Colorado Modified P-403: (dated August 18, 2010)

This Colorado Modified specification may be used on the following types of projects:

1. **Projects less than 3000 tons, or,**
2. **Intermediate course under P-401 for pavements designed for gross loads of less than 60,000 pounds. or,**
3. **Stabilized base course under P-501 pavements. or,**
4. **Leveling courses. or,**
5. **Pavements designed to accommodate aircraft gross weights of 12,500 pounds (5670 kg) or less, or,**
6. **Pavements intended to be used for access roads, perimeter roads, runway and taxiway shoulder pavements, blast pads, and other pavements not subject to full aircraft loading.**

ITEM P-403 (Colorado MODIFIED)

PLANT MIX ASPHALT PAVEMENTS (BASE, LEVELING OR SURFACE COURSE)

DESCRIPTION

403-1.1 This item shall consist of a surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

403-2.1 AGGREGATE. Aggregates shall consist of crushed stone, crushed gravel, or crushed slag with or without natural sand or other inert finely divided mineral aggregate. The portion of combined materials retained on the No. 4 sieve is coarse aggregate. The portion of combined materials passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate, and the portion passing the No. 200 sieve is mineral filler.

a. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. The percentage of wear shall not be greater than **45** percent when tested in accordance with AASHTO T 96. The aggregate shall not contain more than a total of 8 percent by weight of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D 4791 with a value of 5:1.

Aggregate shall contain at least two or more fractured faces when tested in accordance with Colorado Procedure 45. Fractured faces shall be obtained by crushing.

b. Fine Aggregate. Fine aggregate shall consist of clean, sound, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay,

silt, or other objectionable matter and shall contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

Natural (nonmanufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 15 percent natural sand by weight of total aggregates**.** If used, the natural sand shall meet the requirements of ASTM D 1073 and shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

The angularity of the fine aggregate shall be a minimum of 45.0 percent when determined according to AASHTO T 304. Aggregate samples representing each aggregate stockpile shall be non-plastic if the percent of aggregate passing the No. 8 sieve is greater than or equal to 10 percent by weight of the individual aggregate sample. Plasticity will be determined in accordance with AASHTO T 90.

403-2.2 MINERAL FILLER. Mineral filler shall conform to the requirements of AASHTO M 17 and shall consist of rock dust, slag dust, hydrated lime, hydraulic cement, fly ash, or other suitable mineral matter. It shall be free of organic impurities and agglomerations. When used, it shall be dry enough to flow freely. Mineral filler shall be graded within the following limits:

Sieve Size	Mass percent passing
No. 30	100
No. 50	95-100
No. 200	70-100

Mineral filler shall have a plasticity index not greater than four excluding hydrated lime and hydraulic cement.

403-2.3 ASPHALT BINDER. The asphalt binder shall conform to the requirements of AASHTO M320 performance graded binder designation PG_______. A certificate of compliance from the manufacturer must be included with the mix design submittal.

The Contractor shall furnish vendor's certified test reports for each lot of asphalt binder trial shipped to the project. The vendor's certified test report for the asphalt binder material can be used for acceptance or tested independently by the Engineer. Engineer's may use the local state DOT agency certification program for performance graded asphalt suppliers if the Engineer determines it to be acceptable.

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Note to Engineer -- Performance Graded (PG) asphalt binder should be locally available and specified. A high reliability (98 percent) on both the high and low temperature categories should be used. These binders provide benefits for airfield pavements by minimizing low temperature cracking. It is recommended that the designer consult with the state DOT for the binder used for greater than 10M ESALs highways. Using this grade the high temperature should be bumped up one grade for greater than 60K gross aircraft weight. The upper grade should be bumped by 2 for greater than 100K gross weight aircraft. The following table can be used if no DOT information is available. Notify the FAA District Office if these grades are not consistent with those specified or available in the state.

State	**PG Binders for Aircraft Gross Loading**	
	60K and Under	**Over 60 K**
Colorado –Western	**58-28**	**-34**

Note: For some binders a synthetic additive may have to be added to meet the high temperature specification. When the temperature values added together exceed 90, the asphalt will probably contain a modifier. In this case include the Elastic Recovery Testing requirements from the paragraph shown below:

[The binder (RTFO) aged residue shall be tested in accordance with AASHTO T 301 for Elastic Recovery tested at 25 degrees C. The recovery shall be 50% minimum]

403-2.4 PRELIMINARY MATERIAL ACCEPTANCE. Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:

a. Coarse Aggregate.

(1) Percent of wear.

(2) Soundness.

(3) Unit weight of slag.

(4) Percent fractured faces

(5) Flat and elongated particles

b. Fine Aggregate.

(1) Liquid limit.

(2) Plasticity index.

(3) Sand equivalent.

c. Asphalt Binder Material. Test results for asphalt binder material shall include temperature/viscosity charts for mixing and compaction temperatures.

The certification(s) shall show the appropriate ASTM or AASHTO test(s) for each material, the test results, and a statement that the material meets the physical property requirements.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

403-2.5 ANTI-STRIPPING AGENT. Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt binder properties beyond specifications, shall contain no harmful ingredients, shall be added in recommended proportion by approved method, and shall be a material approved by the Department of Transportation of the State in which the project is located.

COMPOSITION

403-3.1 COMPOSITION OF MIXTURE. The asphalt mixture plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the Job Mix Formula (JMF).

403-3.2 Job Mix Formula. No asphalt mixture for payment shall be produced until a Job Mix Formula has been approved in writing by the Engineer.

The use of an existing mix design, meeting the requirements of this specification, and approved for use by CDOT will be acceptable. Mix design approval by CDOT shall not have occurred more than one year previous to the planned use of the mix design. The design mix for hot mix asphalt shall conform to the following:

Table 403-1

Property	Test Method	Value For Grading
		½" N (75)
Air Voids, percent at: N (design)	CPL 5115	3.5 – 4.0
Lab Compaction (Revolutions): N (design)	CPL 5115	75
Stability, minimum	CPL 5106	28
Aggregate Retained on the 4.75 mm (No. 4) Sieve with at least 2 Mechanically Induced fractured faces, % minimum	CP 45	60
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman), minimum	CPL 5109 Method B	80
Minimum Dry Split Tensile Strength, kPa (psi)	CPL 5109 Method B	205 (30)
Grade of Asphalt Cement, Top Layer		PG XX-XX
Grade of Asphalt Cement, Layers below Top		PG XX-XX
Voids in the Mineral Aggregate (VMA) % minimum	CP 48	See Table 403-2
Voids Filled with Asphalt (VFA), %	AI MS-2	65 – 80
Dust to Asphalt Ratio Fine Gradation Coarse Gradation	CP 50	 0.6 – 1.2 0.8 – 1.6
Note: AI MS-2 = Asphalt Institute Manual Series 2 Note: The current version of CPL 5115 is available from CDOT Note: Mixes with gradations having less than 40% passing the 4.75 mm (No. 4) sieve shall be approached with caution because of constructability problems. Note: Gradations for mixes with a nominal maximum aggregate size of one-inch or larger are considered a coarse gradation if they pass below the maximum density line at the #4 screen. Gradations for mixes with a nominal maximum aggregate size of ¾ inch or smaller are considered a coarse gradation if they pass below the maximum density line at the #8 screen.		

All mix designs shall be run with a gyratory compaction angle of 1.25 degrees and properties must satisfy Table 403-1. CDOT Form 43 may be used to establish construction targets for Asphalt Binder and all mix properties at Air Voids up to 1.0 percent below the mix design optimum; otherwise, the submitted Job Mix Formula will be used to establish construction targets stated above.

Table 403-2

Minimum Voids in the Mineral Aggregate (VMA)		
Nominal Maximum Size*, mm (inches)	***Design Air Voids **	
	3.5%	**4.0%**
37.5 (1½)	11.6	11.7
25.0 (1)	12.6	12.7
19.0 (¾)	13.6	13.7
12.5 (½)	14.6	14.7
9.5 (⅜)	15.6	15.7

* The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%.

** Interpolate specified VMA values for design air voids between those listed.

*** Extrapolate specified VMA values for production air voids beyond those listed.

The Contractor shall prepare a quality control plan outlining the steps taken to minimize segregation of HMA. This plan shall be submitted to the Engineer and approved prior to beginning the paving operations. When the Engineer determines that segregation is unacceptable, the paving shall stop and the cause of segregation shall be corrected before paving operations will be allowed to resume.

A minimum of 1 percent hydrated lime by weight of the combined aggregate shall be added to the aggregate for all hot mix asphalt.

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Note to Engineer:
The Engineer may allow the Contractor to submit an alternate job mix formula utilizing liquid anti-strip agent for approval.

CDOT requires the use of lime in all Job Mix Formulas.

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The Contractor shall submit the following to the Engineer:

(1) A proposed hot mix asphalt mix design prepared in accordance with Colorado Procedure 52, including a proposed job-mix gradation which shall be wholly within the Master Range of Table 3 for Grade **[1/2" Nominal or ¾" Nominal** mixture 6.5. The weight of lime shall be included in the total weight of the material passing the No. 200 sieve.

(2) The name of the refinery supplying the asphalt cement and the source of the anti-stripping additive.

(3) The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature for the mixture at the discharge point of the plant.

(4) When Laboratory tests indicate that a proposed job-mix formula complies with the specifications, a CDOT Form 43 may be submitted to the Engineer to establish the job-mix formula.

The job mix formula shall be submitted in writing by the Contractor to the Engineer at least **14** days prior to the start of paving operations and shall include as a minimum:

a. Aggregate Source.

b. Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.

c. Atterberg Limits.

d. Los Angeles Abrasion.

e. Statistical data for the Apparent Specific Gravity and Bulk Specific Gravity

f. Source and grade of asphalt cement from a State Certified Binder Supplier. Include the percent of asphalt cement in JMF.

g. Reclaimed Asphalt pavement (RAP): Percent asphalt, aggregate gradation, effective specific gravity, percent in mix.

h. Voids in Mineral Aggregate (VMA), Dust to Asphalt ration, Percent Voids filled with Asphalt (VFA), Hveem Stability, Maximum Theoretical Specific Gravity, Bulk Specific Gravity, Air Voids.

i. Mixing temperature.

j. Compaction temperature.

k. Temperature of mix when discharged from the mixer.

l. Graphs of stability and air voids vs. asphalt content and VMA-VFA; Voids Filled with Asphalt vs. Asphalt content.

m. A 0.45 power plot of the proposed combined aggregate gradation, with maximum density line, restricted zone, and control points included.

n. Lottman and wet/dry tensile strength at optimum asphalt content.

o. Graphical plots of stability, air voids, voids in the mineral aggregate, and unit weight versus asphalt content.

p. Percent natural sand.

q. Percent fractured faces.

r. Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).

When the project requires asphalt mixtures of differing aggregate gradations, a separate job mix formula and the results of job mix formula verification testing must be submitted for each mix.

The job mix formula for each mixture shall be in effect until a modification is approved in writing by the Engineer. Should a change in sources of materials be made, a new job mix formula must be submitted within **7** days and approved by the Engineer in writing before the new material is used. After the initial production job mix formula(s) has/have been approved by the Engineer and a new or modified job mix formula is required for whatever reason, the subsequent cost of the Engineer's approval of the new or modified job mix formula will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Engineer to approve the initial, new or modified job mix formula.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C 136 and ASTM C 117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMF), shall have a gradation within the limits designated in Table 3 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Deviations from the final approved mix design for asphalt binder content and gradation of aggregates shall be within the action limits for individual measurements as specified in paragraph 403-6.5a. The limits still will apply if they fall outside the master grading band in Table 3, except for the top three sieve sizes for each aggregate gradation product starting at the 100 percent passing band.

The maximum size aggregate used shall not be more than one-half of the thickness of the course being constructed except where otherwise shown on the plans or ordered by the Engineer.

Table 3

Aggregate-Asphalt Pavements		
Grading	**Grading 3/4" Nominal**	**Grading ½" Nominal**
Sieve Size	**Percentage by Weight Passing Sieve**	
1 in.	100	
3/4 in.	90 – 100	100
1/2 in.	*	90 – 100
3/8 in.	*	*
No. 4	*	*
No. 8	23 – 49	28 - 58
No. 30	*	*
No. 200	2 - 6	2 - 7

**These additional CDOT Form 43 Screens will initially be established for the Contractor's Quality Control Testing using values from the As Used Gradation shown on the Job-Mix Formula.*

403-3.3 RECYCLED ASPHALT PAVEMENT. Recycled asphalt pavement (RAP) shall consist of , coarse aggregate, fine aggregate, mineral filler, and asphalt cement. RAP may be used for all courses.

The RAP shall be of a consistent gradation and asphalt content. The Contractor may obtain the RAP from the job site or an existing source.

All new aggregates used in the recycled mix shall meet the requirements of paragraph 403-2.1. New bituminous material shall meet the requirements of paragraph 403-2.3. The desired viscosity of the asphalt blend shall be obtained using only performance grade asphalts. The maximum percent of RAP allowed in the Job Mix Formula is 30%. The RAP shall not contain any material that has been treated with a coal-tar sealer rejuvenator or material that contains coal-tar.

In addition to the requirements of paragraph 401-3.2, the job mix formula shall indicate the percent of reclaimed asphalt pavement.

The Contractor shall submit documentation to the Engineer, indicating that the mixing equipment proposed for use is adequate to mix the percent of RAP shown in the job mix formula and meet all local and national environmental regulations.

403-3.4 TEST SECTION. If the total tonnage in the job exceeds 3,000 tons, an approved test section will be required prior to full production. Jobs with total tonnage less than 3,000 tons will not require a test section.

Prior to full production, the Contractor shall prepare and place a quantity of asphalt mixture according to the job mix formula. The amount of mixture shall be sufficient to construct a test section a minimum of **200 feet** long and **25 feet** wide**,** placed in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. A cold joint is an exposed construction joint where the first mat surface temperature is less than 185 degrees F. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

THE TEST SECTION SHALL BE EVALUATED FOR ACCEPTANCE AS A SINGLE LOT IN ACCORDANCE WITH THE ACCEPTANCE CRITERIA IN PARAGRAPH 403-5.1 AND 403-6.3. THE TEST SECTION SHALL BE DIVIDED INTO EQUAL SUBLOTS. AS A MINIMUM THE TEST SECTION SHALL CONSIST OF 3 SUBLOTS.

The test section shall be considered acceptable if the mat density of the test section cores is greater than or equal to 92.0 percent and less than or equal to 98.0 percent and the joint density of the test section cores is greater than or equal to 90.0 percent (88.0 percent for roads and vehicle parking lots).

If the initial test section should prove to be unacceptable, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the Contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the Contractor's expense. Full production shall not begin until an acceptable section has been constructed and accepted by the Engineer. The initial test section, whether acceptable or unacceptable, and any subsequent section that meets specification requirements shall be paid for in accordance with paragraph 403-8.1.

Job mix control testing shall be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. If the aggregates produced by the

plant do not satisfy the gradation requirements or produce a mix that meets the JMF, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens shall be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

403-3.5 TESTING LABORATORY. The Contractor's laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666 including the requirement to be accredited by a national authority such as the National Voluntary Laboratory Accreditation Program (NVLAP), the American Association for Laboratory Accreditation (AALA), or AASHTO Accreditation Program (AAP). A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

e. ASTM D 3666 certification of accreditation by a nationally recognized accreditation program.

CONSTRUCTION METHODS

403-4.1 WEATHER LIMITATIONS. The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.

Table 4

Base Temperature Limitations	
Mat Thickness	**Base Temperature (Minimum)**
	Degrees F
3 in. or greater	40
Greater than 1.5 in. but less than 3 in.	45
1.5 in. or less	50

403-4.2 ASPHALT MIXING PLANT. Plants used for the preparation of asphalt mixtures shall conform to the requirements of ASTM D 995 with the following changes:

a. Requirements for All Plants.

(1) Truck Scales. The asphalt mixture shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be

inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions, Section 90-01.

In lieu of scales, and as approved by the Engineer, asphalt mixture weights may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total paving mixture. Contractor must furnish calibration certification of the weighing system prior to mix production and as often thereafter as requested by the Engineer.

(2) Inspection of Plant. The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

(3) Storage Bins and Surge Bins. Use of surge bins or storage bins for temporary storage of asphalt mixtures will be permitted as follows:

(a) The asphalt mixture may be stored in surge bins for a period of time not to exceed 3 hours.

(b) The asphalt mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours**.**

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the Engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no temporary storage will be allowed.

403-4.3 HAULING EQUIPMENT. Trucks used for hauling asphalt mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of an approved asphalt release agent. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

403-4.4 ASPHALT PAVERS. Asphalt pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of asphalt material that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

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.

d. Laser control.

e. PaveSet or PaveSmart electronic grade control

If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement and/or base course that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

403-4.5 ROLLERS. Rollers of the vibratory, steel wheel, and pneumatic-tired type shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

All rollers shall be specifically designed and suitable for compacting asphalt mixtures shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used. Depressions in pavement surfaces caused by rollers shall be repaired by the Contractor at its own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

a. Nuclear Densometer. The Contractor shall have on site a nuclear densometer during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the nuclear densometer and obtain accurate density readings for all new bituminous concrete. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

403-4.6 PREPARATION OF ASPHALT MATERIAL. The asphalt material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of the asphalt material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325 degrees F, unless otherwise required by the manufacturer.

403-4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be heated and dried prior to introduction into the mixer. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

403-4.8 PREPARATION OF ASPHALT MIXTURE. The aggregates and the asphalt material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce

a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95 percent of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all asphalt mixtures upon discharge shall not exceed 0.5 percent.

403-4.9 PREPARATION OF THE UNDERLYING SURFACE. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied in accordance with Item P-602 or P-603, if required by the contract specifications.

403-4.10 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING. Prior to the placement of the asphalt mixture, the Contractor shall prepare a laydown plan for approval by the Engineer. This is to minimize the number of cold joints in the pavement. The laydown plan shall include the sequence of paving laydown by stations, width of lanes, temporary ramp location(s), and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (i.e., milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.

The asphalt mixture shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 403-4.3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The Contractor may elect to use a material transfer vehicle to deliver mix to the paver.

Paving during nighttime construction shall require the following:

a. All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.

b. Minimum illumination level shall be twenty (20) horizontal foot candles and maintained in the following areas:

(1) An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.

(2) An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.

(3) An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.

c. As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000-watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.

d. In addition, the Contractor shall furnish portable floodlight units for night work. The number and type shall be submitted to the Engineer for approval.

The initial placement and compaction of the mixture shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250 degrees F.

Edges of existing asphalt pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and painted with bituminous tack coat before new material is placed against it.

Upon arrival, the mixture shall be placed to the full width by a asphalt paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of **12 feet** except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Areas of segregation in the course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of 2 inches deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

Any areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of 2 inches deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

403-4.11 COMPACTION OF MIXTURE. After placing, the mixture shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained.

To prevent adhesion of the mixture to the roller, the wheels shall be equipped with a scraper and kept properly moistened using a water soluble asphalt release agent approved by the Engineer.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power driven tampers. Tampers shall weigh not less than 275 pounds, have a tamping plate width not less than 15 inches, be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to

the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

403-4.12 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be given a tack coat of asphalt material before placing any fresh mixture against the joint.

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MATERIAL ACCEPTANCE

403-5.1 ACCEPTANCE SAMPLING AND TESTING. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor, except that coring as required in this section shall be completed and paid for by the Contractor. Testing organizations performing these tests will meet the requirements of ASTM D 3666. Field laboratories at the project or plant site will be considered to meet ASTM D 3666 provided all testing personnel, laboratory equipment and laboratory supervision are from an ASTM D 3666 accredited branch.

a. Field Placed Material. Material placed in the field shall be tested for mat and joint density on a lot basis. A lot will consist of:

- One day or shift's production not to exceed 2,000 tons, or
- A half day or shift's production where a day's production is expected to consist of between 2,000 and 4,000 tons so no lot exceeds 2,000 tons (1,814,000 kg), or
- Similar subdivisions for tonnages over 4,000 tons so no lot exceeds 2,000 tons (1,814,000 kg).

Where more than one plant is simultaneously producing material for the job, the lot sizes shall apply separately for each plant.

(1) Mat Density. The lot shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Samples will be taken in accordance with ASTM D 979. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Cores shall not be taken closer than two feet from a transverse or longitudinal joint. Does not apply to lifts in thickness less than or equal to 1½"

(2) Joint Density. The lot shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Samples will be taken in accordance with ASTM D 979. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Coring locations shall be centered on the line where the joint between the two adjacent lifts abut the surface. Does not apply to lifts in thickness less than or equal to 1½"

(3) Sampling. Samples shall be neatly cut with a core drill. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be five inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. The Contractor shall furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement shall be cleaned and core holes shall be filled in a manner acceptable to the Engineer and within one day after sampling.

(4) Testing. The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D 2726 or ASTM D 1188, whichever is applicable. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the maximum theoretical specific gravity for that sublot, as determined by paragraph 403-5.1a(2). The maximum theoretical specific gravity used to determine the joint density at joints between two different lots shall be the lower of the specific gravity values from the two different lots.

(5) Acceptance. Acceptance of field placed material for mat and joint density will be determined by the Engineer in accordance with the requirements of paragraph 403-5.2b.

b. Partial Lots—Field Placed Material. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

The last batch produced where production is halted will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they shall constitute a lot. Where one or two sublots are produced, they shall be incorporated into the next lot, and the total number of sublots shall be used in the acceptance plan calculation, i.e., n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project shall be included with the previous lot.

403-5.2 ACCEPTANCE CRITERIA.

a. General. Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement and test results:

(1) Mat density.

(2) Joint density.

(3) Thickness.

(4) Smoothness.

(5) Grade.

Mat density will be evaluated for acceptance in accordance with paragraph 403-5.2b(1). Joint density will be evaluated for acceptance in accordance with paragraph 403-5.2b(2).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 403-5.2b(3). Acceptance for smoothness will be based on the criteria contained in paragraph 403-5.2b(4). Acceptance for grade will be based on the criteria contained in paragraph 403-5.2b(5).

The Engineer may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of bituminous mixture which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

b. Acceptance Criteria.

(1) Mat Density. Acceptance of each lot of plant produced material for mat density shall be based on the densities taken from the sublots. If the mat density of the lot so established is between 92.0 and 98.0, the lot density shall be acceptable. If the mat density of the lot is below 92.0 percent or above 98.0 percent, the lot shall be removed and replaced at the Contractor's expense.

(2) Joint Density. Acceptance of each lot of plant produced material for joint density shall be based on the joint densities taken from the sublots. If the joint density of the lot so established equals or exceeds 90.0 percent (88.0 percent for roads and/or vehicle parking lots), the lot shall be acceptable. If the joint density of the lot is less than 90.0 percent (88.0 percent for roads and vehicle parking lots), the Contractor shall stop production and evaluate the method of compacting joints. Production may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.

(3) Thickness. Thickness of each course shall be evaluated by the Engineer for compliance to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point shall not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, shall not be less than the indicated thickness. Where thickness deficiency exceeds the specified tolerances, the lot or sublot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.

(5) Smoothness. The final surface shall be free from roller marks. The finished surfaces of each course of the pavement, except the finished surface of the final surface course, shall not vary more than 3/8 inch when evaluated with a 16-foot straightedge. The finished surface of the final surface course shall not vary more than 1/4 inch when evaluated with a 16-foot straightedge. The lot size shall be **2,000** square yards. Smoothness measurements shall be made at 50-foot intervals and as determined by the Engineer. In the longitudinal direction, if profilograph measurements are not required, a smoothness reading shall be made, by straight-edge measurements at 50-foot intervals, at the center of each paving lane. In the transverse direction, smoothness readings shall be made continuously across the full width of the pavement. However, transverse smoothness readings shall not be made across designed grade changes. At warped transition areas, straightedge position shall be adjusted to measure surface smoothness and not design grade transitions. When more than 20 percent of all measurements within a lot exceed the specified tolerance, the Contractor shall remove the deficient area to the depth of the course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the course in accordance with the limitations noted above.

(6) Grade. The finished surface of the pavement shall not vary from the gradeline elevations and cross sections shown on the plans by more than 1/2 inch (3/4 inch for roads and/or vehicle parking lots). The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be

performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2**,000** square yards. When more than 20 percent of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates 3/4 inch or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inch wide. The peaks and ridges shall be approximately 1/32-inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting form the grinding operation shall be continuous. The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.

g. Outliers. All individual tests for mat density and air voids shall be checked for outliers (test criterion) in accordance with ASTM E 178, at a significance level of 5 percent. Outliers shall be discarded, and the PWL shall be determined using the remaining test values.

403-5.3 RESAMPLING PAVEMENT FOR MAT DENSITY.

a. General. Resampling of a lot of pavement will only be allowed for mat density and then, only if the Contractor requests same in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 403-5.1b(1). Only one resampling per lot will be permitted.

(1) A redefined mat density shall be calculated for the resampled lot. The number of tests used to calculate the redefined mat density shall include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for Resampled Lots. The redefined mat density for a resampled lot shall be used to evaluate the acceptance of that lot in accordance with Paragraph 403-5.2.

403-5.4 LEVELING COURSE. Any course used for truing and leveling shall meet the requirements of paragraph 403-3.2, but shall not be subject to the density requirements of paragraph 403-5.1. The leveling course shall be compacted with the same effort used to achieve density of the test section. The truing and leveling course shall not exceed a nominal thickness of 1-1/2 inches. The leveling course is the first variable thickness lift of an overlay placed prior to subsequent courses.

CONTRACTOR QUALITY CONTROL

403-6.1 GENERAL. The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 403-6.3, including but not limited to:

a. Mix Design.

b. Aggregate Grading.

c. Quality of Materials.

d. Stockpile Management.

e. Proportioning.

f. Mixing and Transportation.

g. Placing and Finishing.

h. Joints.

i. Compaction.

j. Surface smoothness.

403-6.2 TESTING LABORATORY. The Contractor shall provide a fully equipped asphalt laboratory meeting the requirements of paragraph 403-3.5 and 403-4.2a(2) located at the plant. The Contractor shall provide the Engineer with certification stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures.

403-6.3 QUALITY CONTROL TESTING. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness.

a. Asphalt Content. A minimum of two extraction tests shall be performed per lot in accordance with ASTM D 2172 or ASTM D 6307 for determination of asphalt content. The weight of ash portion of the extraction test, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

The use of the nuclear method for determining asphalt content in accordance with ASTM D 4125 is permitted, provided that it is calibrated for the specific mix being used.

The use of a binder ignition oven for determining asphalt content in accordance with ASTM D-6307 is permitted, provided that it is calibrated for the specific mix being used. This calibration shall be provided to the Engineer prior to the start of production. The Engineer reserves the right to verify the calibration of any equipment.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with AASHTO T 30 and ASTM C 136 (Dry Sieve). When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weights to determine the combined aggregate gradation of the mixture. If RAP is used in the mix and the asphalt content is determined by the ignition method, aggregate gradations shall be determined from mechanical analysis of the extracted (ignited) aggregate in accordance with AASHTO T30 or ASTM C117 and ASTM C136 (Dry Sieve). If RAP is not used in the mix and the asphalt content is determined by the ignition method, aggregate gradations shall be determined from a mechanical analysis of the combined virgin aggregate, taken just prior to introduction into the dryer drum or mixer, and tested in accordance with ASTM C117 and ASTM C136 (Dry Sieve).

c. Fine Aggregate Angularity. The fine aggregate angularity of the fine aggregate used for

production shall be determined once per lot in accordance with AASHTO T304, Method A.

d. Moisture Content of Aggregate. The moisture content of the aggregate used for production shall be determined once per lot in accordance with ASTM C 566

e. Moisture Content of Mixture. The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461 or AASHTO T110. If it exceeds 0.5% by weight of dry mix, the Contractor shall cease production until an action acceptable to the Engineer is taken.

f. Temperatures. Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.

g. In-Place Density Monitoring. The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950 or Colorado Procedure 81.

h. Additional Testing. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.

i. Monitoring. The Engineer reserves the right to monitor any or all of the above testing.

j. Aggregate Quality. The Contractor shall perform specific gravity and absorption tests on all aggregates used. These tests will be run at least one per week. If the specific gravity parameters vary more than plus or minus 10 percent of the values obtained in the mix design, the Contractor will be required to submit a new job mix formula.

403-6.4 SAMPLING. When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

403-6.5 CONTROL CHARTS. The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content.

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor’s test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor’s projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual Measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation and asphalt content. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits for Individual Measurements		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch	+/-0%	+/-0%

Control Chart Limits for Individual Measurements		
Sieve	**Action Limit**	**Suspension Limit**
1/2 inch	+/-6%	+/-9%
3/8 inch	+/-6%	+/-9%
No. 4	+/-6%	+/-9%
No. 8	+/-5%	+/-7.5%
No. 30	+/-4%	+/-5.5%
No. 200	+/-2%	+/-3%
Asphalt Content	+/-0.4%	+/-0.60%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based on Range (Based on n = 2)	
Sieve	**Suspension Limit**
1/2 inch	11 percent
3/8 inch	11 percent
No. 4	11 percent
No. 16	9 percent
No. 50	6 percent
No. 200	3.5 percent
Asphalt Content	0.8 percent

c. Corrective Action. The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two points in a row fall outside the Action Limit line for individual measurements.

(3) ANY LIMIT THAT FALLS OUTSIDE THE CONTROL POINTS IN TABLE 3.

403-6.6 QUALITY CONTROL REPORTS. The Contractor shall maintain records and shall submit reports of quality control activities daily.

METHOD OF MEASUREMENT

403-7.1 MEASUREMENT. Plant mix bituminous concrete pavement shall be measured by the number of tons of bituminous mixture used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

403-8.1 PAYMENT. Payment for an accepted lot of asphalt pavement shall be made at the contract unit price per ton for asphalt mixture**.** The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-403-8.1a	Asphalt Pavement Surface Course (Colorado Grading ½" Nominal) or (Colorado Grading ¾" Nominal) (75)(PG XX-XX) - per ton

TESTING REQUIREMENTS

ASTM C 29	Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Materials Finer than 75µm (No.200) Sieve in Mineral Aggregates by Washing
ASTM C 127	Specific Gravity and Absorption of Coarse Aggregate
ASTM C 131	Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C 183	Sampling and the Amount of Testing of Hydraulic Cement
ASTM C 566	Total Evaporable Moisture Content of Aggregate by Drying
ASTM D 75	Sampling Aggregates
ASTM D 979	Sampling Bituminous Paving Mixtures
ASTM D 995	Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures

ASTM D 1073	Fine Aggregate for Bituminous Paving Mixtures
ASTM D 1074	Compressive Strength of Bituminous Mixtures
ASTM D 1188	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
ASTM D 1461	Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 2172	Standard Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2489	Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D 2950	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D 3203	Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D 3665	Random Sampling of Construction Materials
ASTM D 3666	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D 4125	Standard Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4791	Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4867	Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM E 11	Wire-Cloth Sieves for Testing Purposes
ASTM E 178	Dealing with Outlying Observations
AASHTO M 17	Mineral Filler for Bituminous Paving Mixtures
AASHTO T 30	Mechanical Analysis of Extracted Aggregate
AASHTO T 90	Determining the Plastic Limit and Plasticity Index of Soils

AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 110	Moisture or Volatile Distillates in Bituminous Paving Mixtures
CP 45	Determining Percent of Particles with Two or More Fractured Faces
CP 48	Determination of the Voids in the Mineral Aggregate (VMA)
CP 50	Calculation of Dust to Asphalt Ratio of Bituminous Mixes
CP 52	Contractor Asphalt Mix Design Approval Procedures
CP 81	Density and Percent Relative Compaction of In-Place Bituminous Pavement by the Nuclear Method
CPL 5106	Resistance to Deformation of Bituminous Mixtures by Means of Hveem Apparatus
CPL 5109, Method B	Resistance of Compacted Bituminous Mixture to Moisture Induced Damage
CPL 5115	Preparing and Determining the Density of Bituminous Mixture Test Specimens Compacted by the Superpave Gyratory Compactor
AI MS-2	Asphalt Institute Mix Design Methods for Asphalt Concrete and Other Hot Mixes

MATERIAL REQUIREMENTS

ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 946	Penetration Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 4552	Classifying Hot-Mix Recycling Agents
AASHTO MP1	Performance Graded Binder Designation

END OF ITEM P-403 (Colorado Modified)