

SECTION 400 BITUMINOUS PAVEMENTS



Section 401 - Plant Mix Bituminous Pavements—General

DESCRIPTION

401.01
Work

These specifications include general requirements that are applicable to all types of bituminous pavement structures of the plant mix type regardless of aggregate gradation, kind and amount of bituminous material, or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.

This work shall consist of constructing one or more bituminous bound layers on the prepared foundation. The prepared foundation or preceding layer shall be approved in writing by the Engineer before placement of a new layer.

Where a layer is to be placed over an existing pavement or a previously placed layer, the new layer shall be firmly bonded to the preceding layer.

MATERIALS

401.02
Composition of
Bituminous
Mixtures (Job Mix
Formula)

The bituminous mixtures shall be composed of a mixture of aggregate, mineral filler and additives, when specified in the SPECIAL PROJECT SPECIFICATIONS, and bituminous material.

Prior to producing bituminous mixtures, the contractor shall submit, in writing, a proposed job mix-formula for each mixture to the Engineer for use in setting the job mix-formula to be used with the proposed materials. The proposed job mix shall be submitted at least 15 days prior to the start of mixing operations. For bituminous mixtures, the proposed job mix-formula shall be based on a mix-design-run on aggregates, crushed or otherwise, produced for the project and by using bituminous material that will be furnished for the project. The Engineer shall be notified of the time the samples will be taken and shall be supplied duplicate samples of each material.

Hot bituminous mixtures - The mix-design shall be run in accordance with (a) or (b) as follows:

(a) Marshall Method. The stability and flow tests shall be run in accordance with AASHTO T 245 with the following exceptions:

(1) All specimens shall be compacted by applying 75 blows of the compaction hammer to both ends of the specimen. The number of sets of specimens required shall be sufficient to fully develop curves of bituminous content versus mix properties.

(2) A density and void analysis shall be done in accordance with procedures described in the latest edition of The Asphalt Institute Manual Series No. 2 (MS - 2).

(3) Determination of optimum asphalt content shall be based on recommendations given in MS - 2 that yield optimum mix properties. The minimum acceptable stability value shall be 1500.

(4) When aggregate is required to be produced and/or stockpiled in more than one size, the blend of sizes shall be based on results of mix design properties that yield the most ideal results. The blended gradations, however, must stay within the gradation limits given in Subsection 703.07 and table 703-6.

(5) The Engineer shall be furnished curves developed from the mix design for percent of asphalt by dry weight of mix versus unit weight, percent air voids, stability, flow, and percent voids in mineral aggregate.

(6) The Engineer shall be furnished a laboratory report giving all the items required to be reported in AASHTO T 245.

(b) Hveem Method

(1) Specimens shall be prepared in accordance with AASHTO T 247. The stability and cohesion tests shall be run in accordance with AASHTO T 246. The number of sets of specimens required shall be sufficient to fully develop curves of bituminous content versus mix properties.

(2), (3), and (4) The same as paragraphs (2), (3), and (4) in (a) above, except the last sentence in (3) shall be deleted and the following substituted:

The minimum acceptable stabilometer value shall be 37.

(5) The Engineer shall be furnished curves developed from the mix design for percent of asphalt by dry weight of mix versus percent air voids, stability, and cohesiometer value.

(6) The Engineer shall be furnished a laboratory report giving all the items required to be reported in AASHTO T 246. In addition, the report shall include values for mixing and compacting temperatures determined in accordance with procedures given in AASHTO T 245.

Cold bituminous mixtures - A job-mix formula based on a mix-design will be furnished by the Engineer on aggregates produced for the project, using bituminous materials that will be furnished for the project. The job mix-formula proposed by the contractor will be used as a first trial in the mix design. Adjustments in the proposed job mix-formula will be made to meet mix-design criteria.

Job mix-formula - Each job mix formula shall propose definite single values (hereafter referred to as Target Values-TV) for:

(a) The percentage of aggregate passing each specified sieve, based on the dry weight of aggregate. These percentages shall be within the range shown in Subsection 703.07, table 703-6 or in Subsection 703.10, table 703-8 as applicable.

(b) The percentage of bituminous material to be added, based on the total weight of mixture.

(c) The temperature of the mixture leaving the mixer.

(d) The temperature of the mixture placed on the road. This is defined as the time immediately preceding initial compaction of the mixture.

(e) The kind and percentage of additives to be used.

(f) The kind and percentage of mineral filler to be used.

(g) The percentage of water, based on the total dry weight of mixture.

(h) Emulsions only--the percentage of total fluids at compaction, based on the total dry weight of the mixture.

(i) For dense graded hot mix, the maximum specific gravity of bituminous paving mixtures as determined by AASHTO T209. For cold mixes and open graded hot mixes, the laboratory density developed during mix design shall be used as the target value. It shall be the maximum density for the target value bituminous content.

In addition, except for emulsion mixes, the job mix-formula, as submitted by the contractor, shall conform to the following:

Design Property	Test Method	Acceptable Range of Values		
		Surface	Binder	Base
Index of Retained Strength	AASHTO T 165 ^a	70%+	70%+	70%+

^aFor aggregates having maximum sizes over 1-inch (25.4mm). AASHTO T 165 will be modified to use 6-inch (152mm) by 6-inch (152) cylindrical specimens. The 6-inch (152mm) cylinders will be compacted by the procedures outlined in AASHTO T 167 modified to employ 10 repetitions of a molding load of 1,400 pounds per square inch (9.653 MPa) with no appreciable holding time after application of the full load.

The mixture shall have a minimum dry retained strength of 200 psi.

Should a change in source of material be proposed, or should a job mix-formula prove unsatisfactory, a new job mix-formula shall be established by the contractor.

All of the requirements above shall apply to the new job mix-formula supplied by the contractor.

The contractor shall supply penetration/viscosity/temperature relationships for the bituminous material to be used in the work along with a certification from the supplier as to their accuracy. If the supplier finds it desirable or necessary to change crudes or blends of crudes, new relationships must be supplied along with a sample to use in running a new mix-design 15 days prior to delivery of material from the changed source of materials. The penetration and viscosity values shall be determined at the temperatures and by the procedures specified in AASHTO M 226.

After reviewing the contractor's proposed job mix-formula, the Engineer will determine a job mix-formula with single values for (a) through (i) above, and so notify the contractor in writing.

401.03
Bituminous Materials

Bituminous materials shall be of the type and grade shown in the SCHEDULE OF ITEMS and meet the requirements of the following Subsections:

Asphalt Cements	702.01
Liquid Asphalts	702.02
Emulsified Asphalts	702.03

The grade of bituminous material may be changed one step by the Engineer with no change in unit price.

Mixing temperatures shall meet the requirements of Subsection 702.05.

401.04
Aggregate

Aggregates shall meet the requirements of Subsection 703.07.

401.05
(Reserved)

401.06
Mineral Filler
Portland Cement,
& Hydrated Lime

Mineral filler and hydrated lime shall meet the requirements of Subsection 703.15 and Subsection 712.03, respectively. Portland cement shall meet the requirements of Subsection 701.01.

CONSTRUCTION

401.07
Bituminous Mixing
Plant for Hot
Bituminous Pavements

Plants used for the preparation of hot bituminous mixtures shall meet the requirements in AASHTO M 156, unless producing approved materials for local State highway departments, with the following changes:

(a) Requirements for All Plants.

(1) All projects involving 5,000 tons or more shall be automated, as described in AASHTO M 156, Sections 3.6 and 4.5.

(2) AASHTO M 156, par. 4.6.4., does not apply to weighing devices. The bituminous mixture shall be weighed on scales furnished in accordance with Subsection 105.02.

Scales shall be sensitive to one-half the minimum graduation interval, which shall not be greater than 10 pounds.

(3) AASHTO M 156; delete paragraph 2.10 and substitute the following:

The plant shall be equipped with a dust collector constructed to waste or return uniformly to the hot elevator all or any part of the material collected without the escape of objectionable dust into the atmosphere.

A wet scrubber or other protective device for further treatment of the effluent dust charge gases emanating from the mixing plant dust collector shall be used as needed to comply with established air pollution standards.

Liquids from a wet scrubber shall not be discharged into a live stream, lake, or pond. The effluent shall be circulated through sludge pits or settling tanks. The resultant sedimentation, together with all other waste material developed by the crushing and mixing operation, shall be covered or otherwise disposed. Dustproof covers shall be installed over the screens.

(b) Requirements for Dryer-Drum Mixing Plants.

(1) Dryer-drum mixers shall be specifically designed and constructed for the process and shall be capable of producing a uniform mixture. A positive means of controlling mixing time shall be provided showing the rate of aggregate flow through the mixer per revolution and per minute at the plant operating speed and tilt.

(2) The cold feed shall be capable of being calibrated to ensure full control of the mix gradation. The plant shall include means for accurately proportioning each size of aggregate and shall include aggregate bins divided into at least two compartments. Separate dry storage shall be provided for mineral filler, Portland cement, or hydrated lime (if used), and provisions shall be made for accurate proportioning. Each compartment shall have an outlet feed that can be shut off completely and shall be equipped with an automatic plant shutoff that operates when any bin becomes empty. The bins or aggregate feeding system shall be constructed so samples can be readily obtained.

Cold feed aggregates for the mixture shall be divided into at least two general sizes and stockpiled or stored separately; one stockpile containing at least 80 percent of the material retained on the Number 4 sieve, and one stockpile containing at least 80 percent of the material passing the Number 4 sieve.

(3) Positive weight measurement of the combined cold feed shall be maintained to allow regulation of the feed gate and permit automatic correction for variations in load.

(4) The bitumen feed control shall be coupled with the total aggregate weight measurement device to automatically vary the bitumen feed rate and to maintain the required proportion. Means shall be provided for checking and calibrating the quantity or rate of flow of bitumen into the mixing unit.

(5) Thermometers shall be fixed in the bitumen feed line at the charging valve of the mixer unit and at the discharge chute of the mixer unit. The Engineer may require replacement of any thermometer by an approved temperature-recording apparatus to allow better regulation of the material temperature.

(6) A method shall be provided to automatically adjust the bituminous content in the mix for moisture variations in the cold feed.

(c) AASHTO M 156, paragraphs 2.5 and 2.6, and all other reference to hot screens and bins do not apply to continuous mixing plants provided the requirements for feed control of bituminous mixture materials specified above in paragraph (b) for Dryer-Drum mixing plants are met. The following alternates to what is specified in paragraph (b) are acceptable:

Paragraph (b)(3). Positive weight measurements may be on the hot feed between the dryer and the mixer unit.

Paragraph (b)(5). Temperature measurement of the aggregate may be made at the discharge from the dryer in lieu of temperature measurements of the mix.

Paragraph (b)(5). Automatic adjustments in the mix for moisture variation in the cold feed are not required if the alternate in paragraph (b)(3) of weight measurements of the hot feed are used.

401.08
Hauling Equipment

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a material to prevent the mixture from adhering to the beds. Truck beds shall be drained prior to loading.

401.09
Bituminous Pavers

Bituminous pavers shall be self-contained, power-propelled units, provided with an adjustable activated-screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths and thicknesses SHOWN ON THE DRAWINGS. When SHOWN ON THE DRAWINGS, pavers shall be equipped with a control system capable of automatically maintaining the proper screed elevation. The control system shall be automatically actuated from either a reference line or surface through a system of sensors that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope control system shall be capable of being made inoperative so that the screed can be controlled by mechanisms that will independently control the elevation of each end of the screed from reference lines or surfaces.

The controls shall be capable of working in conjunction with any of the following attachments:

- (a) Ski-type device of not less than 30 feet in length.
- (b) Taut stringline (wire) set to grade.
- (c) Short ski or shoe.

The contractor shall furnish the long ski, the short ski, or shoe and furnish and install all required stakes and wire for a taut stringline.

401.10
Rollers

Rollers shall meet the requirements of Subsection 212.02(b), (c), (d).

401.11
Weather
Limitations

(a) Hot Mixes. The bituminous mixture shall not be placed when weather conditions prevent the proper handling or finishing of the mixture, when the base course is frozen, or when the average temperatures of the underlying surface upon which the bituminous mixture is to be placed are less than those specified in the following table:

Surface Temperature Limitations

<u>Compacted Thickness of Layer to be Placed</u>	<u>Layer to be Placed</u>	
	<u>Surface Course</u>	<u>Subsurface Courses</u>
Less than 1-1/4 in	55 °F	55 °F
1-1/4 in. to 2-1/2 in	45 °F	35 °F
2-1/2 in. to 4 in	35 °F	35 °F
More than 4 in	Does not apply	25 °F ^a

^aOnly when air temperature is rising.

Placing during rain or other adverse weather conditions or when foundation contains standing water or flowing water, will not be permitted.

(b) Cold Mixes. Cold mixes shall be placed only when the atmospheric temperature in the shade is above 50 °F, the surface of the base is reasonably dry, and it is not raining.

401.12
Conditioning
of Existing Surface

Immediately before placing the bituminous mixture, the existing surface shall be cleaned of loose or deleterious material.

Contact surfaces of curbing, gutters, manholes, and other structures shall be painted with a thin, uniform coating of bituminous material prior to placing bituminous mixture.

401.13
Preparation
of Bituminous
Material for Hot
Bituminous Pavements

The bituminous material shall be evenly heated to the specified temperature. A continuous supply of the bituminous material shall be fed to the mixer at a uniform temperature. The temperatures of asphalt cement delivered to the mixer shall be in accordance with table 702-2.

401.14
Preparation
of Aggregates for
Hot Bituminous
Pavements

Aggregate for pugmill mixing shall be heated, dried, and delivered to the mixing unit at a temperature within +30 °F of the bitumen, but shall not exceed 325 °F. Moisture content of the aggregate shall not exceed 1 percent at the time it is introduced into the mixing unit. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate and soot on the aggregate.

Moisture content of the mixture from dryer-drum mixing plants shall not exceed 3 percent at the output in accordance with AASHTO T 110.

401.15
Mixing

The aggregates, bituminous material, additives, mineral filler, and water shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

After the required amounts of aggregate, bituminous material, and other required materials have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is obtained.

401.16
Control of
Bituminous Mixture

The contractor has the responsibility of providing the necessary tests to maintain the mixture within the TV's specified by the job mix-formula. The Engineer may also do expedient quality control testing determinations to spot check the acceptability of the product during progress of the job. These test results will not be used for acceptance testing, but the results will be made available to the contractor upon request. Upon completion of a unit of work, hereafter referred to as a lot, the Engineer will perform acceptance tests.

For the purpose of acceptance sampling and testing in accordance with Subsection 401.21, a lot is defined as the number of tons of material or work produced, and/or placed, and that will be represented by randomly selected samples tested for acceptance.

The size of a lot will be approximately 2,000 tons or one day's production. The Engineer will establish the lot sizes to fit field conditions, testing, and production capabilities. A minimum of two tests per lot will be taken. Acceptance or rejection of completed work will be on a lot basis.

401.17
Transporting,
Spreading,
& Finishing

The mixture shall be transported from the mixing plant to the point of use in vehicles meeting the requirements of Subsection 401.08.

The mixture shall be spread and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture. Maximum compacted lift thickness shall be 4 inches unless otherwise SHOWN ON THE DRAWINGS.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches. The joint in the top layer shall be at the centerline of a two-lane traveled way. Transverse joints in succeeding layers and in adjacent lanes shall be offset at least 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture may be placed and finished by hand tools.

401.18
Compaction

Compaction shall be performed with vibratory or nonvibratory steel-wheel rollers and pneumatic-tire rollers.

Rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping 6 inches or two times the pavement depth, whichever is greater, gradually progressing to the center. When paving in echelons or abutting a previously placed lane, the longitudinal joint should be rolled first, then followed by the above rolling procedure. On superelevated curves, the rolling shall begin at the low side and progress to the high side.

Initial breakdown rolling shall be accomplished while the mix temperature exceeds 250 °F. Rolling shall be completed while mix temperature exceeds 175 °F.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers.

401.19
Joints,
Trimming Edges,
& Cleanup

Placing of the bituminous mixture shall be continuous. Rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back into the previous run to expose the full depth of the course. Heat shall be applied to contact surfaces of transverse joints just before any additional mixture is placed against the previously rolled material.

Material trimmed from the edges and any other discarded bituminous mixture shall be removed from the roadway and disposed of by the contractor in an approved area.

ACCEPTANCE SAMPLING & TESTING

401.20
Finished
Work Samples

The contractor shall cut samples from the pavement. Sample size and locations will be DESIGNATED by the Engineer. Samples shall be neatly cut with a saw or core drill. Voids left by sampling shall be backfilled and compacted to the density of the surrounding material.

401.21
 Acceptance
 Sampling & Testing
 of Bituminous
 Mixture (Gradation &
 Bituminous Content)

Acceptance samples of the mixture will be taken after it has been discharged into hauling units or placed on the road in accordance with AASHTO T 168. Samples will be selected on a random basis.

Samples will be tested for bitumen content by means of AASHTO T 164 or other methods approved by the Engineer. Gradation of the entire quantity of extracted aggregate shall be determined in accordance with AASHTO T 30.

The lot will be accepted if:

(a) All individual test results for gradation fall within the grading band specified in Subsection 703.07 for hot mixes and 703.10 for cold mixes and

(b) The average of all test results and measured temperatures fall within the tolerances shown in the following table.

<u>Mixture Characteristic</u>	<u>Tolerances Defining Nondefective Test Results</u>
Bitumen Content	TV ± 0.5
Sieve Size--Percent by Weight	
3/8" and Larger	TV ± 5.0
Number 4 or 1/4"	TV ± 5.0
Number 8 or 10	TV ± 5.0
Number 16 to 50	TV ± 5.0
Number 200	TV ± 2.0
Temperature	
Leaving the Mixer	TV ± 10 °F
Placed on the Road	TV ± 15 °F

401.22
 Acceptance
 Sampling & Testing
 of Bituminous
 Mixture (Compaction)

After the bituminous mixture has been placed and compacted, the lot will be accepted with respect to compaction if:

(a) All individual test results equal or exceed 92 percent compaction for cold mix and open graded hot mix, and 89 percent for dense graded hot mix, and

(b) The average of all test results equals or exceeds 95 percent compaction for cold mix and open graded hot mix, and 92 percent for dense graded hot mix.

Samples and tests will be taken as frequently and at such locations as the Engineer elects. Testing will be in accordance with AASHTO T 230 or ASTM D 2950 or other approved methods. The specific gravity of standard specimens shall be determined in accordance with AASHTO T 166 Method A.

If directed by the Engineer, a control strip may be used to establish the target density. Procedures for constructing the control strip shall be as required in subsection 212.03. Acceptance requirements (a) and (b) above shall apply. Those areas failing to meet density requirements shall be replaced.

A new test strip shall be required for any of the following:

- (1) Any change in the characteristics of the material.
- (2) Any change in the pavement thickness.
- (3) If the weather turns cooler (reduction by 20 °F).

401.23
Acceptance
Sampling & Testing
of Bituminous
Mixture (Surface &
Thickness Tolerance)

(a) Surface. Acceptance testing will be performed on the top surface. The surface shall be tested by the Engineer with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge shall not deviate at any point more than 3/8 inch.

(b) Thickness. The total compacted thickness of the mixture shall not vary more than 1/4 inch for wearing course of 1/2 inch for base course from the specified thickness. The compacted thickness shall not be consistently below nor consistently above the specified thickness.

The Engineer reserves the right to test areas that appear defective and require immediate correction.

401.24
Acceptance
Sampling & Testing
of Bituminous
Materials

Acceptance of bituminous material will be based upon certificates and samples provided in accordance with Subsection 105.04.

MEASUREMENT

401.25
Method

No separate measurement will be made for work performed under this Section. Batch weights will not be permitted for quantity determination. The tonnage will be the weight used in the accepted pavement, and no deduction will be made for the weight of bituminous material in the mixture.

PAYMENT

401.26
Basis

The accepted quantities will be paid for at the contract unit price of each pay item in other Sections shown in the SCHEDULE OF ITEMS.

Section 403 - Hot Bituminous Pavement

DESCRIPTION

403.01 Work This work shall consist of constructing one or more courses of hot bituminous pavement on a prepared surface that has been approved in writing by the Engineer.

MATERIALS

403.02 Requirements The materials and their use shall meet the requirements of Subsections 401.02 through 401.06.

Pavement aggregate shall meet the requirements of Subsection 703.07.

CONSTRUCTION

403.03 Performance The construction requirements shall be in accordance with Subsections 401.07 through 401.24, except for bituminous base course:

(a) The requirement for plant screens (AASHTO M 156, paragraph 2.5) for plants with pugmill type mixers, except to remove oversize material, is deleted.

(b) The requirement for divided bins (AASHTO M 156, paragraph 2.6) is deleted.

403.04
(Reserved)

MEASUREMENT

403.05 Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS and in accordance with Subsection 401.25.

PAYMENT

403.06 Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
403(01) Hot Bituminous Pavement, Grading _____ . . .	TON
403(02) Hot Bituminous Pavement, Grading _____ . . .	S.Y.
403(03) Asphalt Cement, Grade _____	TON
403(04) Asphalt Cement, Grade _____	GAL.
403(05) Hot Bituminous Pavement Patching, Grading _____	TON
403(06) Hot Bituminous Pavement Patching, Grading _____	S.Y.

Section 404 - Cold Bituminous Pavement

DESCRIPTION

404.01 Work This work shall consist of constructing one or more courses of cold bituminous pavement on a prepared base that has been approved in writing by the Engineer.

MATERIALS

404.02 Requirements The composition of cold bituminous mixtures shall meet the requirements of Subsection 401.02.

The type and grade of bituminous material as shown in the SCHEDULE OF ITEMS shall meet the requirements of the following subsections:

Liquid Asphalts	702.02
Emulsified Asphalts	702.03

The grade of bituminous material may be changed one step by the Engineer with no change in unit price.

Mixing temperature shall meet the requirements of Subsection 702.05.

Portland cement shall meet the requirements of Subsection 701.01.

The aggregate and top dressing material shall meet the requirements of Subsection 703.10.

Water, if used in the mixture, shall be free of silt and other matter deleterious to the quality of the bituminous mixture.

Filler and hydrated lime shall meet the requirements of Subsection 703.15 and 712.03, respectively.

CONSTRUCTION

404.03 Performance Construction requirements shall be in accordance with Subsections 401.07 through 401.19, with the following modifications:

(a) When combined with bituminous materials other than emulsified asphalt, the aggregate shall not contain more than 3-percent moisture and shall be at a temperature not less than 60 °F nor more than 225 °F.

(b) When combined with emulsified asphalt, the aggregate shall be at a temperature not less than 50 °F nor more than 175 °F.

(c) The aggregate, prepared as prescribed above, shall be combined in the amounts required to meet the job mix formula and shall be introduced into the mixer. Water, or cement, when required, shall be introduced into the batch in the proper proportion prior to the introduction of bituminous material. The bituminous material, in the proper proportion, shall then be introduced into the batch and mixed until the aggregates are thoroughly coated and the mass is a uniform color.

The mixing time for each phase of the mixing operation shall be determined from the nature of the aggregates, the job mix formula, and the size of the batch.

(d) The mixer shall be a pugmill, continuous, or dryer-drum type meeting the requirements of Subsection 401.07 with the following modifications:

(1) Add the following to AASHTO M 156, paragraph 4.3: The flow of water and other additions, when required, shall also be interlocked with the flow of aggregate and bituminous material. The mixing plant shall be equipped with volumetric rate meters registering in gallons per minute to accurately measure the flow of bitumen and water.

(2) Delete AASHTO M 156, paragraph 2.5, 2.6, 4.5, and 4.6.

(3) Delete AASHTO M 156, paragraph 2.3 and 2.4 unless a dryer is used. Dryer-drum plants will only be allowed for mixing dense, graded mixtures.

(e) The moisture content shall be controlled by adding water in the plant, by drying the aggregate, or by a combination of both methods as necessary to comply with the job mix formula. When approved in writing by the Engineer, additives such as lime or cement may be incorporated into the mixture to correct moisture content.

(f) The following job mix formula tolerances are added to Subsection 401.21:

<u>Mixture Characteristic</u>	<u>Percent Allowable Deviation From Target Value</u>
Water in Aggregate at Mixing	± 1.0
Total Fluids in Aggregate at Compaction	± 1.5

(g) After placing the top layer of bituminous mixture, the surface shall be compacted. The top dressing material for open graded mixtures shall then be applied to the surface with aggregate spreading equipment designed for the controlled spreading of fine material. The material shall be spread uniformly to a depth that, when compacted, shall be sufficient to fill the surface voids of the bituminous mat. Excess dressing material shall be removed by brooming. Multilayered mats shall have a top dressing material applied only to the top layer.

(h) Existing bituminous surface shall be prepared as SHOWN ON THE DRAWINGS or described in the SPECIAL PROJECT SPECIFICATIONS.

(i) For dense graded mixtures, the material shall be aerated by periodically moving and exposing the material in the stockpile or by manipulation in a windrow to remove excess moisture.

(j) For open graded mixtures, initial compaction shall consist of a minimum of two complete coverages with a vibratory steel roller.

Final compaction shall immediately follow application of aggregate top dressing and shall consist of two complete coverages with a static roller. When no aggregate top dressing is required, final compaction shall be performed while emulsion is still tacky.

404.04
Acceptance Sampling
& Testing

Acceptance sampling and testing shall be performed in accordance with Subsections 401.20 through 401.24.

MEASUREMENT

404.05
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS and in accordance with Subsection 401.25.

PAYMENT

404.06
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
404(01) Cold Bituminous Pavement, _____ Graded . . .	TON
404(02) Cold Bituminous Pavement, _____ Graded . . .	S.Y.
404(03) Liquid Asphalt, Grade _____	TON
404(04) Liquid Asphalt, Grade _____	GAL.
404(05) Emulsified Asphalt, Grade _____	TON
404(06) Emulsified Asphalt, Grade _____	GAL.
404(07) Aggregate Top Dressing	TON
404(08) Cold Bituminous Pavement Patching, _____ Graded	TON
404(09) Cold Bituminous Pavement Patching, _____ Graded	S.Y.

Section 405 - Road Mix Bituminous Pavement

DESCRIPTION

405.01
Work This work shall consist of constructing one or more courses of road mix bituminous pavement on a prepared base or road surface that has been approved in writing by the Engineer.

MATERIALS

405.02
Bituminous Material The type and grade of bituminous material as shown in the SCHEDULE OF ITEMS shall meet the requirements of the following Subsections:

Liquid Asphalts	702.02
Emulsified Asphalts	702.03

Application temperatures of bituminous materials shall meet the requirements of Subsection 702.05.

The grade of bituminous material may be changed one step by the Engineer with no change in unit price.

The amount of bituminous materials to be added shall be as SHOWN ON THE DRAWINGS.

405.03
Aggregate Aggregate shall be either new aggregate (Case 1) or aggregate scarified from the existing roadbed (Case 2), or both as SHOWN ON THE DRAWINGS. New aggregate shall meet requirements of Subsection 703.11. The contractor shall not be responsible for the grading or quality of the existing aggregate scarified from the roadbed except for removal of particles that are retained on a 1.5-inch sieve.

CONSTRUCTION

405.04
Weather &
Temperature
Limitations Bituminous material shall be applied only when the atmospheric temperature in the shade is above 50 °F and when the weather is not foggy or rainy. The temperature of the aggregate material shall be above 40 °F.

405.05
Equipment The equipment shall include scarifying, mixing, spreading, finishing and compacting equipment, a bituminous distributor, and equipment for heating bituminous material.

The distributor shall be so designed, equipped, maintained, and operated that bituminous material at even heat may be applied uniformly on variable widths of surface up to 16 feet. Application shall be at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with uniform pressure and with an allowable variation from any specified rate not to exceed 0.02 gallon per square yard. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with (1) power unit for the pump; (2) full circulation spray bars that adjust laterally and vertically; and (3) hose and nozzle attachment for applying material to areas inaccessible to the distributor spray bars.

Traveling cross-shaft, traveling pugmill, or blade graders shall be used by the contractor as SHOWN ON THE DRAWINGS.

Traveling cross-shaft mixers and traveling pugmills shall be capable of accurately adding the required amount of bituminous material.

Rollers shall be self-propelled, steel-wheel tandem or three-wheel rollers weighing not less than 8 tons each and pneumatic-tire rollers having a total compacting width of not less than 60 inches

and a gross weight adjustable within the range of 200 to 350 pounds per inch of compaction width. The operating weight shall be as directed. Contact pressure may be specified for pneumatic-tire rollers. All tires on pneumatic rollers shall be equally inflated and exert equal unit pressure, and have a means of varying the contact pressure to suit project conditions. Vibratory steel-wheel rollers may also be used providing they weigh at least 6 tons, have amplitude and frequency controls, and are specifically designed to compact bituminous materials.

405.06
Preparation of Base

(a) Case 1 (New Aggregate). When new aggregate is to be used for the road mix bituminous pavement, the existing base shall be scarified lightly and bladed to uniform grade and to the cross section SHOWN ON THE DRAWINGS and shall then be rolled, or watered and rolled. Depressions shall be filled and weak portions of the base strengthened with new aggregate.

(b) Case 2 (Salvaged Aggregate). When aggregate in the existing road surface is to be used for mixing, the surface shall first be scarified lightly and bladed to uniform grade and to the cross section SHOWN ON THE DRAWINGS. The reshaped surface shall then be scarified again to the depth SHOWN ON THE DRAWINGS so a foundation of undisturbed material is left. The loosened material shall be bladed into a windrow at the side of the road and the undisturbed material rolled, or watered and rolled.

405.07
Placing Aggregates

New aggregates shall be uniformly spread on the road by use of spreader boxes or other approved mechanical spreading devices. When two or more sizes of aggregates are used, each size of aggregate shall be placed in the proper amount to provide for surfacing of the required width and thickness. Each size of aggregate shall be windrowed to a uniform section and left undisturbed until measuring and sampling are completed, after which they shall be mixed until they are uniformly blended and then spread over the road surface.

If the surface moisture of the aggregate is more than three percent of the dry weight of the aggregate, except when the bituminous material is emulsified asphalt, the aggregate shall be turned by blades or disc harrows or otherwise aerated until the moisture content is reduced to 3 percent or less. The aggregate shall then be spread smoothly and uniformly over half the road or other convenient width of the surface ready for the application of bituminous material, except that when a traveling mixing plant is used, the aggregate shall be formed into a uniform cross section.

405.08
Application of
Bituminous Material

For blade grader mixing, bituminous material shall be uniformly distributed in successive applications, in such amounts and at such intervals as directed by the Engineer. The mixing equipment shall follow immediately behind the distributor after each application of bituminous material to partially mix the aggregate and the bituminous material.

When traveling pugmill or traveling cross-shaft mixers are specified, the bituminous material shall be added during mixing.

405.09
Mixing

If mixing is done with a blade grader, after the last application of bituminous material and partial mixing, the entire mass of bituminous material and aggregate shall be windrowed on the road surface. Then the mass shall be mixed until all aggregate particles are coated with bituminous material. The mixture shall have a uniform color and be free from fat or lean spots, or balls. During the mixing operations, care shall be taken to avoid cutting into the underlying course or contaminating the mixture with earth or other extraneous matter. When directed by the Engineer the mixing process shall be confined to part of the width or area of the road that allows traffic to pass.

Should the mixture show an excess, deficiency, or uneven distribution of bituminous material, the condition shall be corrected by the addition of aggregate or bituminous material and remixing. If the mixture contains excessive amounts of moisture or volatile matter, it shall be bladed, aerated, or otherwise manipulated until the moisture and volatile content are satisfactory. The spreading of the mix shall not be done until the surface to be covered is approved by the Engineer.

At the end of each day's work, or when the work is interrupted by weather conditions or otherwise, all loose material shall be bladed into a windrow, whether mixing is completed or not, and shall be retained in a windrow until operations are resumed when liquid asphalts are used as the binder. Emulsion mixtures may be left in a windrow a maximum of 6 hours before being spread and compacted.

When the mixing operations have been satisfactorily completed, the mixture shall be formed into a windrow of uniform cross section.

If traveling mixing plants are used, the same requirements given above shall apply.

405.10
Spreading,
Compaction,
& Finishing

The material shall be spread by a self-propelled, pneumatic-tire blade grader or a mechanical spreader of approved type. When spreading from the windrow, care shall be taken to avoid cutting into the underlying base.

After the material is spread, the surface shall be rolled. Rolling shall be parallel to the road centerline and shall commence at the outer edges of the road, overlapping the shoulders, and shall progress toward the center, overlapping on successive phases by at least one-half the width of the roller. On superelevated curves, rolling shall progress from the lower to the upper edge. Each pass shall terminate at least 3 feet in advance or to the rear of the end of the preceding pass.

During compaction, the surface shall be dragged or bladed to fill ruts and to remove incipient corrugations or other irregularities. Rolling shall continue until the surfacing is of uniform texture and satisfactory compaction is obtained. Initial rolling shall be performed with a pneumatic-tire roller and final rolling with a three-wheel or tandem-type, steel-wheel roller, either static or vibratory. Rolling shall be discontinued whenever it begins to produce excessive pulverizing of the aggregate or displacement of the mixture.

Where the compacted thickness of the road mix surface is to be more than 4 inches, the mixture shall be spread from the windrow and compacted in two layers. The first layer shall be bladed and rolled before the second layer is spread.

405.11
Surface
Requirements

Acceptance testing will be performed on the top surface. The surface shall be tested by the contractor with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge shall not deviate at any point more than 1/2 inch.

405.12
(Reserved)

MEASUREMENT

405.13
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

405.14
Basis

The accepted quantities will be paid at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
405(01) Road Mix Surfacing Laid, Case _____	MI.
405(02) Road Mix Surfacing Laid, Case _____	S.Y.
405(03) Road Mix Aggregate	TON
405(04) Road Mix Aggregate	C.Y.
405(05) Liquid Asphalt, Grade _____	TON
405(06) Liquid Asphalt, Grade _____	GAL.
405(07) Emulsified Asphalt, Grade _____	TON
405(08) Emulsified Asphalt, Grade _____	GAL.

Section 406 - Hot Bituminous Plant Mix (Commercial Source)

DESCRIPTION

406.01
Work This work shall consist of constructing one or more courses of hot bituminous plant mix on a prepared base or roadbed. Surface to be constructed upon shall be approved, in writing, by the Engineer prior to placing plant mix.

MATERIALS

406.02
Bituminous Material Asphalt cement shall meet the requirements of Subsection 702.01. The exact percent of asphalt cement and the grade to be used will be furnished by the Engineer after test results required in Subsection 406.05 have been reviewed and evaluated. The grade may be changed one step by the Engineer during construction with no change in unit price.

Mixing temperatures shall meet the requirements of Subsection 702.05.

406.03
Aggregate Aggregate shall meet the quality requirements of Subsection 703.07, except for aggregate gradation. Aggregate gradation will be submitted by the contractor to the Engineer for approval.

406.04
Additives Filler shall meet the requirements of Subsection 703.15. Hydrated lime shall meet the requirements of Subsection 712.03. Additives, such as filler, hydrated lime, and antistrip agents may be used as necessary to meet specifications.

406.05
Job Mix-Formula The job mix-formula shall meet the requirements of Subsection 401.02 or the contractor may submit test results and job mix formulas accepted by and currently being used by public road agencies. After review of the submitted material the Engineer will determine a job-mix formula and notify the contractor in writing or request additional information or testing.

CONSTRUCTION

406.06
Performance The construction requirements shall be as prescribed in Subsections 401.07 through 401.24.

MEASUREMENT

406.07
Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Certificates furnished by the contractor showing the net weight of bituminous material used in the mixture may be used for determining quantities for pay items 406(02) and 406(03). Certification shall include specific gravities as shown on the manufacturer's invoice. The net weight is subject to correction if material is lost or wasted. The net weight is also subject to correction based on Forest Service extraction tests.

The quantity of plant mix bituminous mixture will be the number of tons used in the accepted work with no deduction for the weight of liquids contained in the mixture.

PAYMENT

406.08
Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
406(01) Hot Bituminous Plant Mix	TON
406(02) Asphalt Cement, Grade _____	TON
406(03) Asphalt Cement, Grade _____	GAL.

Section 407 - Tack Coat

DESCRIPTION

407.01 This work shall consist of preparing and treating an existing
Work bituminous or concrete surface with bituminous material.

MATERIALS

407.02 The type and grade of bituminous material will be shown in the
Requirements SCHEDULE OF ITEMS. The grade may be changed one step by the
Engineer during construction with no change in unit price.

The bituminous material shall meet the requirements of the following Subsections:

Liquid Asphalts	702.02
Emulsified Asphalts	702.03
Water	712.01

Application temperatures of bituminous material shall meet the requirements of Subsection 702.05.

When emulsified asphalt is used, other than RS and CRS grades, water shall be added to the asphaltic emulsion material and thoroughly mixed to result in a mixture containing 50 percent by volume of added water unless otherwise SHOWN ON THE DRAWINGS.

CONSTRUCTION

407.03 The contractor shall provide for the passage of traffic in
Maintaining Traffic accordance with Section 104.

407.04 Equipment for heating and applying the bituminous material shall
Equipment meet the requirements of Subsection 405.05.

A power broom and/or power blower shall be provided for cleaning the surface to be treated.

407.05 Immediately before the application of the bituminous material, the
Preparation of surface to be treated shall be patched and all foreign and loose
Surface To Be material shall be removed.
Treated

The surface to be treated shall be approved in writing by the Engineer prior to treatment.

407.06 The bituminous material shall be uniformly applied with a pressure
Application of distributor within the 24 hours preceding placement of covering
Bituminous Material courses.

The tack coat shall be applied so as to cause the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material when an existing two-lane road is to be kept open in accordance with Section 104.

The tack coat shall not be applied during wet weather, after sunset, to a wet surface, or when the temperature of the surface to be tacked is below 40 °F in the shade. The rate of application and the areas to be treated shall be as SHOWN ON THE DRAWINGS.

The surfaces of adjacent structures and trees shall be protected from spattering or marring. Bituminous material shall be discharged only in approved areas.

The tack coat shall be applied sufficiently in advance of the cover course to allow curing to the proper condition of tackiness. The tack coat shall be protected from damage until the cover course is placed.

MEASUREMENT

407.07
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Water used for diluting emulsified asphalts will not be included in the quantities for bituminous material.

PAYMENT

407.08
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will made made under:

<u>Pay Item</u>	<u>Pay Unit</u>
407(01) Liquid Asphalt, Grade _____	TON
407(02) Liquid Asphalt, Grade _____	GAL.
407(03) Emulsified Asphalt, Grade _____	TON
407(04) Emulsified Asphalt, Grade _____	GAL.

Section 408 - Prime Coat

DESCRIPTION

408.01
Work This work shall consist of preparing and treating an existing surface with bituminous and blotter material. Surface to be treated shall be approved in writing by the Engineer prior to treatment.

MATERIALS

408.02
Bituminous Material The type and grade of bituminous material will be shown in the SCHEDULE OF ITEMS. The grade may be changed one step by the Engineer during construction with no change in unit price.

The bituminous material shall meet the requirements of the following Subsections:

Liquid Asphalts 702.02
Emulsified Asphalts 702.03

Application temperatures of bituminous materials shall meet the requirements of Subsection 702.05.

When emulsified asphalt is specified in the SCHEDULE OF ITEMS, the emulsion shall be diluted as specified in the SPECIAL PROJECT SPECIFICATIONS.

408.03
Blotter Material Blotter material shall meet the requirements of Subsection 703.14.

CONSTRUCTION

408.04
Maintenance for Traffic The contractor shall provide for the passage of traffic in accordance with Section 104.

408.05
Weather Limitations The prime coat shall be applied only when the surface temperature in the shade is above 55 °F and rising or above 60 °F if falling and the weather is not foggy or rainy.

408.06
Equipment The contractor shall provide equipment for heating and applying the bituminous material and for applying blotter material. The distributor shall meet the requirements of Subsection 405.05.

408.07
Preparation of Surface The surface shall be lightly bladed and rolled with a smooth-wheel roller immediately before application of bituminous material. The moisture content of the top 1 inch of the surface to be treated shall be slightly damp.

408.08
Application of Bituminous Material Bituminous material shall be applied with a pressure distributor in a uniform, continuous spread. Application of bituminous material at the junctions of spreads shall not be in excess of the designated amount. Excess bituminous material shall be removed from the surface, and the surface shall be covered with blotter material. Skipped areas or deficiencies shall be corrected.

The rate of application and areas to be treated shall be as SHOWN ON THE DRAWINGS. The exact rate of application may be adjusted by the Engineer to fit local conditions.

The surfaces of adjacent structures and trees shall be protected from spattering or marring. Bituminous material shall be discharged only in areas approved by the Engineer.

A prime coat curing period shall be at least 5 days for cutbacks and 1 day for emulsions unless approved otherwise by the Engineer.

408.09
Application of
Blotter Material

Blotter material shall be spread to cover any unabsorbed bituminous material if traffic must be routed over the primed surface before the bituminous material has penetrated and dried sufficiently to prevent pickup by vehicles, or to minimize possible damage by rain before complete penetration.

Blotter material shall be spread so traffic does not pick up bituminous material.

When blotter material is shown in the SCHEDULE OF ITEMS, it shall be applied at the rate SHOWN ON THE DRAWINGS by approved methods.

Surplus blotter material shall be removed from the surface before placing bituminous surfacing courses.

MEASUREMENT

408.10
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Water used for diluting emulsified asphalt will not be included in the quantity for pay items 408(03) or 408(04) and will not be paid for separately.

PAYMENT

408.11
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
408(01) Liquid Asphalt, Grade _____	TON
408(02) Liquid Asphalt, Grade _____	GAL.
408(03) Emulsified Asphalt, Grade _____	TON
408(04) Emulsified Asphalt, Grade _____	GAL.
408(05) Blotter Material (Grading _____) _____ .	TON
408(06) Blotter Material (Grading _____) _____ .	C.Y.

Section 410 - Bituminous Surface Treatment & Seal Coat

DESCRIPTION

410.01 This work shall consist of the construction of a single- or
Work multiple-course bituminous surface treatment or fog seal.

MATERIALS

410.02 The approximate quantities of materials per square yard and the
Requirements sequence of applications and spreading shall be as shown in tables
410-1 or 410-2 for the type of treatment SHOWN ON THE DRAWINGS.
For bituminous fog seal, quantities will be as SHOWN ON THE
DRAWINGS.

The amounts of bituminous and aggregate material per square yard
may be varied by the Engineer for each application and spreading
to fit field conditions or materials conditions as determined in
Subsection 410.04.

410.03 The types and grades of bituminous material shall be as shown in
Bituminous Material the SCHEDULE OF ITEMS. The grade may be changed one step by the
Engineer prior to delivery to the construction site with no change
in unit price.

The bituminous material shall meet the requirements of the
following Subsections:

Asphalt Cements	702.01
Liquid Asphalts	702.02
Emulsified Asphalts	702.03

Application temperatures of bituminous material shall be in
accordance with Subsection 702.05.

A fog seal shall consist of a slow-setting asphalt emulsion
diluted with water at a ratio of one part emulsion to one part
water. The mixture shall be applied at the rates SHOWN ON THE
DRAWINGS.

410.04 Aggregates shall meet the requirements of Subsection 703.13. The
Aggregates material shall be tested for acceptance in the stockpile.
Representative samples of acceptable aggregate to be used for each
application shall be furnished to the Engineer at least 10 days
prior to the planned start of work. These samples will be used
for testing to establish the aggregate and bituminous material
spread rates.

CONSTRUCTION

410.05 Bituminous surface treatments with aggregate shall be applied only
Weather Limitations when the existing surface is dry or slightly damp, when the
surface temperatures are above 65 °F, and when the weather is not
foggy or rainy.

Fog seal shall be applied only when the existing surface is dry or
slightly damp, when pavement temperatures are above 50 °F, and
when the weather is not foggy or rainy.

410.06 Traffic control shall be provided for in accordance with Section
Traffic Control 104.

410.07 The following equipment or its equivalent shall be furnished:
Equipment

(a) A distributor for heating and applying bituminous material
that shall meet the requirements of Subsection 405.05.

(b) A rotary power broom and/or blower, a drag broom, or a
blade-mounted broom.

Table 410-1.--Bituminous-surface surface treatments using liquid asphalt, asphalt cement, and emulsified asphalts.

Aggregate Gradations & Sequence of Operations (See Subsection 703.13 for gradations)	Type of Treatment			
	BST-1 Single	BST-2A Double	BST-2B Double	BST-3 Triple
First Course: Bituminous Material (Gal /yd ²)	0.25-0.45 ^b	0.14-0.18 ^b	0.22-0.28 ^b	0.23-0.28 ^b
Aggregate (1b /yd ²)	-	25-30	-	-
Grading 7 or 7A	20-30	-	-	-
Grading 7B ^a	-	-	40-50	40-50
Grading 6 or 6A	-	-	-	-
Second Course: Bituminous Material (Gal /yd ²)	-	0.21-0.27 ^b	0.33-0.42 ^b	0.29-0.37 ^b
Aggregate (1b /yd ²)	-	10-15	-	-
Grading 9 or 9A	-	-	20-25	-
Grading 8 or 8A	-	-	-	25-30
Grading 7 or 7A	-	-	-	-
Third Course: Bituminous Material (Gal /yd ²)	-	-	-	0.23-0.28 ^b
Aggregate (1b /yd ²)	-	-	-	15-20
Grading 9 or 9A	-	-	-	-
Totals: Bituminous Material	0.25-0.45 ^b	0.35-0.45 ^b	0.55-0.70 ^b	0.75-0.95 ^b
Aggregate (1b /yd ²)	20-30	35-45	55-70	75-95

^aCutback asphalts only.
^bResidual quantities.

Table 410-2.--Seal coat application rates.

Type of Application	Type 1	Type 2	Type 3	Type 4
Bituminous Material (gal/yd ²)	0.05-0.12 ^a	0.10-0.15 ^a	0.15-0.20 ^a	0.25-0.30 ^a
Cover Aggregate (1b/yd ²)	None	10-15	15-20	25-30
Grading Number (See Subsection 703.13)	N/A	#9 or 9A	#8 or 8A	#7 or 7A

^aResidual quantities.

(c) A pneumatic-tire roller meeting the requirements of Subsection 405.05 when cover aggregates are applied.

(d) A second pneumatic-tire roller shall be required if rolling is not completed in a timely manner. Rollers shall be operated at a maximum of 5 miles per hour.

(e) Aggregate spreaders shall be self propelled and equipped so the required amount of material will be deposited uniformly over the full width of the bituminous material.

410.08
Preparation
of Surface

Immediately before placing each layer of bituminous surface treatment, loose dirt and other objectionable material shall be removed from the existing surface. The surface will be approved in writing by the Engineer before the coat application. A prime coat curing period shall be at least 5 days for cutbacks and 1 day for emulsions unless approved otherwise by the Engineer.

410.09
Application of
Bituminous Material

Bituminous material shall be applied in a uniform, continuous spread at the application temperature and rate per square yard for the type of treatment SHOWN ON THE DRAWINGS. The distributor shall be moving forward at proper application speed when the spray bar is opened. Any skipped areas or deficiencies shall be corrected. Junction of spreads shall be carefully made to ensure uniform coverage and a smooth-riding surface.

Building paper joints shall be constructed when directed by the Engineer. These joints shall be formed by spreading building paper on the surface for a sufficient distance back from the end of the completed application so flow through the nozzles will operate properly over the entire length being treated. Building paper so used shall be immediately removed and properly disposed.

The length of spread of bituminous material shall not be in excess of that which aggregate spreading equipment can immediately cover.

The surfaces of adjacent structures and trees shall be protected from spattering or marring. Bituminous material shall be discharged only in areas approved by the Engineer.

When bituminous surface treatment is applied one-half width at a time, 4 to 6 inches of the inside edge shall be left uncovered with aggregate to allow for an overlap of asphaltic material when the remaining half of the surface is treated. Traffic shall not be allowed to travel over the freshly treated surface.

The distributor, when not spreading, shall be parked so the spray bar or mechanism will not drip bituminous materials on the surface of the traveled way.

410.10
Application
of Aggregate

Each layer of aggregate for all types of surface treatments shall be spread immediately following the application of the bituminous material. Operations shall proceed in a manner that will not allow bituminous material to chill, set up, dry, or otherwise impair retention of the aggregate. The aggregate spreader shall be operated so that bituminous material will be covered before any tires pass over it. Aggregate shall be clean. Aggregate shall be dry when using asphalt cement.

Immediately after the aggregate has been spread upon the bituminous material, any piles, ridges, or uneven distribution shall be carefully removed to prevent permanent ridges, bumps, or depressions in the completed surface. Additional cover aggregate shall be spread in the quantities needed to prevent picking up bituminous material by the rollers or traffic. The surface shall then be rolled.

Rolling shall begin immediately behind the spreader. Initial rolling shall consist of one completed coverage performed with a pneumatic-tire roller. Displacement of the aggregate by pick-up or sticking of materials to the tire surface shall not be permitted.

The amount of rolling shall be sufficient to uniformly and thoroughly bond the aggregate over the full width, and in no case shall be less than three complete coverages. Rolling shall be completed within 1 hour of application of bituminous material. Brooming shall be performed as necessary to obtain a smooth surface of uniform texture.

Traffic will be permitted to travel over surface treatment upon completion of rolling following any application of bituminous material and aggregate.

When more than one application of bituminous material and aggregate is required, the curing period shall fully cure or dry the bituminous material. In no case will this period be less than 3 days unless otherwise approved, in writing, by the Engineer.

During this curing period, the contractor shall maintain the surface by brooming to keep the surface evenly covered so there are no areas with a lack or an excess of aggregate. The surface shall be kept in repair. All holes and raveled areas shall be patched and repaired with bituminous-treated material using penetration methods or other approved procedures. Before the next application, the surface shall be free from holes or depressions and shall be of uniformly sound texture. The Engineer may require rolling during the curing period between lifts and following completion of the final lift. Rolling shall follow brooming. Before placing each succeeding lift, excess aggregate shall be swept from the entire surface by means of a rotary broom in a manner that avoids displacement of imbedded aggregate.

After the application of the last layer of aggregate, and rolling and brooming have been performed as described above, the surface shall be lightly broomed or otherwise maintained, for a period of 4 days unless approved otherwise by the Engineer.

Maintenance of the surface shall include the distribution of aggregate over the surface by brooming to absorb any free asphaltic materials and cover any area deficient in aggregate. The maintenance shall be conducted to avoid displacing imbedded materials. Excess aggregate shall be swept from the entire surface by means of rotary brooms at the end of the maintenance period unless directed otherwise by the Engineer.

410.11
(Reserved)

MEASUREMENT

410.12
Method The method of measurement, as designated in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. Water used for diluting emulsified asphalt will not be included in the measurement for bituminous material.

PAYMENT

410.13
Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
410(01) Aggregate, Grading _____	TON
410(02) Aggregate, Grading _____	C.Y.
410(03) Liquid Asphalt, Grade _____	TON
410(04) Liquid Asphalt, Grade _____	GAL.
410(05) Emulsified Asphalt, Grade _____	TON
410(06) Emulsified Asphalt, Grade _____	GAL.
410(07) Asphalt Cement, Grade _____	TON
410(08) Asphalt Cement, Grade _____	GAL.

Section 412 - Dust Palliative Treatment

DESCRIPTION

412.01 This work shall consist of furnishing and applying dust palliative
Work and blotter material, if necessary, to a road surface.

MATERIALS

412.02 The type and grade of material shall be as shown on the SCHEDULE
Requirements OF ITEMS and shall meet the requirements of the following
Subsections:

Liquid Asphalts	702.02
Calcium Chloride and Sodium Chloride	712.02
Emulsified Asphalts	702.03
Bituminous Dust Palliatives	702.04
Magnesium Chloride	712.12
Lignin Sulfonate	712.10

Application temperature of bituminous materials shall meet the requirements of Subsection 702.05.

Application temperature of magnesium chloride shall meet the requirements of Subsection 712.12(d) and application temperatures of lignin sulfonate shall meet the requirements of Subsection 712.10.

When emulsified asphalt is diluted, water shall be added as specified in the SPECIAL PROJECT SPECIFICATIONS.

412.03 Blotter Material shall meet the requirements of Subsection 703.14.
Grading will be SHOWN ON THE DRAWINGS.

CONSTRUCTION

412.04 Bituminous dust palliative treatment shall be applied only when
Weather Limitations the surface to be treated contains sufficient moisture to get uniform distribution of the dust palliative; when the road surface and atmospheric temperature are 50 °F or more and rising, or above 60 °F if falling; and when the weather is not foggy or rainy.

Chlorides and lignin sulfonate shall be applied only when the atmospheric temperature is 40 °F or higher, the ground is not frozen, and it is not raining.

412.05 Equipment shall meet the requirements of Subsection 405.05.
Equipment

412.06 One or more of the following preparation and application methods
Preparation of Road Surface shall be followed as SHOWN ON THE DRAWINGS:

Method 1. Apply the dust palliative directly to the prepared and compacted surface.

Method 2. A layer of loose cushion material approximately 1 inch in depth shall be developed for the full width of traveled way and kept in as loose a condition as possible prior to applying dust palliative. After application is completed, material shall be compacted when the dust palliative has penetrated and roller pickup of material will not occur.

When trucks are hauling, making maintenance of the loose cushion difficult, approximately 1 inch of cushion material developed from the surface shall be bladed into a berm on the shoulder. Just prior to applying the dust palliative, the material in berm shall be bladed to a uniform depth across the full width of the previously watered surface. The loose material shall be watered

to the extent that the required moisture penetrates the full depth of loose material prior to applying dust palliative. After application, compact as specified above.

Method 3. Approximately 1 inch of the surface material shall be bladed into a berm on the shoulder. The initial application shall then be made on the existing surface. As soon as practicable, but no more than 4 hours after application, the material in the berm(s) shall be bladed to a uniform depth across the previously treated surface and watered if necessary, to meet required water content. The second application shall then be applied. Compaction shall be performed as specified in Method 2.

412.07
Application of
Dust
Palliative
Treatment

Application rates shall be as SHOWN ON THE DRAWINGS. Uniform distribution shall be obtained at all points. Overlapping or skipping between spread sections shall be corrected. Accidental spillage and areas with excess dust palliative that are hazardous to traffic shall be covered with blotter material at the contractor's expense. The surface of adjacent structures and trees shall be protected from spattering or marring. Dust palliative material shall be discharged only in approved areas.

412.08
Maintenance &
Opening to Traffic

Traffic shall not be permitted on dust palliative treatment until the treatment has penetrated and cured enough to prevent excessive pickup under traffic. If it becomes necessary to permit traffic prior to that time, blotter material shall be applied to permit traffic to use the lane or lanes.

MEASUREMENT

412.09
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Water used for diluting emulsified asphalts will not be included in the quantities for bituminous materials.

PAYMENT

412.10
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
412(01) Liquid Asphalt, Grade _____	TON
412(02) Liquid Asphalt, Grade _____	GAL.
412(03) Emulsified Asphalt, Grade _____	TON
412(04) Emulsified Asphalt, Grade _____	GAL.
412(05) Bituminous Dust Palliative, Grade _____	TON
412(06) Bituminous Dust Palliative, Grade _____	GAL.
412(07) Magnesium Chloride	TON
412(08) Magnesium Chloride	GAL.
412(09) Lignin Sulfonate	TON
412(10) Lignin Sulfonate	GAL.
412(11) Blotter Material	TON

412(12)	Blotter Material	C. Y.
412(13)	Calcium Chloride	TON
412(14)	Sodium Chloride	TON