribution throughout the length of each station, unless other methods are approved by the Engineer. The windrow shall be formed on the same day the material is hauled.

C. Shaping and Maintenance. Material placed in driveways and incidental areas adjacent to the roadway shall be properly shaped and compacted in a manner approved by the Engineer.

Holes, waves and undulations which develop shall be corrected by blading and by adding more material from the windrow. The shaping of the surface material shall be continued until it is well-compacted, free from ruts, waves, and undulations and conforms to the cross-section shown on the Plans and until final acceptance.

Excess material not required for maintenance shall be removed and stockpiled at a place approved by the Engineer.

D. Traffic Control. The road shall not be closed to traffic during this construction work. The Contractor shall so carry on his operations so as to interfere the least possible with the movement of traffic, and he shall maintain sufficient warning signs and lights as required to safeguard against accidents.

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Windrows or piles of material shall not be left on the traveled roadway overnight but must be placed on the shoulders.

403.05 METHOD OF MEASUREMENT. Traffic bound surface course will be measured by the ton. All moisture in excess of 5 percent oven dry weight will be deducted.

403.06 BASIS OF PAYMENT. Accepted quantities of traffic bound surface course, measured as provided above, will be paid for at the contract unit price for:

- | | | |
|-----|--------------------------------------|-----|
| (A) | Traffic Bound Surface Course, Type A | Ton |
| (B) | Traffic Bound Surface Course, Type B | Ton |
| (C) | Traffic Bound Surface Course, Type C | Ton |
| (D) | Traffic Bound Surface Course, Type D | Ton |
| (E) | Traffic Bound Surface Course, Type E | Ton |

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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405.00 ASPHALT SURFACE COURSE (HOT MIX-COLD LAID)

405.01 DESCRIPTION. This work shall consist of a surface course or leveling course composed of a mineral aggregate uniformly coated with bituminous binder in a stationary plant and laid on an approved base in accordance with these Specifications and in reasonably close conformity with the lines, grades and typical cross-sections shown on the Plans or established by the Engineer.

405.02 MATERIALS. Materials shall meet the requirements specified in Section 708.

Leveling course, when required, shall be of the same material specified for surfacing.

405.04 CONSTRUCTION METHODS.

A. *Weather Limitations.* No asphalt material shall be applied or mixed material laid down and consolidated on a wet surface, when the temperature in the shade is below 50° F or when frost is in the underlying course or foundation.

B. *Preparation of Site and Transportation of Mixtures.* Sites for stockpiles shall be approved by the Engineer. The ground on which the stockpile is to be placed shall be well-drained, cleaned of weeds, grass, loose earth, dust and other foreign material before any asphalt material is placed thereon. The site shall be well drained, smoothed and compacted, by sprinkling and rolling if necessary, to obtain a smooth dense surface from which a maximum amount of material can be reclaimed without being mixed with foreign material.

The material shall be transported to the work in tight vehicles previously cleaned of foreign material. Dispatching of the vehicles shall be so arranged that materials delivered may be placed and shall have received initial compaction in daylight.

C. *Preparation of Base.* Prior to the placing of the asphalt surface course, the base shall be brought reasonably true to the lines, grades and cross-sections shown on the Plans or established by the Engineer.

Material used for this purpose shall conform to the type indicated on the Plans and in the Proposal. Patching material shall be thoroughly bound to the existing base and compacted.

After the base has been patched, the road shall be thoroughly cleaned of dust, clay or other foreign matter.

If the base is asphaltic concrete, brick, portland cement concrete or other type of rigid base course, the surface shall be cleaned thoroughly. This shall include the removal of asphalt patches or excessive joint filler, rich in asphalt or

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volatiles. The clean surface shall then be given a coat of the approved asphalt material.

Where old pavement is shattered or broken to such an extent that it will not provide a suitable foundation, the Engineer will designate the areas to be removed and replaced with approved material indicated on the Plans or in the Proposal. Such work shall be done prior to placing of the tack coat.

Any depressions in this type of old pavement that would tend to increase the thickness of the surface course more than one inch over that specified on the Plans, shall be built up with a leveling course composed of asphalt surface course as specified herein.

When a leveling course is used, a tack coat shall be applied previous to placing leveling course material. No tack coat will be required on this course in advance of surfacing.

D. Prime Coat. Prime coat, if specified, shall meet the requirements of Section 408.

E. Tack Coat. Tack coat, if specified, shall meet the requirements of Section 407.

F. Placing of Bituminous Surface Course. One edge of the asphalt surface course shall be established by a string or wire line in advance of the placing of the material. The material shall be laid only on an approved base course or pavement which has been primed or tack coated as previously specified and is reasonably free of objectionable material and only when the surface of the base course is dry and weather conditions are suitable. Contact surfaces of curbs, structures and joints shall be painted with a thin uniform coating of materials as specified for tack coat. The mixture shall be aerated, if required, and may then be spread in a uniform layer of such depth that after receiving ultimate compaction by rolling the requirements of the typical cross-section will be fulfilled. Hand spreading will be permitted where the mixture is placed on narrow strips or small irregular areas.

G. Compaction. Rolling equipment shall be in good operating condition and of an approved type which will produce a pavement of the required density. Rolling shall start longitudinally at the sides and proceed toward the center of the pavement. Alternate trips of the roller shall be different in length. Rolling or compaction shall continue until the compressed mixture has a density of not less than 95 percent of the laboratory compacted density for the mixture. Final compaction shall be made with steel wheel rollers. The operation of the rollers shall be such as to avoid displacement of the mixture. Adhesion of the mixture to the roller wheels will not be permitted. Necessary precautions shall be taken to prevent the dripping of gasoline, oil, grease or other foreign

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matter on the pavement, either when the rollers are in operation or when standing.

- H. Joints.** Placing of the mixture shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the courses is discontinued or interrupted for an appreciable period and joints shall be formed at such points.

Where joints are to be formed, the previous work shall be cut back so as to expose the full depth of the course.

- I. Surface Tolerances.** Surface tolerance shall be in conformity with Section 401.

- J. Opening to Traffic.** The pavement shall be open to traffic as directed by the Engineer at any time after completion of final compaction, but any damage to the surface prior to final acceptance shall be satisfactorily repaired. If the surface becomes rough or wavy under traffic the Engineer may require the Contractor to loosen the surface, reshape and re-compact as hereinbefore specified.

405.05 METHOD OF MEASUREMENT.

- A.** Asphalt surface course, hot-mix cold laid, will be measured by the ton.
- B.** Prime material, if required, will be measured and paid for in accordance with Section 408.
- C.** Tack coat for rigid bases, painting curbs, headers, etc. will be measured and paid for in accordance with Section 407. When asphalt-emulsion is used, it will be measured for payment before dilution in accordance with Section 407.

405.06 BASIS OF PAYMENT. The accepted quantities, measured as provided above, will be paid for at the Contract unit price for:

(A) Asphalt Surface Course (Hot Mix-Cold Laid) Type HC-1	Ton
(B) Asphalt Surface Course (Hot Mix-Cold Laid) Type HC-2	Ton
(C) Asphalt Surface Course (Hot Mix-Cold Laid) Type HC-3	Ton
(D) Asphalt Surface Course (Hot Mix-Cold Laid) Type HC-4	Ton

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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407.00 TACK COAT

407.01 DESCRIPTION. This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these Specifications and in reasonably close conformity with the lines shown on the Plans or established by the Engineer.

407.02 MATERIALS. Materials shall meet the requirements specified in the following Subsection of Section 700-Materials.

Emulsified Asphalt 708.03

The emulsified asphalt may be diluted as specified or approved by the Engineer.

407.03 EQUIPMENT. Distributors, heating equipment and supply tanks shall meet the requirements of Subsection 401.03.

407.04 CONSTRUCTION METHODS. The existing surface or course shall be clean to the satisfaction of the Engineer before tack coat is placed. The tack coat shall be applied, as directed by the Engineer, at the rate of not to exceed 0.10 gallons per sq. yd. of surface. All contact surfaces of curbs and gutters, manholes, and other structures shall be painted with a thin uniform coat of asphalt material used for the tack coat. In case no tack coat is shown in the Plans, curbs and other structures shall be painted with a thin uniform coating of the approved tack coat material and included in other items of work.

The tack coat shall be applied in such manner as to minimize damage and to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material.

Tack coat shall not be applied during wet or cold weather, when wind drift presents a potential problem to the traveling public or adjacent property, after sunset, or to a wet surface; however, the surface may be damp. Tack coat that is not "covered" the same day may be reapplied at a rate that insures proper adhesion as directed by the Engineer.

The quantity, rate of application, temperature and areas to be treated shall be approved prior to application.

407.05 METHOD OF MEASUREMENT. Tack coat will be measured by the gallon before dilution. Water used in dilution of emulsified asphalt will not be measured for payment.

407.06 BASIS OF PAYMENT. The accepted quantities, measured as provided above, will be paid for at the contract unit price for:

Tack Coat Gal.

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which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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408.00 PRIME COAT

408.01 DESCRIPTION. This work shall consist of preparing an existing surface with bituminous material and blotter material, if required, in accordance with these Specifications and in reasonable close conformity with the lines shown on the Plans or established by the Engineer.

408.02 MATERIALS. Materials shall meet the requirements specified in the following Subsections of Section 700-Materials.

Prime Materials MC-30 or MC-70 708.03

Blotter material, if required, shall meet the requirements of Subsection 402.04.J.

408.03 EQUIPMENT. Distributors, heating equipment and supply tanks shall meet the requirements of Subsection 401.03.

408.04 CONSTRUCTION METHODS.

A. *Weather Limitations.* Bituminous materials shall not be applied when the temperature is below 50° F air temperature in the shade, unless otherwise provided, or when weather conditions would otherwise prevent the proper construction of the prime coat.

B. *Preparation of Surface.* Before priming, the sub-grade, sub-base or base shall be cleaned of loose material and shall be in a condition that maximum penetration of the prime will be obtained.

C. *Priming Sub-grades, Sub-bases or Bases That Are Non-Cohesive.* Subject to the acceptance by the Engineer, when friable or non-cohesive materials are encountered in the surface to be primed, the bituminous material shown on the Plans may be changed to an asphalt emulsion. The bituminous materials shown on the Plans may also be changed to an asphalt emulsion in those areas of the State in which the use of cutback asphalt is prohibited. Sprinkling water with asphalt emulsion added may be used in the final operations of sprinkling, manipulation, shaping and rolling of the sub-grade, sub-base or base. Additional applications may be made if required to form a firm, bonded, working table.

D. *Application of Bituminous Material.* Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread at the approximate rate of 0.1 to 0.4 gallon per square yard as directed by the Engineer. When traffic is maintained, not more than 1/2 of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount. Excess bituminous material shall be removed from the surface. Skipped areas or

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deficiencies shall be corrected.

When traffic is to be maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

Succeeding applications of bituminous materials or other courses shall not be applied until after sufficient time has elapsed to allow both proper penetration and hardening of the prime coat.

E. Application of Blotter Material. If, after the application of the prime coat, the bituminous material fails to penetrate within the time specified and the roadway must be used by traffic, blotter material shall be spread in the amounts required to absorb any excess bituminous material.

408.06 BASIS OF PAYMENT. When indicated on the Plans or required on the project accepted quantities of prime coat shall be included in other items of work, which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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411.00 PLANT MIX ASPHALT CONCRETE PAVEMENT

411.01 DESCRIPTION. This work shall consist of acceptable constructed bituminous mixtures in accordance with these Specifications and requirements for the type of plant mix asphalt concrete under contract. The finished products shall meet the specific requirements of the Contractor's approved mix design, materials gradation, blend of materials, bitumen content, roadway density, and stability, and be in close conformity with the lines, grades, thickness and typical cross-sections shown on the Plans or established by the Engineer. The finished surface shall be free from short wavelength roughness as evidenced by meeting the specification for surface tolerance, non-uniform mat texture and segregation, bleeding or fat spots, surface cracking and poor construction joints.

411.02 MATERIALS. Materials shall meet the requirements of Section 708. The Contractor shall have ample material in the stockpiles at the plant site at the beginning of each day's operation to supply and be used for that day's operation.

Reclaimed asphaltic concrete materials or reclaimed portland cement concrete materials, that have been processed into quality aggregates that meet the requirements of Section 708 of these Specifications, may be used with prior written permission by the Engineer.

411.03 EQUIPMENT.

A. *Mixing Plants.* At all times the Contractor shall have available at the plant site a legible copy of the manufacturer's specifications for the mixing plant and any modifications made to the plant including the manufacturer's tolerances for points of wear effecting the production of bituminous mixtures. Mixing plants shall be inspected and found to be within manufacturer's tolerances, in good working order, and be of sufficient capacity and coordinated to adequately produce the required bituminous mixture. All plants used by the Contractor for preparation of bituminous concrete mixtures shall conform to the requirements of AASHTO M 156 for plants and shall be able to meet the Oklahoma Department of Transportation certification requirements. Batch plants shall be equipped with a mechanical batch counter.

1. *Calibration Charts.* The Contractor shall develop and maintain calibration charts for each cold feed for the job aggregates or other suitable evidence of compliance with the paving mixture Specifications.

B. *Scales.* The bituminous mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. When an approved automatic printer system is used in conjunction with an automatic batching and mixing control system, the printed batch weights may be used in lieu of truck scales. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected and certified as often as the

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Engineer deems necessary to assure their accuracy but not less than once every 6 months.

C. *Bituminous Pavers.* Bituminous pavers shall be in good working order, self-contained, power-propelled units, provided with an activated heated screed, with an approved automatic control device for laying the mixture to the specified slope and grade, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the Plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the Plans.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation and equipped with a distribution system to place the mixture uniformly in front of the screed.

The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.

The Contractor may use an approved strike-off assembly, heated if necessary, provided the finished surface produces the required evenness and uniform texture without tearing, shoving, or gouging the mixture.

D. *Trucks and Transports.*

1. Trucks used for hauling bituminous mixtures shall comply with legal load limits and have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of soap solution, lime solution or other approved material to prevent the mixture from adhering to the beds. Anti-adhesive solutions shall not be allowed to pond in the truck beds. The use of solutions which contain diesel fuel or other contaminating solvents will not be allowed between daily truck deliveries.

Each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

2. Transports used for hauling liquid asphalt materials shall comply with Subsection 708.03.B. The Contractor shall keep a log or diary containing the delivery date, asphalt grade, source, quantity, invoice number and the material hauled in the previous load. This information shall be furnished to the Engineer upon request.

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411.04 CONSTRUCTION METHODS.

A. *Stockpiling Materials.* Delivering and stockpiling of aggregates shall be in accordance with Subsection 106.07.

B. *Preparation of Materials.*

1. The bituminous material and aggregate shall be heated to the temperature specified in Subsection 708.03 and in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.
2. Flames used for drying and heating the aggregate shall be properly adjusted to avoid damage to the aggregate and avoid soot on the aggregate.
3. For plants controlling gradation of hot dry aggregates, the aggregate shall be screened and stored in separate bins.

C. *Mixing.* The aggregates shall be combined in the mixer in the amount of each fraction of aggregates required to meet the approved job-mix formula. The bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job-mix formula. The moisture content of the bituminous mixture at the point of discharge shall not exceed 0.75 percent. Uncoated or non-uniform mixtures will not be accepted.

During daily start-up or shutdown of plant operations, sufficient material shall be wasted to assure that all deliveries to the storage silo or roadway are in compliance with the Specification requirements for the type mixture specified. At any time during the course of producing bituminous mixtures, the Contractor shall not change from one type of mixture to another until the plant has been emptied and the cold feed bins charged with the proper aggregates.

D. *Segregation of Mixture.* Segregation of the mixture will not be acceptable.

E. *Tack Coat.* Tack coat, if required, shall be in accordance with Section 407.

F. *Weather Limitations.* The minimum surface temperature of the foundation course on which asphalt concrete may be laid shall be as shown in the following table.

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Compacted Lift Thickness (Inches)	Surface Temperature (Minimum)
3 or more	40° F
1½ to 3	45° F
Less than 1½	50° F

Asphalt concrete shall not be laid when there is frost in the foundation course. When a strong wind is blowing or conditions otherwise are such that the material becomes chilled to an extent which prevents proper leveling and thorough consolidation, the laying of the asphalt concrete shall be stopped.

G. Spreading and Finishing. The asphalt mixture shall be laid with a paver meeting the requirements of Subsection 411.03 C. and upon an approved surface which is dry. The mixture shall be delivered on the job at an optimum workable temperature which will produce the density herein specified after final compaction. After the optimum workable temperature is determined, it shall not vary more than + 20° F.

The alignment of one edge of the asphalt mixture shall be established by a string or wire line in advance of the placing of the asphalt mixture.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be dumped, spread, raked and luted by hand tools to give the required compacted thickness.

Placing of mixtures shall be as continuous as possible.

Immediately adjacent to curbs, gutters, manholes, and other structures, the wearing course mixture shall be spread uniformly high so that after compaction it will be level with the edges of such structures. Before placing the mixture against them, all contact surfaces of curbs, gutters, headers, manholes, etc., shall be cleaned and painted with a thin uniform tack coat of a type specified herein.

When an unsatisfactory asphalt course is being produced, the Contractor shall immediately make the necessary corrections to obtain a satisfactory surface. If deemed necessary, the Engineer may terminate the lay-down operation until such time as satisfactory performance can be obtained and require that the unsatisfactory material be removed as unacceptable work.

H. Joints. Longitudinal and transverse joints on succeeding lifts shall be staggered approximately 6 inches and made in a careful manner.

The longitudinal joints in the top layer shall be at lane lines.

Well bonded and sealed joints are required. Joints between old and new

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pavements or between successive days' work shall be carefully made in such a manner as to insure a thorough and continuous bond between the old and new surfaces. The edge of the previously laid course shall be cut back to its full depth so as to expose a fresh surface, after which the edge shall be painted with a tack coat and the hot mixture shall be placed in contact with it and raked to a proper depth and grade.

I. *Compaction.*

1. *General.* Compacting and smoothing shall be accomplished by use of self-propelled steel wheel and pneumatic tired compactors. Steel wheeled compactors shall weigh not less than ten tons.

Pneumatic tired compactors shall have at least seven pneumatic tires of equal size and diameter. They shall be constructed so that their total weights shall be varied to produce an operating weight of not less than 3500 pounds per tire. The tires shall be capable of being inflated to at least 110 pounds per square inch (psi) and be spaced so that the gaps between adjacent tires shall be covered by the following tires. Operating tire pressure (after one hour of operation) shall be maintained at 90 to 110 psi with variance in pressure between tires not to exceed 10 psi.

Compactors shall be of adequate number, size and weight and designed and properly maintained so that they are capable of accomplishing the required compaction and shall be operated in accordance with the manufacturer's recommendations.

During compaction, any displacement occurring as a result of the reversing of direction of compactor, or other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care shall be exercised in compaction not to displace the line and grade of the edges of the bituminous mixture. Damage, caused by adhesion of the mixture to the compactors, will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to the compaction equipment, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons or with mechanical tampers. A trench compactor to transmit compression to a depressed area may be used when approved by the Engineer.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced at the expense of the Contractor as unacceptable work.

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2. *Acceptance.*

All lifts 1½ inches or greater in nominal (Plan) thickness including both new construction and overlays will be accepted on the basis of density as specified in Subsection 2.1.

All lifts less than 1½ inches in nominal thickness will be accepted on the basis of compactive effort as specified in Subsection 2.2.

Both new construction and overlays (all thickness) will be tested every 450 tons or 1700 sq. yds. of asphalt, extraction and gradation and stability hveems, and every 600 tons or 2300 sq. yds. for field densities.

Asphaltic concrete immediately behind the laydown machine shall be a minimum of 250° F. The target density of thicker lifts and optimum densities of thinner lifts shall be obtained before the mat temperature of the lift under compaction drops below 180° F.

- 2.1 All lifts 1½ inches or greater in nominal (Plan) thickness. The target density of each lot shall be 94 percent of Maximum Theoretical Specific Gravity at the Job Mix Formula (JMF) asphalt content determined by the most recent specific gravity of the bituminous paving mixture in accordance with AASHTO T209.

The roadway density for each lot will be the average of three separate tests taken randomly within the limits of the area represented by the lot.

- 2.2 All lifts less than 1½ inches in nominal (Plan) thickness. Through the use of test strips and daily monitoring of asphalt placement, the Engineer and Contractor will determine the rolling patterns necessary to obtain optimum compaction. While 94 percent of maximum theoretical density shall be considered the target, acceptance will be based on the Contractor performing as agreed to obtain compaction.

New monitoring and/or test strip shall be required either when ordered by the Engineer or requested by the Contractor under one or more of the following conditions:

- (a) There is a change in the material or mix design.
- (b) There is reason to believe the material being placed or the underlying material has changed significantly.

Compaction shall consist of an established sequence of coverage using specified types, sizes and weights of compactors adjusted as necessary to obtain optimum density.

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The rolling sequence, the type of compactor to be used, and the maximum roller speed shall be as follows:

Rolling Sequence	Type Compaction	Max. Roller Speed (MPH)
Initial	Steel Wheel or Pneumatic Tired	2½
Intermediate	Pneumatic Tired	2½
Finish	Static Steel	3

Changes to the compactive effort shall be made as directed by the Engineer based upon results from monitoring and/or any subsequent test strips.

J. Tolerances.

1. *Surface.* The surface tolerance shall be in conformity with Section 401.
2. *Width and Thickness.* The width shall be in reasonably close conformity with the dimensions shown on the Plans or established by the Engineer.

The thickness of individual courses and the total thickness of the asphalt concrete pavement shall be in reasonably close conformity with the thicknesses shown on the Plans or established by the Engineer.

K. Opening to Traffic. Traffic shall not be permitted on the asphalt concrete pavement until it has received its final rolling and the mat temperature has stabilized.

411.05 METHOD OF MEASUREMENT.

A. Plant mix asphalt concrete pavement including the aggregate, liquid asphalt and other ingredients as specified in the job-mix formula shall be measured by the ton of combined mixture.

B. Tack coat will be measured and paid for in accordance with Section 407.

411.06 BASIS OF PAYMENT. Accepted quantities for plant mix asphalt concrete pavement, measured as provided above, shall be paid for at the contract unit price for:

- | | |
|------------------------------|-----|
| (A) Asphalt Concrete, Type A | Ton |
| (B) Asphalt Concrete, Type B | Ton |
| (C) Asphalt Concrete, Type C | Ton |
| (D) Asphalt Concrete, Type D | Ton |

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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414.00 PORTLAND CEMENT CONCRETE PAVEMENT

414.01 DESCRIPTION. This work shall consist of constructing a jointed pavement composed of portland cement concrete (P.C.C.) with or without reinforcement or continuously reinforced pavement, as specified, on a prepared base course in accordance with these Specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross-sections shown on the Plans or established by the Engineer.

414.02 MATERIALS.

Materials shall meet the requirements specified in the following Subsections of Section 700 – Materials.

Portland Cement Concrete	701
Fly Ash	702
Steel Reinforcement, Dowell Bars & Tie Bars	723

Tie bars which are bent and later straightened to facilitate construction shall conform to:

Deformed Billet-Steel Bars for Concrete Reinforcement	AASHTO M 31	Grade 40
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Steel for wide flange terminal joint steel beams shall meet the requirements of AASHTO M 183. Terminal joint steel beams shall be galvanized in accordance with AASHTO M 111 after fabrication (including end plates and shear studs).

Reclaimed portland cement concrete materials may not be used. The Contractor shall furnish to the City copies of his quality control tests.

414.03 EQUIPMENT. Equipment and tools necessary for handling materials and performing all parts of the work shall be the responsibility of the Contractor as to design, capacity, and mechanical condition. The equipment shall be at the job site sufficiently ahead of the start of construction operations.

A. Plants and Equipment.

1. *General.* The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, hopper, and separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation. All controls, gauges, revolution counters, etc. shall be properly functioning.

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The Contractor shall provide, if requested, documented evidence to The City that the batching plant is producing quality concrete, and that the plant is functioning in proper working order at all times. See AASHTO M 157 Annex "Concrete Uniformity Requirements". The mixing plant shall conform to requirements of AASHTO M 157 as appropriate.

The mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn. The Contractor shall have available at the job site a copy of the manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth.

Storage silos for cement and fly ash shall be properly vented during filling or use.

Plants and scales shall be inspected and certified as often as the Engineer may deem necessary to assure their accuracy but not less than every 6 months.

B. Finishing Equipment.

1. *Finishing Machine.* The finishing machine shall be equipped with at least two oscillating type transverse screeds or other approved methods of striking off the concrete. Rotary type finishing machines will not be accepted, except in areas in accessible to mainline paving equipment. When this type of equipment is approved for use, the finished pavement shall meet the specified paving tolerances.
2. *Vibrators.* Vibrators, for full width vibration of concrete paving slabs, may be the internal type with either immersed tube or multiple spuds. Pan type vibrators, if used, shall be used in conjunction with internal type vibrators. They may be attached to the spreader of the finishing machine, or may be mounted on a separate carriage. They shall not come in contact with the joint, load transfer devices, sub-grade, or side forms. The rated frequency of the surface vibrators shall not be less than 3,500 impulses per minute and the frequency of the internal type shall not be less than 5,000 impulses per minute for tube vibrators and not less than 7,000 impulses per minute for spud vibrators. When spud type internal vibrators, either hand-operated or attached to spreaders or finishing machines, are used adjacent to forms, they shall have a frequency of not less than 3,500 impulses per minute.
3. *Transverse Grooving Machine.* The transverse grooving machine shall be either a vibrating roller or a comb equipped with steel tines. The machine shall be self-propelled and shall automatically lift the roller or tine comb bar near the edge of the pavement to minimize edge damage. Hand

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grooving methods will be permitted in a manner accepted by the Engineer in those areas where the mechanical equipment cannot be used.

- C. Concrete Saw.** The Contractor shall provide sawing equipment in good working condition, adequate in number of units and power, to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. All of this equipment shall be on the job both before and continuously during concrete placement.
- D. Forms.** Straight side forms shall be made of a metal having a thickness of not less than 7/32 inch and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth at least equal to the prescribed thickness of the concrete and a base width that will provide adequate support for all equipment operating on the forms. Flexible or curved forms of proper radius shall be used for curves of 100 feet radius or less. Flexible or curved forms shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than 2/3 height of the form. Forms with battered top surfaces, and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall be cleaned of old accumulated concrete, grout, or other materials. The forms shall be sprayed or covered with a form release agent prior to their use.
- E. Header Boards.** Header boards to be used when paving operations are stopped shall be of 2 inch material, cut to the exact cross-section of the paving slab and set to a line parallel to the transverse joint. The boards shall be so designed as to insure accurate installation of dowels or tie boards as called for on the Plans.
- F. Longitudinal Float.** The longitudinal float may either be a mechanical float or screed mechanism acceptable to the Engineer or a manually operated float. The hand operated float shall be a rigid straightedge float not less than 12 feet nor more than 18 feet in length with a troweling or smoothing surface not less than 8 inches nor more than 12 inches in width, and shall be worked from bridges spanning the pavement.

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Longitudinal floats shall be maintained in good repair and working order at all times. If satisfactory results are not being obtained by use of a mechanical float, a manually operated float shall be available on the job for immediate use in lieu of the mechanical float.

The mechanical float shall be so adjusted and so operated that the screed will have a small quantity of concrete in front of it at all times. The screed shall not be raised or lowered solely for the purpose of maintaining the proper amount of concrete in front of the screed.

In lieu of the mechanical or hand operated longitudinal float, the use of a finishing machine with the float pan type finisher will be permitted provided that satisfactory performance and specified surface smoothness and tolerances are obtained.

- G. *Small Tools, Belt and Burlap Drag.*** The Contractor shall furnish a sufficient number of work bridges, hand floats, 10 foot straightedges, and small tools to satisfactorily complete the pavement as specified herein. Any float or straightedge which becomes warped or distorted and any belts or finishing tools which are defective, shall be promptly replaced with acceptable appliances.

The burlap drag shall consist of a seamless strip of burlap or cotton fabric, which shall produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement. The dimensions of the drag shall be such that a strip of burlap or fabric at least 3 feet wide is in contact with the full width of the pavement surface while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 6 inches wider than the upper layer.

- H. *Spraying Equipment.*** The equipment for applying the white pigmented curing membrane shall be the fully atomizing type equipped with a tank agitator which will keep the compound thoroughly mixed during application. Hand sprayers of the pressure tank type accepted by the Engineer may be used to apply curing membrane to vertical surfaces, irregular areas or edges after form removal.

- I. *Joint Sealing Equipment.*** All necessary equipment shall be furnished by the Contractor in accordance with the requirements of Subsection 108.06. Minimum requirements for construction equipment as required to complete the work are specified herein.

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1. *Concrete Saw.* The Contractor shall provide sawing equipment adequate in size and power to complete the sawing of concrete joints to the required dimensions.
2. *Hydroblast Unit.* High pressure cold water jet system for cleaning joints as specified, utilizing 2,000 psi minimum nozzle pressure.
3. *Air Compressors.* Air compressors capable of delivering compressed air having a pressure in excess of 90 psi and equipped with suitable traps for removal of all free water and oil from the compressed air.
4. *Extrusion Pump.* Air-powered extrusion pumps for applying the joint sealant shall have an output capable of delivering a sufficient volume of sealant to the joint.
5. *Injection Tool.* A mechanical injection device shall be furnished for applying the sealant into the joint.
6. *Sand-Blast Unit.* The sand-blasting equipment shall provide oil and moisture-free air and be adequate in size and power to clean the joints.
7. *Joint Sealer Kettle.* When the joint sealant requires heating, the kettle shall be a double bottom oil bath indirect flame type, adequate in size and power to mix, heat, deliver and maintain the desired temperature.

414.04 CONSTRUCTION METHODS.

- A. *Preparation of Grade.*** After the roadbed has been graded and compacted, the grade shall be trimmed approximately to correct elevation, extending the work beyond each edge of the proposed concrete pavement. When the foundation is stabilized with an admixture, it shall be within the tolerances provided for the foundation type.
- B. *Setting Forms.*** Forms shall be set to line and grade by shimming or other approved methods. Imperfections or variations in the base or foundation which prohibits the placement of forms to the specified lines or grades shall be corrected in a manner accepted by the Engineer. Forms shall be staked into place. Form sections shall be tightly locked, free from play or movement in any direction. The forms shall not deviate from true line by more than 0.25 inch at any point. No excessive settlement or springing of forms under the finishing machine will be tolerated. Forms shall be cleaned and oiled prior to the placing of concrete.

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1. *Grade and Alignment.* The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and re-checked.

C. *Conditioning of Sub-grade or Base Course.* When sideforms have been securely set to grade, the sub-grade or base course shall be brought to proper cross-section.

When cementitious bases are used, material trimmed from high areas shall be removed and low areas shall be filled with concrete integral with the pavement. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.

Unless waterproof sub-grade or base course cover material is specified, the sub-grade or base course shall be uniformly moist when the concrete is placed.

D. *Handling, Measuring and Batching Materials.* The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work. The quantities of materials available at the concrete plant at no time shall be less than that required for a normal day's paving operation. Delivering and stockpiling materials shall be in accordance with Subsection 106.07.

Materials for concrete shall be measured and batched in accordance with AASHTO M 157, except as otherwise specified. The fine aggregate and each size of coarse aggregate shall be separately weighed into hoppers in the respective amounts set in the job mix. Cement shall be measured by weight. Separate scales and hoppers shall be used for weighing the cement, with a device to indicate positively the complete discharge of the batch of cement into the batch box or container.

E. *Mixing Concrete.* Concrete shall be mixed and delivered in accordance with AASHTO M 157 except as otherwise specified. The concrete may be mixed at the site of the work, in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are in the drum. There shall be a maximum time limit of 1 hour from the time that the water, cement and aggregate are combined until the mixed concrete is deposited in its final position in the forms.

When mixed at the site of the work or in a central mixing plant, the mixing time shall not be less than 50 seconds nor more than 90 seconds. Four seconds shall be added to the specified mixing time if timing starts the instant the skip reaches its maximum raised position. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included

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in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The mixer shall be operated at a drum speed as shown on the manufacturer's name plate. Any concrete mixed less than the specified time shall be discarded and disposed of by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the mixers nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to 10 percent above the mixers nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

The batch shall be so charged into the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Re-tempering concrete by adding water or by other means will not be permitted, except that when concrete is delivered in transit mixers or agitators additional water may be added to the batch materials and additional mixing performed at 20 revolutions at mixing speed, provided the design maximum water-cement ratio is not exceeded.

- F. *Limitations of Mixing.*** No concretes shall be mixed, placed or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated. Unless otherwise authorized, the temperature of the mixed concrete shall be not less than 50° F and not more than 90° F at the time of placing it in the forms.

Concreting under adverse weather conditions, as defined in Section 101, shall be according to Section 509.04 F. The Contractor shall be responsible for the protection and quality of concrete placed during any weather conditions.

- G. *Placing Concrete.*** The concrete shall be deposited on the grade in such a manner as to require as little re-handling as possible. Unless truck mixers, truck agitators or non-agitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a 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. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

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Where concrete is to be placed adjoining a previously constructed lane of pavement and mechanical equipment will be operated upon existing lane of pavement, that lane shall have attained the strength specified for opening to traffic (Subsection 414.04 Q). If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after 3 days.

Concrete shall be thoroughly consolidated against the supporting grade and against the face of all forms and joint assemblies throughout their full length. The vibrator shall not be operated in any one location longer than necessary to complete the consolidation.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

Should any concrete materials fall on or be worked into the surface of a completed slab, they shall be removed immediately by approved methods.

Concrete shall not be placed unless an inspector is present.

H. *Test Specimens.* The Contractor shall furnish the concrete necessary for performing acceptance testing.

I. *Joints.* Joints shall be constructed perpendicular to the surface of the slab and of the type, dimensions, and at locations shown on the Plans. Suitable guide lines or devices shall be used to assure satisfactory alignment of joints.

All sawed joints shall be reasonably straight and true to line as to be pleasing in appearance. Those not shall be repaired or corrected to the satisfaction of the Engineer.

The sawed joints shall be thoroughly cleaned by hydroblasting and/or sand blasting methods, to be determined by existing field conditions. The joints are to be free from all dust coating, any contaminates and free from all moisture that might interfere with the proper and satisfactory bonding of the approved joint sealing material.

1. *Longitudinal Joints.* Longitudinal joints shall be formed by sawing. Deformed steel tie bars of specified length, size, spacing and material shall be placed perpendicular to the longitudinal joint. Tie bars shall be placed, by approved mechanical equipment or rigidly secured by chairs or other approved supports, to prevent displacement. Tie bars shall not be painted or coated with asphalt or other materials or enclosed in tubes or sleeves.

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The longitudinal joint shall be sawed as soon as possible to the depth shown on the Plans without causing damage to the pavement or joint. The sawed area shall be thoroughly cleaned and be free from dust, chalk, contaminants and filled with an approved joint sealing material.

Construction equipment and other vehicles which may cause damage to the pavement joints shall not be allowed on the pavement before the end of the curing period.

When tested with a straightedge, the surface across any joint shall not vary from the straightedge by more than 1/8 inch.

2. *Transverse Joints.*

2.1 Expansion Joints. The expansion joint filler shall be continuous from form to form, shaped to the sub-grade and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used unless approved by the Engineer.

Pre-molded joint filler shall be appropriately punched to the exact diameter and location of the dowels. It shall, unless otherwise provided, be furnished in lengths equal to the pavement width. However, in cases where pavement two or more traffic lanes wide is being placed, the pre-molded filler may be furnished in sections, provided the length of each section is equal to the width of one lane. Where more than one section is used in a joint, the sections shall be securely laced or clipped together. The pre-molded joint filler shall be placed on the side of the installing bar nearest the mixer. The bottom edge of the filler shall project to or slightly below the bottom of the slab and unless otherwise prescribed, the top edge shall be one inch below the surface of the pavement. While the concrete is being placed, the top edge of the filler shall be protected by a metal channel cap of at least 10-gauge material, having flanges not less than 1½ inches in depth.

After concrete has been placed on both sides of the joint and struck off, the installing bar shall be slowly and carefully withdrawn leaving the pre-molded filler in place. Before the installing bar and channel cap is completely withdrawn, the concrete shall be carefully vibrated and additional freshly mixed concrete worked into any depression left by the removal of the installing bar. The filler must be exposed for the full width of the slab. The installing bar must be cleaned and re-oiled prior to each installation of a joint. After the removal of the side forms, the ends of the transverse joints at the edges of the pavement shall be carefully opened for the entire depth of the slab. Before the pavement is opened to traffic, pre-molded joints

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shall be sealed or topped out with the joint sealing filler specified, leaving a neat uniform strip of joint sealing filler slightly below the surface of the pavement.

Joints in concrete curbing that cannot be satisfactorily sawed shall be formed by means of steel templates or other approved joint forming dividers installed at the time the concrete is poured and at the location of the joint to be sawed

- 2.2 Contraction Joints. Transverse contraction joints shall be formed by sawing.

The contraction joints shall be sawed as soon as possible to the depth shown on the Plans without causing damage to the pavement or joint. Succeeding joints shall be sawed consecutively from beginning to end of the day's run and all transverse joints shall be sawed soon enough to prevent uncontrolled transverse cracking.

The sawed area shall be thoroughly clean and dry and be free from dust, chalk, contaminants, spalling, and filled with an approved joint sealing material.

Construction equipment and other vehicles which may cause damage to the pavement joints shall not be allowed on the pavement before the end of the curing period.

- 2.2.1 Skewed Contraction Joints. Skewed transverse contraction joints shall have a nominal 4-inch wide band surface skipped or blanked out from the transverse grooving equipment by mechanical or physical means.

Skewed transverse contraction joints shall be formed by sawing. The contraction joint shall be sawed as soon as possible to the depth shown on the Plans without causing damage to the pavement or joint. The sawed area shall be thoroughly cleaned and dry and be free from dust, chalk, contaminants, spalling and filled with an approved joint sealing material.

Construction equipment and other vehicles which may cause damage to the pavement joints shall not be allowed on the pavement before the end of the curing period.

Contraction joints shall be sawed consecutively from the beginning of the day's run.

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- 2.3 Construction Joints. Unless otherwise directed, transverse construction joints shall be constructed when there is an interruption of more than 30 minutes, or as field conditions dictate in the concreting operations. No transverse joint shall be constructed within 10 feet of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete back to the last preceding joint shall be removed and disposed of as directed by the Engineer.

A rigid header shall be provided with holes or slots for dowel bars that shall be of the spacing and dimensions as for expansion joints and in no case shall the transfer load bar vary more than 1/8 inch from the planned horizontal or vertical position.

3. *Load Transfer Devices.* Approved load transfer devices shall be firmly held in the position indicated on the Plans. Dowels shall be held in position parallel to the surface and center line of the slab by an approved support and in no case shall the transfer load bar vary more than 1/8 inch from the planned horizontal or vertical position. Dowels for expansion joints shall be capped as shown on the Plans.

J. *Final Strike off, Consolidation and Finishing.*

1. *General.* The sequence of operations shall be the strike off and consolidation, floating and removal of laitance, straight-edging, and final surface finish.

The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

2. *Finishing at Joints.*

- 2.1 The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated.

- 2.2 After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints. If uninterrupted operation of the finishing machine, to, over, and beyond the joints causes segregation of concrete and of the joints, the finishing machine shall be stopped when the front screed is approximately 8

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inches from the joint. Segregated concrete shall be removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

3. *Machine Finishing.* The concrete shall be distributed or spread as soon as placed. As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish.

During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length.

Vibrators for full width vibration of concrete paving slabs, shall meet the requirements in Subsection 414.03 B. If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and methods which will produce pavement conforming to the Specifications.

4. *Hand Finishing.* Hand finishing methods will not be permitted except under the following conditions:

In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade or in transit when the breakdown occurs.

Narrow widths or areas of irregular dimensions where operation of the mechanical equipment is impractical may be finished by hand methods.

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Concrete as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete if reinforcement is used.

The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off.

Consolidation shall be attained by the use of a suitable vibrator or other approved equipment.

In operation the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture reasonably true to grade and cross-section and free from porous areas.

5. *Floating.* After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float.

If necessary, long handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open textured areas in the pavement. Long handled floats shall not be used to float the entire surface of the pavement. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a straightedge 10 feet or more in length.

Successive drags shall be lapped one-half the length of the blade.

6. *Straightedge Testing and Surface Correction.* After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 10 foot straightedge. For this purpose, the Contractor shall furnish and use an accurate 10 foot straightedge. The straightedge shall be held in contact with the surface in successive positions parallel to the road center line and the whole area gone over from one side of the slab to the other as necessary. Advance along the road shall be in successive stages of not more than one-half the length of the straightedge. Any

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depressions found shall be immediately filled with freshly-mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and the slab conforms to the required grade and cross-section.

7. Finishing.

7.1 Burlap Drag. The burlap drag shall be used prior to final finish of the pavement surface. The burlap or cotton fabric drag shall produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement. For pavement 16 feet or more in width, the drag shall be mounted on a bridge which travels on the forms. The drag shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drag substituted.

7.2 Transverse Groove Final Finish. When final longitudinal texturing with the burlap drag is completed, the plastic pavement surface shall be mechanically transverse grooved and textured in a manner accepted by the Engineer with equipment meeting the requirements of Subsection 414.03 B. 3.

The grooves shall be perpendicular to the center line of the pavement, 0.08 to 0.125 inches wide, 0.125 to 0.250 inches deep, and approximately spaced at 0.50 to 1.0 inches. The machine shall automatically lift the roller or tines near the edge of pavement so that edge damage shall be held to a minimum. The overlap between grooving passes shall be less than 3 inches.

In those areas where mechanical grooving equipment cannot be operated, hand grooving methods will be permitted in a manner approved by the Engineer.

7.3 Edging at Forms and Joints. After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse

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construction joints, and emergency construction joints shall be worked with an approved tool and rounded to the radius required by the Plans. A well-defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

All joints shall be tested with a straightedge before the concrete has set, and correction made if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

- K. *Surface Tests.*** As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 10-foot straightedge or other specified device. Areas showing high spots of more than 1/8 inch but not exceeding 1/2 inch in 10 feet shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of 1/8 inch when tested with a 10-foot straightedge. The surface of ground areas shall be re-textured to match the surface of the surrounding areas. Where the departure from correct cross-section exceeds 1/2 inch, the pavement shall be removed and replaced by and at the expense of the Contractor.

Any area or section so removed shall be not less than 10 feet in length, nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length, shall also be removed and replaced.

- L. *Curing.*** Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be covered and cured in accordance with one of the following methods. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other

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requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than one-half hour between stages of curing or during the curing period.

1. *Cotton or Burlap Mats.* The surface of the pavement shall be entirely covered with mats. The mats used shall be of such length (or width) that as laid they will extend at least twice the thickness of the pavement beyond the edges of the slab. The mat shall be placed so that the entire surface and both edges of the slab are completely covered. Prior to being placed, the mats shall be saturated thoroughly with water. The mats shall be so placed and weighted down as to cause them to remain in intimate contact with the surface covered, and covering shall be maintained fully wetted and in position for 72 hours after the concrete has been placed unless otherwise specified.

2. *Impervious Membrane Method.* The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound meeting the requirements of Subsection 701.07 D. immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with jute or cotton mats, it may be applied upon removal of the mats. The curing compound shall not be applied during rainfall.

Curing compound shall be applied under pressure at the rate of one gallon to not more than 200 square feet by mechanical sprayers meeting the requirements of Subsection 414.03 H. Provided, however, that when the temperature on the roadway is 100° F or above, the curing compound shall be applied at the rate of one gallon to not more than 150 square feet.

At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. Hand-spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed.

The curing compound shall be of such character that the film will harden within 4 hours after the application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound.

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Upon removal of side forms, the sides of the slabs, exposed shall be protected immediately to provide a curing treatment equal to that provided for the surface.

3. *White Polyethylene Sheeting.* The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least 18 inches. The sheeting shall be so placed and weighted down as to cause it to remain in intimate contact with the surface covered. The sheeting as prepared for use shall have such dimensions that each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed.
4. *Curing of Cold Weather.* The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.

M. *Removing Forms.* Forms shall be removed carefully so as to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated above. Honeycombed areas shall be satisfactorily repaired.

N. *Sealing Joints.* The joints shall be of the type shown on the Plans. All joints shall be reasonably true to the line width and depth shown on the Plans. Joints in portland cement concrete pavement shall be thoroughly clean and dry prior to placement of backer rod and/or joint sealant. Cleaning shall be done by the hydroblast method, with a minimum nozzle pressure of 2,000 psi, and/or sandblasted. The method used will be determined by existing field conditions.

O. *Protection of Pavement.* The Contractor shall erect and maintain suitable barricades and employ watchmen as may be required to exclude traffic from newly constructed pavement for the period herein prescribed. When it is necessary to provide for traffic across the pavement, the Contractor shall at his expense, construct suitable and substantial crossings to bridge over the concrete, which will be adequate for the traffic and satisfactory to the Engineer. The Contractor shall protect the pavement against both public traffic and the traffic caused by his own employees and agents. All

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ditches and drains shall be in such condition as to provide effective drainage. When berms of earth are placed along the shoulders, proper provisions shall be made for the surface drainage. Any part of the pavement damaged by traffic or other causes, occurring prior to its final acceptance, shall be repaired or replaced, by and at the expense of the Contractor, in a manner satisfactory to the Engineer.

P. *Opening to Traffic.* Traffic shall be excluded from the newly constructed pavement for a period of 14 days after the concrete is placed or longer if weather conditions make it advisable to extend this time. However, at the discretion of the Engineer, the pavement may be opened to traffic when specimen beams or cylinders made, cured and tested meet the strength requirements specified in Subsection 701.01 D.

Q. *High-Early-Strength Concrete Pavement.*

1. *General Requirements.* When high-early-strength concrete pavement is specified, it shall be made with high-early cement and meeting the other requirements of Section 701. In lieu of high-early-strength cement, and with written permission of the Engineer, the Contractor may use standard portland cement with a cement factor 25 percent in excess of that specified for portland cement concrete pavement. No additional compensation shall be allowed for the 25 percent additional cement if standard portland cement is used. When 25 percent of cement is added, the absolute volumes in the mix shall be adjusted to compensate for the additional cement. All other requirements hereinbefore specified for concrete pavement shall be applicable subject to the following modifications.

2. *Curing.* When high-early-strength concrete pavement is specified or used, the pavement shall be cured in the same manner as is provided for regular pavement.

3. *Opening to Traffic.* Traffic shall be excluded from the newly constructed pavement for a period of not less than 24 hours and for 72 hours if necessary, unless test beams or cylinders prepared meet strength requirements specified in Subsection 701.01 D before 72 hours.

R. *Optional Use of a Slip-Form Paver.* If the Contractor so elects, a slip-form paver may be used in lieu of the conventional paving train and stationary side forms.

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When a slip-form paver is used, all requirements of placing pavement with rigid forms shall be complied with except as provided herein:

1. *Grade.* After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of a properly designed machine. If the density of the base is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed. The grade shall be constructed sufficiently in advance of the placing of the concrete.

If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of the placing of the concrete. When the foundation for the surfacing is stabilized with an admixture, the area under the pavement and the supporting area for the paving machine shall be within the specified tolerances for the foundation type before concrete is placed.

2. *Placing Concrete.* The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine in such manner that a minimum of hand finish will be necessary to provide a dense and homogeneous pavement in conformance with the Plans and Specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibrations shall be accomplished with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms.

The slip-form paver shall be operated with a continuous forward movement and all operations of mixing, delivering and spreading concrete shall be so coordinated as to provide a uniform progress with stopping and starting of the paver held to a minimum.

If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately.

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3. *Finishing.* A tube float finishing machine shall be used immediately following the slip-form paver, in a manner approved by the Engineer.
4. *Tolerances.* Tolerances of the finished pavement shall meet the requirements of Subsection 414.04 T. except that for the outer 6 inches along the edges of the pavement, a maximum deviation of 1/4 inch from a 10-foot straightedge placed perpendicular to the center line of the roadway will be permitted. When auxiliary parallel lanes are constructed using a slip-form paver, there shall be no appreciable slump along edges of adjoining lanes. Any valleys or depressions that will not drain properly shall be corrected by the Contractor at his own expense to the satisfaction of the Engineer.
5. *Curing.* Unless otherwise specified, curing shall be done in accordance with one of the methods included in Subsection 414.04 M. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the payment.
6. *Joints.* All joints shall be constructed in accordance with Subsection 414.04 J.
7. *Protection Against Rain.* In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood plank having a nominal thickness of not less than 2 inches and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper, or plastic sheeting material for the protection of the surface of the pavement. When rain appears eminent, all paving operations shall stop and all available personnel shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

S. Tolerances.

1. *Surface.* The surface tolerance shall be in conformity with Section 401.

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2. *Width and Thickness.* The width shall be in reasonably close conformity with the dimensions shown on the Plans or established by the Engineer. The thickness of the pavement will be determined by the average caliper measurement of cores tested in accordance with AASHTO T 148.

T. *Acceptance of Pavement.* Pavement slabs may be rejected because of unsound concrete, uncontrolled cracking, malfunctioning of the sawed joints, spalling, honeycombing, surface irregularities, insufficient thickness, or for any deficiencies commonly associated with poor quality pavements. Rejected slabs shall be removed and replaced with new pavement conforming to these requirements. The removal and replacement shall be at least one lane in width and ten feet in length. Where the linear extent of removal falls within ten feet of a transverse joint, the removal limits shall be extended to the joint.

414.05 METHOD OF MEASUREMENT.

A. *Portland Cement Concrete Pavement.* The yardage to be paid for under this item shall be the number of square yards of concrete pavement of the type shown on the Plans or in the Proposal, completed and accepted, measured complete in place. The width for measurement will be the width from outside to outside of the completed pavement, but not to exceed the width as shown on the Plans or as directed by the Engineer. The length will be the actual length measured along the riding surface on the center line of the road, and shall exclude the length occupied by bridges, approach slabs, and all other exceptions. Reinforcing steel, load transfer devices, joint fillers and joint sealers will not be measured for payment.

B. *Approach Slabs.* The yardage to be paid for under this item will be measured as provided above for portland cement concrete pavement.

414.06 BASIS OF PAYMENT. The accepted quantities of concrete pavement, and approach slabs, measured as provided above, will be paid for at the contract unit price for:

(A) Portland Cement Concrete Pavement	Sq. Yd.
(B) High-Early-Strength Concrete Pavement	Sq. Yd.
(C) Approach Slabs	Sq. Yd.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

No additional compensation will be allowed when the Contractor, at his option, uses high-early-strength portland cement in lieu of standard portland cement.

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417.00 COLD MILLING PAVEMENT

417.01 DESCRIPTION. This work shall consist of cold milling and removing existing pavement surfaces below the present grade to a depth shown on the plans, removing ridges, ruts and other imperfections as determined by the Engineer. The milling operation shall produce a plane surface that will provide a smooth riding surface for traffic.

417.03 EQUIPMENT. The Contractor shall provide a power-operated milling machine capable of planing a minimum depth of one and one-half inches in a single pass. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing the existing pavement by means of a ski, or matching shoe or from an independent grade control, and shall have an automatic system for controlling cross slope at a given rate. The machine shall be equipped with an integral loading means to remove the material being cut from the pavement surface and to discharge the cuttings into a truck, all in a single operation.

417.04 CONSTRUCTION METHODS. The existing pavement shall be uniformly milled to provide a uniform texture, true to line, grade and cross-section, it shall have no deviations in excess of 3/16 inch in ten feet. Any portion of the planed surface not meeting this requirement shall be corrected in a manner approved by the Engineer.

The machine shall make as many passes as necessary to remove irregularities and to profile the surface to the depth and cross-slope shown on the Plans.

Cold milling shall be done in a manner that will not create undue traffic hazards.

The milling operation shall be performed in each lane in such a manner that the milled lanes are evened up as near as practical at the end of each day's operation so as to eliminate the hazard of an exposed vertical edge when traffic is carried through construction.

All materials removed shall become the property of the Contractor and shall be disposed of by him in accordance with Section 104.06 unless otherwise specified on the Plans.

417.05 METHOD OF MEASUREMENT. Cold milling pavement will be measured by the square yard of surface area.

417.06 BASIS OF PAYMENT. Accepted quantities of cold milling pavement, measured as provided above, will be paid for at the contract unit price for:

Cold Milling Pavement

Sq. Yd.

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which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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419.00 CONCRETE JOINT REHABILITATION

419.01 DESCRIPTION. This work shall consist of sawing, cleaning and sealing contraction joints in existing portland cement concrete pavement in reasonably close conformity with the details shown on the Plans or as approved by the Engineer.

419.02. MATERIALS. Materials shall meet the requirements of Subsection 701.08 the type joint filler or sealer shown on the Plans or designated in the Proposal.

419.03. EQUIPMENT. All necessary equipment shall be furnished by the Contractor in accordance with the requirements of Subsection 108.06. The minimum requirements for construction equipment as required to complete the work are specified herein.

A. Concrete Saw. Sawing equipment adequate in size and power to complete the sawing of concrete joints to the required dimensions.

B. High Pressure Water Pumping System. High pressure water pumping system capable of delivering sufficient pressure and volume of water to thoroughly flush concrete slurry from sawed joints.

C. Sand Blasting Unit. Compressed air pressure type sand blasting equipment of proper size and capacity to clean joint surfaces as specified. The unit shall be equipped with suitable traps for removal of all free water and oil from the compressed air.

D. Air Compressors. Air compressors capable of delivering compressed air having a pressure in excess of 90 psi and equipped with suitable traps for removal of all free water and oil from the compressed air.

E. Extrusion Pump. Air powered extrusion pumps as required for applying joint sealer with an output capable of delivering a sufficient volume of material to the joint.

F. Injection Tool. A mechanical injection device as required for applying the sealer into the joint.

419.04 CONSTRUCTION METHODS.

A. Sawing Joints. The existing contraction joints shall be cut to the width and depth shown on the Plans. Sawing shall be done in such a manner as to produce a new joint having a cut face on both sides and be uniform in width along its full length.

B. Flushing Joints. Within 5 minutes after sawing, the resulting slurry shall be

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removed from the joint and immediate area by flushing with a high pressure water system and other equipment necessary to thoroughly remove the slurry.

C. *Cleaning Joint Faces.*

1. *General.* The cut faces of the joints shall be thoroughly cleaned of all foreign materials, as may be required for proper installation and bonding of the joint sealer or filler, including old sealant or any residue from water flushing operations, by sandblasting as required. The use of portable hand saws will not be permitted for cleaning joint faces.

The cut faces of the joint shall be thoroughly air dried for a minimum of 48 hours after flushing with water. Blow drying of the joints with compressed air will not be permitted.

2. *Sandblasting.* After complete drying, the joint shall be sandblasted. The sandblaster nozzle shall be attached to a mechanical aiming device so as to direct the sandblast at approximately a 45 degree angle and at a maximum of 2 inches from the faces of the joint. Both joint faces shall receive sandblasting.

After sandblasting the joints shall be blown out using filtered oil free and moisture free air at a minimum of 90 psi and 120 cfm. Blowing out of the joint shall be accomplished by using a blow tube which will fit into the joint.

After blowing, the joint shall be checked for any residual dust or coating. If any is found the sandblasting and blowing operations shall be repeated until the joint is cleaned. The cleaned joints shall be sealed the same day as cleaned. Joints left open overnight shall be recleaned prior to sealing.

3. *Joint Contamination.* In the event the open joints prepared for installation of joint sealing materials become contaminated by traffic, or the result of weather conditions, they shall be recleaned as specified above or as approved by the Engineer.

D. *Bond Breaker Rod.* When shown on the plans or recommended by the sealant manufacturer, a bond breaker rod shall be installed prior to application of the joint sealant. The bond breaker rod shall be of the type recommended by the manufacturer of the sealant material. The bond breaker rod shall be installed in a manner that will produce the dimensions (width and depth) described on the Plans.

E. *Sealing Joints.*

1. *Approval of Joints for Sealing.* The Department's inspectors will examine

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joints prepared for sealing just prior to installation of the joint filler or sealer. Joints will not be approved for sealing if contaminated or not adequately dry as required for bonding of sealing materials.

2. *Installation of Joint Sealers and Fillers.*

2.1. General. A representative of the joint filler and/or joint sealer manufacturer shall be on the job site at the beginning of the joint sealing operation to demonstrate to the Contractor and to the Department's inspectors the manufacturer's acceptable standards for installation of the joint sealant materials.

3. *Application of Joint Sealers.*

3.1. Joint Sealers. The joint sealer shall be applied using a mechanical injection tool approved by the Engineer. Application of the joint sealer will not be permitted when the joint temperature is less than 40° F. Joints shall not be sealed unless they are thoroughly clean and dry. Sealers to fill the joint shall be injected into the joint and applied in a manner which causes it to bond to the joint face surfaces. The surfaces of sealers requiring tooling shall be tooled using an approved mechanical device to produce a slightly concave surface approximately 0.25 to 0.50 inch below the pavement surface. Tooling shall be accomplished before a skin forms on the surface of the sealer. The use of soap or oil as a tooling aid will not be permitted. Tooling will not be required if the sealer is self-leveling.

4. *Bonding Failures.* Failure of the sealant to bond to sawed surfaces of the concrete joint will be cause for rejection and repair shall be at the Contractor's expense.

F. Traffic. Traffic shall not be allowed on the fresh applied sealant until it becomes tack free.

419.05 METHOD OF MEASUREMENT. Concrete joint rehabilitation will be measured by the linear foot after the joint sealant is in place.

419.06 BASIS OF PAYMENT. The accepted quantities, measured as provided above, will be paid for at the contract unit price for:

Concrete Joint Rehabilitation	Lin. Ft.
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which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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420.00 FABRIC REINFORCEMENT FOR ASPHALT CONCRETE PAVEMENT

420.01 DESCRIPTION. This work shall consist of the application of reinforcement fabric for plant mix asphalt concrete pavement in accordance with these Specifications and in reasonably close conformity with the locations and dimensions shown on the Plans or established by the Engineer.

420.02 MATERIALS. Materials shall meet the requirements specified in the following Subsections of Section 700 - Materials.

Reinforcement Fabric	712.01
Asphalt Cement	708.03

420.03 EQUIPMENT.

- A. General.** Equipment and tools necessary for performing all parts of the work shall be furnished by the Contractor in conformance with Subsection 108.06.
- B. Distributors.** Distributors shall meet the requirements of Subsection 401.03. Distributor units shall also be equipped with a hand spray with a single nozzle and positive shut-off valve.
- C. Fabric Laydown Equipment.** Mechanical laydown equipment shall be capable of handling full or partial rolls of fabric and shall be capable of laying the fabric smoothly without excessive wrinkles and/or folds. When manual laydown is required, a length of standard one-inch pipe, together with suitable roll tension devices shall be used for proper roll handling.
- D. Miscellaneous Equipment.** Miscellaneous equipment shall include stiff bristle brooms to smooth the fabric, scissors or blades to cut the fabric, and brushes as required for use in applying asphalt binder to fabric overlap at spliced joints.

420.04 CONSTRUCTION METHODS.

- A. Surface Preparation.** The surface on which the fabric is to be placed shall be free of dirt, dust, water, oil or other foreign matter.
- B. Application of Bituminous Binder.** Bituminous binder material shall be heated and uniform spray applied over the area to be fabric covered. Laps shall be mopped between layers of fabric. The longitudinal lap may be sprayed with the distributor.

The minimum application temperature of the bituminous binder shall not be less than 290° F. If the fabric is over-sprayed, the maximum application temperature shall not exceed 325° F. to avoid damage to the fabric. The

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bituminous binder shall be applied at the rate of 0.20 to 0.35 gal./sq. yd. (actual application rates will be based on asphalt retention tests for the fabric used) as established by the Engineer. Application of the bituminous material shall be accomplished with an asphalt distributor. Areas not accessible to the distributor shall be hand-sprayed. The distributor shall be started and stopped over paper or roofing felt to provide neat cutoff lines. The width of binder application shall be two to six inches wider than the fabric width. Care shall be exercised in the application of the binder to avoid spills or excessive application to cause flushing of the bituminous material.

- C. Placement of Reinforcement Fabric.** The fabric shall be placed after the bituminous binder has been applied and before the binder has cooled and lost tackiness. The fabric shall be unrolled and placed into the binder with the unfused (fuzzy) side down with a minimum of wrinkles. Every effort shall be made to lay the fabric as smoothly as possible. The fabric shall be broomed to remove air bubbles and maximize fabric contact with the pavement surface. Wrinkles shall be cut and laid out flat. If misalignment of the fabric occurs the fabric shall be cut, realigned and jointed as directed by the Engineer. Overlap of fabric at joints shall be between 4 and 6 inches. Transverse joints shall be shingled in the direction of paving to prevent edge pick up by the paver. Additional binder shall be applied to joints at the rate specified by the Engineer. Transverse joints shall be mopped, brushed or hand-sprayed. The longitudinal joints shall be sprayed with the distributor. The reinforcement fabric shall be embedded into the bituminous binder and bonded to the pavement. Self-propelled pneumatic tired rollers may be used if deemed necessary by the Engineer. Fabric not overlaid the same day shall be blotted with clean apparently dry sand before being turned to traffic. Sand for blotting will be included in other items for payment.
- D. Weather Limitations.** Asphalt binder shall not be applied for installation of the fabric when the air temperature is less than 50° F unless otherwise approved by the Engineer.
- E. Tack Coat.** Tack coat, if required for the pavement overlay shall be applied in accordance with Section 407. The bituminous material type, grade, rate of application and temperature shall be approved by the Engineer. Cut-back asphalt or emulsified asphalt containing petroleum distillate additives shall not be used.
- F. Pavement Overlay.** Placement of the asphalt concrete pavement overlay should closely follow fabric lay down unless otherwise permitted by the Engineer. Any damage or disbonding of the fabric reinforcement membrane caused by traffic or wet weather conditions due to unnecessary delay or negligence of the Contractor shall be repaired at his own expense. In the event excess binder bleeds through the fabric before the overlay is placed, the excess material shall be blotted by spreading sand on the affected area as directed by the Engineer. The temperature of the paving mix at time of

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placement on the reinforcement fabric membrane shall not exceed 325° F to prevent damage to the fabric. The turning of pavers or other vehicles should be gradual and kept to a minimum to avoid damage to the fabric. Should equipment tires pick up the fabric or the paver cause movement of the membrane during paving operations asphalt paving mix may be broadcast ahead of trucks and the paver to prevent damage. Any damage to the reinforcement membrane due to equipment shall be repaired by the Contractor at his expense.

420.05 METHOD OF MEASUREMENT.

- A.** Fabric reinforcement will be measured by the square yard in place.
- B.** Bituminous binder will be measured by the gallon in accordance with Subsection 109.01 A.

420.06 BASIS OF PAYMENT. The accepted quantities of fabric reinforcement and bituminous binder, measured as provided above, will be paid for at the contract unit price for:

(A)	Fabric Reinforcement	Sq. Yd.
(B)	Bituminous Binder	Gal.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

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425.00 DIAMOND GRINDING CONCRETE PAVEMENT

425.01 DESCRIPTION. This work shall consist of grinding portland cement concrete pavement to restore drainage and riding characteristics to the pavement surface. This work shall be accomplished in accordance with these Specifications and in reasonably close conformity to the details shown on the Plans.

425.03 EQUIPMENT. The grinding equipment shall be a power-driven, self-propelled machine that is specifically designed to smooth and texture portland cement concrete pavement with diamond blades. The effective wheel base of the machine shall not be less than 12 feet. It shall have a set of pivoting tandem bogey wheels at the front of the machine and the rear wheels shall be arranged to travel in the track of the fresh cut pavement. The center of the grinding head shall be no further than 3 feet forward from the center of the back wheels.

The equipment shall be of a size that will cut or plane at least 3 feet wide. It shall also be of a shape and dimension that does not encroach on traffic movement outside of the work area. Equipment that causes excessive ravels, aggregate fractures, spalls or disturbance of the transverse and longitudinal joints or cracks will not be permitted.

Other equipment may be considered in accordance with Subsection 108.06.

425.04 CONSTRUCTION.

A. Grinding Pavement. The Plans will designate the areas of pavement surfaces to be ground. Grinding shall be performed in the longitudinal direction so that grinding begins and ends at lines normal to the pavement centerline. The entire area designated on the Plans shall be ground until the pavement surfaces of adjacent sides of transverse joints and cracks are in the same plane. Extra depth grinding to eliminate minor depressions in the pavement to obtain 100% texturing will not be required.

The construction operation shall be scheduled and proceed in a manner that produces a uniform finished surface. Grinding shall be accomplished in a manner that eliminates joint or crack faults, while providing positive lateral drainage by maintaining a constant cross-slope between the edges of grinding operations. Auxiliary or ramp lane grinding shall transition as required from the mainline edge to provide positive drainage and an acceptable riding surface.

1. *Surface Texture and Grooving.* The grinding process shall produce a pavement surface that is uniform in appearance with a longitudinal line type texture. The surface shall have grooves between 0.09 to 0.15 inches wide, spaced up to 0.125 inches apart. The peaks of the ridges shall be approximately 1/16 inch higher than the bottom of the grooves.

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2. *Slurry Removal.* The Contractor shall provide positive means for removal of grinding slurry or residue by vacuum or other continuous methods. Slurry shall not be allowed to flow across lanes being used by traffic.
3. *Pavement Smoothness.*
 - 3.1. *Profiling Pavement Surface.* All ground surfaces shall be profiled by the Contractor for smoothness using the profilograph specified on the Plans or in the Proposal. Profiles will be made 3 feet from and parallel to each edge of pavement and at the approximate location of each longitudinal joint for all pavement areas. Pavement so tested shall have a profile index of 5 inches per mile or less using a 0.2 inch blanking width. Individual high points in excess of 0.3 inch, as determined by measurements of the profilograph shall be reduced by grinding, until such high points as indicated by reruns of the profilograph do not exceed 0.3 inch.

After grinding has been completed to reduce individual high points in excess of 0.3 inch, additional grinding shall be performed as necessary to reduce the profile index to values specified above in any 0.1 mile section along any line parallel with the pavement edge.

Additional grinding shall be performed as necessary. All ground areas shall be neat rectangular areas of uniform surface appearance.

- 3.2 *Straight Edge Tolerance.* The surface may be straightedged, at locations to be determined by the Engineer, with a straightedge 10 feet long. When the straightedge is laid on finished pavement parallel to centerline or normal to the centerline, the maximum distance to the roadway surface from the bottom edge of the straightedge shall not exceed 1/8 inch at any point. Additional grinding will be required at the locations found in excess of the 1/8 inch tolerance.

B. Traffic Control. Traffic control shall be in accordance with the Manual on Uniform Traffic Control Devices. Overnight closure of traffic lanes for the sole purpose of grinding pavement will not be permitted.

425.05 METHOD OF MEASUREMENT. Diamond grinding concrete pavement will be measured by the square yard. The square yards measured will be the final textured surface area regardless of the number of passes required to achieve acceptable results. Minor areas of untextured pavement within the

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designated areas to be textured will be included in the measurement.

425.06 BASIS OF PAYMENT. The accepted quantities, measured as provided above, will be paid for at the contract unit price for:

Diamond Grinding Concrete Pavement	Sq. Yd.
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which shall be full compensation for furnishing all materials, equipment, labor and incidentals necessary to complete the work as specified.