SECTION 02510
ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This section includes the following:

A. The repair of all existing pavements which have been damaged or removed during the course of construction. The Work under this section shall also include the placement and subsequent removal of such temporary pavements, subgrade, backfill, and any other materials as may be required for installation of the permanent repairs in accordance with the Contract Drawings and these Specifications or directed by the Engineer.

B. The construction of a bituminous concrete bottom course (binder) or of a bituminous concrete leveling course composed of a coarse aggregate and sand, uniformly mixed with asphalt cement. It shall be constructed on the prepared surface in accordance with these Specifications and in conformity with the line, grade, compacted thickness and typical cross section as shown on the Contract Drawings.

C. Dense graded bituminous concrete surface course to be constructed on a prepared bituminous concrete binder course in accordance with these Specifications and in conformity with the lines, grades and typical cross section shown on the Plans.

D. The construction of bituminous concrete lip curbing machine formed. Their construction shall be on an asphalt tack coat on existing bituminous concrete at the locations shown on the Contract Drawings or as ordered by the Engineer and in accordance with the Contract Drawings and Specifications.

E. Installation of Bituminous Seal Coat in the locations indicated on the Contract Drawings

F. Pavement Overlay required as shown on the Contract Drawings of the various thickness and class with tack coat. This work shall include all sweeping and surface preparation as required to receive the overlay.

1.3 SUBMITTALS

A. The job mix formula for bituminous concrete base course, bituminous concrete surface course and bituminous concrete lip curbing shall indicate in writing the single definite percentage for each sieve fraction of aggregate, and for asphalt chosen as the fixed mean in each instance, and also the temperature of completed mixture taken as it is dumped from the mixer. The source and locations of all materials shall be included with the job mix formula.

B. Sources of Supply: Approval of sources of all material shall be obtained from the Engineer prior to delivery of material and samples of each shall be submitted as directed by the Engineer.

C. Formula for Job Mix: The general limits prescribed are master ranges of tolerance to govern mixtures made from any raw materials meeting specifications and they are maximum and minimum for all cases.

A closer control appropriate to the materials is required in accordance with the job mix formula. Such job mix formula shall show the bitumen expressed as a percentage of the total mixture and the individual fractions of the aggregate expressed as percentage of the total weight of the aggregate.

The job mix formula shall indicate in writing the single definite percentage for each sieve fraction of aggregate, and for asphalt chosen as the fixed mean in each instance, and also the temperature of completed mixture taken as it is dumped from the mixer. The source and locations of all materials shall be included with the job mix formula.

The submission of such job mix formula shall, upon approval and thereafter, bind the Contractor to furnish a mixture not only within the master ranges, but, as a further requirement, also meeting the exact formula thus set up, within the allowable tolerances described herein.

D. Tack Coat Material: Submit manufacturer's product data for approval by the Engineer prior to delivery of material.

E. Seal Coat Material: Submit manufacturers product data for approval by the Engineer prior to delivery of material.

1.4 QUALITY ASSURANCE

A. Samples of the actual mixture in use will be taken as many times daily as necessary at the discretion of the Engineer and the mixture shall be maintained uniform within the above tolerances. If an additional source of supply for materials is approved, the job mix formula shall be readjusted as necessary. Any job mix formula submitted but found unacceptable shall be readjusted to the satisfaction of the Engineer.

The Contractor shall make available to the Engineer either samples or grading analysis of the hot bins, when required by the Engineer.

Mixtures found to have voids or other characteristics requiring a bitumen content greater or less than the bitumen range above tabulated will be rejected.

B. Control of Mixture: The Contractor shall at all times and in all ways cooperate with the Laboratory personnel in obtaining an approved mix.

Failure of the Contractor to consistently meet the approved job mix formula or any other part of the specifications shall be deemed sufficient cause for the Engineer to prohibit the use of any material from the plant. Use of material shall not be resumed until the producer has demonstrated the ability to supply an approved mix.

C. Pavement Base Samples: As required by the Engineer, the Contractor shall furnish for test purposes samples cut from the completed work. All areas of base so removed, shall be replaced with new mixture and refinished. No additional compensation will be allowed for furnishing test samples and replacing the areas with new base.

D. Mixing Plant Inspection: Before any mixture is accepted the mixing plants may be inspected and approved by the Engineer. In case unsatisfactory mixtures are

consistently produced by a previously approved plant, the Engineer reserves the right to discontinue the use of such plant until necessary corrections have been made.

For the verification of weights or proportions and character of materials and determination of temperatures used in the preparation of the mixture the Engineer or his authorized representatives shall have access at any time to all parts of the mixing plant. A safe and adequate platform or catwalk with ladder access shall be provided adjacent to the truck loading space to accommodate the Inspector while checking temperatures of the mixer as it is discharged into the truck bodies.

E. Approval of Job Mix Formula: After receiving the job mix formula, the Laboratory will make a minimum of two Marshall mold specimens of bituminous concrete made at the plant and meeting the submitted job mix formula. The Marshall molds shall meet the aforementioned requirements.

All equipment, tests and computations shall conform to the Marshall method.

If the Marshall molds meet requirements, the job mix formula will be approved. If the Marshall molds do not meet all of the requirements, the job mix formula shall be changed (within the master specification) until an approved mix is obtained.

PART 2 - PRODUCTS

2.12. BITUMINOUS CONCRETE PAVING MIXTURES

A. Mixture Classification: These mixtures shall consist of coarse aggregate, fine aggregate, mineral filler, if necessary, and asphalt cement, combined to meet the following composition limits by weight and other characteristics:

Percent Passing By Weight (Square Mesh Sieve)	**Class 1* Base Course and/or Surface Course**	**Class 2* Surface Course**
Passing 1"	100	-
Passing 3/4"	90-100	-
Passing 1/2"	70-100	100
Passing 3/8"	60-82	90-100
Passing #4	40-65	55-80
Passing #8	28-50	40-64
Passing #30	10-32	16-36
Passing #50	6-26	8-26
Passing #100	-	-
Passing #200	3-8	3-8
Bitumen %	5-8	5-8

* As noted in the Contract Drawings.

Marshall Tests:

Voids %	3-6	2-5
Stability, lbs. min.	1,200	1,000
Flow inches	0.08-0.15	0.08-0.15

The fraction actually retained between any two consecutive sieves shall not be less than 4 per cent.

The temperature shall be so controlled that the temperature of the asphalt cement shall not exceed 325 degrees F. and that of the aggregate at the drier outlet shall be between 280 degrees F. and 350 degrees F. depending on the amount of moisture in the aggregate. The temperature of the mixture as it is dumped from the mixer must be between 265 degrees F. and 325 degrees F.

The materials for this work shall conform to the following requirements:

1. Asphalt Cement: Shall conform to requirements for premix bituminous macadam base material.

2. Coarse Aggregate: The coarse aggregate shall consist of clean, hard, tough, durable fragments of broken stone or gravel of uniform quality throughout. It shall not contain more than 1 percent of material such as crusher dust sand elongated or soft disintegrated pieces. It shall be free of mud, dirt, organic or other injurious materials. When gravel is used at least 50 percent shall be crushed. When tested by means of the Los Angeles Rattler using AASHTO Method T-96, the loss shall not exceed 40 percent.

3. Fine Aggregate: Except for base coarse which shall be 100 percent sand, the fine aggregate shall consist of sand or a mixture of a minimum of 50 percent sand and a maximum of 50 percent stone screenings, and shall be composed of clean, tough, rough surfaced and angular grains. The fine aggregate shall be limited to material 95 percent of which passes a No. 4 sieve having square openings and not more than 8 percent of which passes a No. 200 sieve. The material shall be free from clay, loam and foreign material. The Engineer reserves the right to reject material which does not conform to the following requirements for plasticity:

    a. When the fraction of the dry sample passing the No. 100 mesh sieve is 4 percent or less by weight, no plastic limit test will be made.

    b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 4 percent and not greater than 8 percent by weight, that fraction shall not have sufficient plasticity to permit the performance of the plastic limit test using AASHTO Method T-90.

    c. When the fraction of the dry sample passing the No. 100 mesh is greater than 8 percent by weight, the sample shall be washed and additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T-146, except that the No. 100 mesh sieve shall be submitted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T-146. The combined materials that have passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performance of the plastic limit test using AASHTO Method T-90. When screenings are blended they shall be free from coatings of fine dust after drying.

    d. Mineral Filler: Mineral filler shall conform to the requirements of AASHTO M17.

B. Job Mix Tolerances

Aggregate passing Sieve No. 4 and larger	5%

Aggregate passing Sieve No. 10 through No. 100	4%
Aggregate passing Sieve No. 200	2%
Bitumen	0.5%
Temperature of Mixture when dumped from mixer	15°F

C. Preparation of Mixture: The hot coarse and fine aggregates and asphalt cement shall be measured separately and accurately by weight for each batch to be mixed. After the coarse and fine aggregates have been charged into the mixer and thoroughly mixed for a period of not less than 15 seconds, the asphalt cement shall be added, and the mixing continued for a period of at least 30 seconds, or longer if necessary, to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated.
The ingredients shall be heated and combined in such a manner as to produce a mixture which shall be at a temperature, when discharged, of not less than 265°F. nor more than 325°F.

D. Transportation of Mixture shall conform to requirements for transportation of premix bituminous macadam base material.

E. Tack coat material shall be grade CRS-1, CSS1 or CSS1H. Emulsified asphalt for tack coat shall use RS-1, SS-1, SS-1H conforming to AASHTO M 140.

F. Seal coat bituminous materials shall be selected from the following grades;

Asphaltic Cutback grade MC-70 or MC-800
Tar RT-2, RT-4 or RT-6
Asphalt Emulsion as directed by Engineer.

G. Processed Aggregate Base shall conform to Section 02230.

PART 3 - EXECUTION

3.1 PAVEMENT REMOVAL

A. Pavement to be removed shall be cut uniformly along the lines shown on the Contract Drawings or as directed by the Engineer.

Concrete pavement and/or bases shall be cut with an approved concrete saw through a minimum of one third of the depth pavement/base.

Bituminous pavement/base to be removed shall be cut by saw or other approved methods.

After the pavement has been cut, care shall be exercised by the Contractor during breaking and removal of the pavement in order that the adjacent pavement outside the cut shall not be damaged.

The Contractor shall remove the excavated pavement from the site and dispose of at a disposal area supplied by the Contractor at no additional cost to the Owner; or the Engineer may direct the Contractor to incorporate this material in other parts of the Work.

No sections or pieces of pavement shall be used for trench backfill and all such materials shall be kept separate from other excavated materials.

3.2 BITUMINOUS CONCRETE BASE COURSE

A. Methods

The methods employed in performing the work and all equipment, tools, machinery and other plant used in handling material and executing any part of the work, shall be subject to the approval of the Engineer before the work is started and, whenever found unsatisfactory, shall be changed and improved as required by the Engineer. All equipment, tools, machinery and plant used must be maintained in a satisfactory working condition.

Unless specifically authorized by the Engineer, the mixture shall be placed only upon a clean, dry surface at an atmospheric temperature in the shade of not less than 40 degrees F. The temperature of the mixture as it is dumped from the truck shall be within the range of 150 degrees F. to 200 degrees F.

B. Forms

When forms are required they shall be of a depth not less than the total proposed thickness of the bituminous concrete course or courses. The forms shall be of an approved section, straight, free from warps and bends at all times and shall be of sufficient strength when properly set and staked to resist the pressure of any bituminous mixture, and to remain true to line and grade throughout the entire rolling and compaction operation. The forms shall have properly designed joints and not less than three stake pockets to each ten-foot length.

The forms shall be accurately set to line and to such grade that after screening by the finishing machine, the weight of mixture per square yard required for each course will be secured. The forms shall be tightly jointed and sufficiently braced so as to prevent the mixture squeezing out under the rolling. The width between the forms shall not vary more than one-half inch from the indicated width of the pavement.

The alignment and grade of all forms set shall be approved before and immediately prior to the placing of any material against them. Forms shall be cleaned thoroughly and oiled each time they are used. They shall remain in place until after the placing and final compaction of the surface course or courses. Care shall be exercised in rolling so as not to displace the line and grade of the forms.

C. Placing of Mixture

Immediately before placing the mixture the base surface shall be cleaned by brooming or by other means acceptable to the Engineer. Unless the restriction is waived by written consent of the Engineer, the mixture shall be laid only during the period from April 15 to October 15, and further, these operations shall be carried on only when the surface is dry, the atmospheric temperature in the shade is at least 50^{o}F and the weather is not foggy or rainy. The Engineer may, however, permit work of this character to continue when overtaken by sudden storms, up to the amount which may be in transit from the plant at the time, provided the mixture is within temperature limits specified. Upon arrival, the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off to the full width required and to such appropriate loose depth for each successive course that when the work is completed the weight of the mixture required per square yard will be secured. Each course shall be struck off by the mechanical equipment. For use in striking off the bottom course the machine shall be equipped with easily adjustable strike-off plates. When approved in writing by the

Engineer, the mechanical equipment may be omitted and spreading accomplished by hand.

In order to secure tight and well compacted longitudinal joints, the sequence of the bituminous concrete placing operations shall be subject to the control of the Engineer for all courses laid.

Before any rolling is started, the finished surface struck by the machine shall be checked, and inequalities adjusted, all "drippings" i.e., fat, sandy accumulations from the screed and all fat spots from any source, shall be removed and replaced by satisfactory material.

In areas where, on account of irregularities or unavoidable obstacles, the use of mechanical spreading and finishing equipment is impracticable, the mixture may be spread and screeded by hand.

When hand spreading is permitted by special provisions or when, because of any project conditions, it becomes necessary to spread by hand, the mixture, upon arrival, shall be dumped on approved steel dump sheets outside of the area on which it is to be spread and shall then be immediately distributed into place by means of suitable shovels and other tools and spread with metal lutes in a uniformly loose layer of such depth as will result in a completed pavement having the weight per square yard required. Any deviation from standard section shall be immediately remedied by placing additional material or removing surplus as directed. The Engineer may direct that other means of placing the material in addition to the metal lutes be used to insure a better control of the depths of material and the surface finish.

Contact surfaces of curbings, gutters, manholes, etc., shall be painted with a thin uniform coat of hot asphalt cement, or tack coat, just before the material is placed against them. Where the bituminous material is spread on a concrete or an old bituminous base a uniform coat of asphalt shall be spread about one foot wide along each edge of the pavement to prevent water getting between the new pavement and the base. In any area where the new pavement is less than 1 1/2 inches thick and on steep grades the Engineer may order a very light web-like coating of hot asphalt paint tack coat applied to the old pavement. Care must be taken not to apply too heavy a coating or large blobs of asphalt paint. All surfaces which have been in place longer than five calendar days shall receive a tack coat. Emulsions for tack coat shall be diluted 50/50 with water and shall not be heated in excess of 160^{o}F. Care must be taken not to apply too heavy a coating; application rate of the diluted emulsion shall be 0.03 to 0.10 gallons per square yard. The emulsion shall be applied by a pressurized spray method approved by the Engineer.

The refueling of equipment in such position that fuel might be spilled on a bituminous concrete mixture already placed or to be placed is prohibited.

Kerosene, gasoline or fuel oil for use in cleaning mechanical equipment or hand tools shall be stored well clear of areas paved or to be paved. Before any such equipment and tools are cleaned they shall be moved off the areas paved or to be paved, and they shall not be returned for use until after they have been allowed to dry.

D. Compaction

After the courses have been screeded as specified, each shall be rolled with power rollers as hereinafter provided. When the course spread has set sufficiently or come to the proper condition, it shall be rolled at such a speed as not to cause undue displacement or shoving.

Rollers to be used to compact the course shall be power driven rollers weighing not less than ten tons. If only one roller is used, it shall be a tandem roller; a second roller may be of the three-wheel type. The roller wheels shall be wet with only sufficient water to moisten the wheel surface.

Rolling shall begin at the sides and progress toward the center, uniformly lapping at least one-half the width of the compacting wheel of the roller. Alternate trips of the roller shall be terminated in stops at least three feet distant from any preceding stop. Other rolling procedure may be directed by the Engineer as conditions may require. Rolling shall be discontinued if the surface shows signs of cracking and shall be continued later as directed.

The speed of the roller shall not exceed 3 miles per hour and shall at all times be slow enough to avoid displacement of the hot mixture. The rollers shall be in good condition. They shall be operated by experienced rollermen and must be kept in continuous operation as nearly as practicable in such a manner that all parts of the pavement shall receive substantially equal compression.

In all places inaccessible to a roller, such as adjacent to curbs, headers, gutters, bridges, manholes, etc., the required compression shall be secured with tamps. Depressions which may develop before the completion of the rolling shall be remedied by adding new material to bring such depressions to a true surface. Should any depressions remain after the final compaction has been obtained, new material shall be added to form a true and even surface. All high spots, high joints and other defects shall be adjusted as directed by the Engineer.

E. Joints

Placing of the courses shall be nearly continuous as possible and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued or interrupted for an appreciable period, and joints shall be formed at such points. Where joints are to be formed the end of the freshly laid mixture shall be cut "square" with the pavement, slightly set up with the back of a metal lute and rolled at slow roller speed so as to cause as little feathering as possible. Before new material is laid the joint shall be cut back and a thin coating of hot asphalt applied to the joint. Care shall be taken to paint off the surface of the pavement.

F. Surface Test of the Pavement

For the purpose of testing the finished surface, a standard template cut to the true cross section of the road shall at all times be available on the work, along with a 10-foot straight edge.

The Contractor shall provide or designate some employee whose duty it is to use the straight edge and template in checking all rolled surfaces under the direction of the Engineer.

The finished pavement shall be such that it will not vary more than 1/4 inch from the template cut to the cross section of the road no more than 1/4 inch from a 10-foot straight edge applied parallel to the center line of the pavement. Any irregularity of the surface exceeding the above limits shall be corrected. Depressions which may develop after the initial rolling shall be remedied by loosening the surface mixture laid, and adding new material to bring such depressions to a true surface. Such portions of the completed pavement as are defective in surface, compression or composition, or that do not comply with the requirements of the Specifications, shall be taken up, removed and replaced with

suitable mixture, properly laid in accordance with these Specifications at the expense of the Contractor.

G. Protection of the Work

Sections of the newly finished work shall be protected from traffic at least six hours, or until they have become properly hardened by cooling.

3.3 BITUMINOUS CONCRETE SURFACE COURSE

A. The methods employed in performing the work and all equipment, tools, machinery and other plant used in handling material and executing any part of the work shall be subject to the approval of the Engineer before the work is started, and whenever found unsatisfactory, shall be changed and improved as required by the Engineer. All equipment, tools, machinery and plant used must be maintained in a satisfactory working condition.

1. Forms: This shall conform to the requirements for Bituminous Concrete Base Course.

2. Placing of Mixture: This shall conform to the requirements for Bituminous Concrete Base Course.

3. Compaction: This material shall be compacted in accordance with the requirements for Bituminous Concrete Base Course.

4. Placing Mineral Filler: After final rolling and checking of a bituminous surface, the Contractor shall dust the surface with a light coat of mineral filler if requested by the Engineer.

5. Joints: This work shall conform to the requirements for Bituminous Concrete Base Course.

6. Surface Test of the Pavement: Same requirements as base course surface testing. For the purpose of testing the finished surface, a standard template cut to the true cross section of the road shall at all times be available on the work, along with a 10-foot straight edge.

The Contractor shall provide or designate some employee whose duty it is to use the straight edge and template in checking all rolled surfaces under the direction of the Engineer.

The finished pavement shall be such that it will not vary more than 1/4 inch from the template cut to the cross section of the road nor more than 1/4 inch from the 10-foot straight edge applied parallel to the center line of the pavement. Any irregularity of the surface exceeding the above limits shall be corrected. Depressions which may develop after the initial rolling shall be remedied be loosening the surface mixture laid, and adding new material to bring such depressions to a true surface. Such portions of the completed pavement as are defective in surface, compression or composition, or that do not comply with the requirements of the Specifications shall be taken up, removed and replaced with suitable mixture, properly laid in accordance with these Specifications at the expense of the Contractor.

7. Protection of the Work: This shall be done in accordance with the requirements for Bituminous Concrete Base Course.

8. A tack coat shall be applied to any bituminous aggregate base course which has been in place over five days or has been used by traffic prior to placement of the bituminous surface course.

3.4. BITUMINOUS CONCRETE LIP CURBING

A. The methods employed in performing the work and all equipment, tools, machinery and other plant used in handling material and executing any part of the work shall be subject to the approval of the Engineer before the work is started, and whenever found unsatisfactory, shall be changed and improved as required by the Engineer. All equipment, tools, machinery and plant used must be maintained in a satisfactory working condition.

B. Placing of Mixture: Clean surface of pavement where the curbing is to be constructed of all loose and foreign material. Apply to clean and dry surface approved tack coat just prior to placing the mixture

Transfer mixture from truck to hopper of approved curbing machine keeping mixture free from dirt and foreign matter.

Where machine work is impractical the Engineer may permit hand laid curbing to be constructed.

C. Compaction: No compaction shall be done other than that obtained from the curbing machine.

D. Testing: The surface of the curbing shall be tested with a 10-foot straightedge, and any variation from a true line exceeding 1/4 inch shall be satisfactorily corrected.

E. Protection of work: After the completion of curbing, traffic shall be kept at a safe distance for a period of not less than 24 hours and until the curbing has set sufficiently to prevent injury to the Work.

END OF SECTION 02510