

10.0 Geotechnical, Roadway Pavements, and Structure Foundations

This section includes the requirements for the geotechnical and Roadway pavements work for the Design Build Project (Project). This work shall be completed in accordance with the Contract Documents

10.1 Administrative Requirements

10.1.1 Standards

The Contractor shall design and construct the Project in accordance with the requirements of the standards in the documents listed in Table 10-1 and those referenced in Book 3. The Contractor shall use the latest adopted edition at the time of the Proposal Due Date.

Table 10-1. Standards

Author or Agency	Title
American Association of State Highway and Transportation (AASHTO)	<i>AASHTOWare Pavement Mechanistic-Empirical Design Software, Version 2.3.1</i>
AASHTO	<i>Load Resistance Factor Design (LRFD) Bridge Design Specifications</i>
AASHTO	<i>Policy on Geometric Design of Highways and Streets</i>
Colorado Department of Transportation (CDOT)	<i>Standard Specifications for Road and Bridge Construction (Standard Specifications)</i>
CDOT	<i>Mechanistic-Empirical (M-E) Pavement Design Manual</i>
CDOT	<i>Field Materials Manual</i>
CDOT	<i>Geotechnical Design Manual</i>
CDOT	<i>M&S Standard Plans</i>

10.2 Design Requirements

Asphalt Patching is anticipated on this Project and shall be designed and constructed according to the requirements in this Section.

If the Contractor's Activities impact the roadway within the EJMT, asphalt paving shall be required, and be designed and constructed according to the requirements of this Section.

The asphalt binder required for asphalt patching shall be determined using LTPPBind and location-specific climate data assuming 98% reliability and slow conditions.

The pavement smoothness criteria for all asphalt patching and paving shall meet the requirements of the Revision of Section 105 - HMA Pavement Smoothness, Subsection 105.07 (a) 2.

Aggregate Base Course (ABC) used in paving and pavement patching designs shall be ABC Class 6. The ABC Class 6 shall meet the gradation requirements and have an R-value of at least 78 when tested by the Hveem Stabilometer method.

The Contractor shall submit all paving and pavement patching designs to CDOT for Acceptance with preliminary design packages.

All asphalt patching and paving shall be Hot Mix Asphalt (Grading SX)(75)(PG 58-28). The lift breakdown of the intermediate and bottom lifts shall follow the guidelines established in Table 3.7 of the CDOT 2021 Pavement Design Manual. The thickness of each overlying lift shall be equal to or less than the thickness of the lift directly below.

10.2.1 Submittals

All submittals shall be prepared, Reviewed, and submitted in accordance with the requirements set forth in Book 2, Section 3.

10.3 Construction Requirements

The Contractor shall construct the HMA and all other paved surfaces in accordance with the requirements of the Contract Documents. Construction of Contractor-designed permanent patched or paved surfaces shall not commence until the design has been Accepted by CDOT.

Where it is required to cut existing pavement, the cutting shall be done to a neat work line full depth with a pavement-cutting saw or other method as Accepted by CDOT.

At no time should the blunt end of guardrail, barrier, end treatment, etc. be exposed to oncoming traffic.

To provide for adequate sulfate resistance in all concrete supplied, Severity of Potential Exposure shall be Class 2 for this Project. The Contractor may, at their expense, have a certified laboratory test the subgrade as per the Field Materials Manual. Testing shall be at the same schedule and frequency as required for a preliminary soil survey. The Contractor may propose a different Class of Exposure for the Project based on those test results.

Any curb and gutter, and barrier which is to remain and is damaged as a result of the Contractor's operation, shall be replaced at the Contractor's expense.

10.4 Deliverables

At a minimum, the Contractor shall submit the following to CDOT for Review, Approval, and/or Acceptance:

Table 10-1: Deliverables by the Contractor

Deliverable	Review, Acceptance, or Approval	Schedule
Patching Pavement Design	Acceptance	Submitted with design packages
HMA Mix Designs	Acceptance	At least 21 days prior to the use of any HMA on the Project

All deliverables shall also conform to the requirements of Book 2, Section 3.

10.5 Project Special Provisions

The following specifications modify and take precedence over the Standard Specifications.

**REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)**

Sections 105 and 106 of the Standard Specifications are hereby revised for this project as follows:

Delete subsection 105.05 and replace with the following:

105.05 Conformity to the Contract of Hot Mix Asphalt. Conformity to the Contract of all Hot Mix Asphalt, Item 403, including Hot Mix Asphalt (Patching) but excluding temporary pavement, will be determined by tests and evaluations of elements that include asphalt content, gradation, in-place density and joint density in accordance with the following:

All work performed and all materials furnished shall conform to the lines, grades, cross sections, dimensions, and material requirements, including tolerances, shown in the Contract.

For those items of work where working tolerances are not specified, the Contractor shall perform the work in a manner consistent with reasonable and customary manufacturing and construction practices.

When the Engineer finds the materials or work furnished, work performed, or the finished product are not in conformity with the Contract and has resulted in an inferior or unsatisfactory product, the work or material shall be removed and replaced or otherwise corrected at the expense of the Contractor.

Materials will be sampled randomly and tested by the Department in accordance with Section 106 and with the applicable procedures contained in the Department's Field Materials Manual. The approximate maximum quantity represented by each sample will be as set forth in Section 106. Additional samples may be selected and tested as set forth in Section 106 at the Engineer's discretion.

A process will consist of either a single test value or a series of test values resulting from related tests of an element of the Contractor's work and materials. An element is a material or workmanship property that can be tested and evaluated for quality level by the Department approved sampling, testing, and analytical procedures. All materials produced will be assigned to a process. A change in process is defined as a change that affects the element involved. For any element, with the exception of the process for joint density element, a process normally will include all produced materials associated with that element prior to a change in the job mix formula (Form 43). For joint density, a new process will be established for each new layer of pavement or for changes in joint construction. Density measurements taken within each compaction test section will be a separate process. The Engineer may separate a process in order to accommodate small quantities or unusual variations.

Evaluation of materials for pay factors (PF) will be done using only the Department's acceptance test results. Each process will have a PF computed in accordance with the requirements of this Section. Test results determined to have sampling or testing errors will not be used.

-2-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

Except for in-place density measurements taken within a compaction test section, any test result for an element greater than the distance $2 \times V$ (see Table 105-2) outside the tolerance limits will be designated as a separate process and the pay factor will be calculated in accordance with subsection 105.05(a). An element pay factor less than zero shall be zero. The calculated PF will be used to determine the Incentive/Disincentive Payment (I/DP) for the process.

In the case of in-place density or joint density the Contractor will be allowed to core the exact location (or immediately adjacent location for joint density) of a test result more than $2 \times V$ outside the tolerance limit. The core must be taken and furnished to the Engineer within eight hours after notification by the Engineer of the test result. The result of this core will be used in lieu of the previous test result. Cores not taken within eight hours after notification by the Engineer will not be used in lieu of the test result. All costs associated with coring will be at the Contractor's expense.

- (a) *Representing Small Quantities.* When it is necessary to represent a process by only one or two test results, PF will be the average of PFs resulting from the following:

If the test result is within the tolerance limits then $PF = 1.00$

If the test result is above the maximum specified limit, then

$$PF = 1.00 - [0.25(TO - TU)/V]$$

If the test result is below the minimum specified limit, then

$$PF = 1.00 - [0.25(TL - TO)/V]$$

Where: PF = pay factor.
V = V factor from Table 105-2.
TO = the individual test result.
TU = upper specification limit.
TL = lower specification limit.

The calculated PF will be used to determine the I/DP for the process.

- (b) *Determining Quality Level.* Each process with three or more test results will be evaluated for a quality level (QL) in accordance with Colorado Procedure 71.
- (c) *Gradation Element.* Each specified sieve, with the exception of 100 percent passing sieves, will be evaluated for QL separately. The lowest calculated QL for a sieve will be designated as the QL for gradation element for the process.
- (d) *Joint Density Element.* Joint Density will be tested according to subsection 401.17.

-3-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

- (e) *Process Pay Factor*. Using the calculated QL for the process, compute PF as follows: The final number of random samples (Pn) in each process will determine the final pay factor. . As test values are accumulated for each process, Pn will change accordingly. When the process has been completed, the number of random samples it contains will determine the computation of PF, based on Table 105-3 and formula (1) below. When Pn is from 3 to 9, or greater than 200, PF will be computed using the formulas designated in Table 105-3. Where Pn is equal to or greater than 10 and less than 201, PF will be computed by formula (1):

$$(1) \text{ PF} = \frac{(PF1 + PF2)}{2} + \left[\frac{(PF2 + PF3)}{2} - \frac{(PF1 + PF2)}{2} \right] \times \frac{(Pn2 - PnX)}{(Pn2 - Pn3)}$$

Where, when referring to Table 105-3:

- PF1 = PF determined at the next lowest Pn formula using process QL
- PF2 = PF determined using the Pn formula shown for the process QL
- PF3 = PF determined at the next highest Pn formula using process QL
- Pn2 = the lowest Pn in the spread of values listed for the process Pn formula
- Pn3 = the lowest Pn in the spread of values listed for the next highest Pn formula
- PnX = the actual number of test values in the process

When evaluating the item of Furnish Hot mix asphalt, the PF for the element of In-Place Density shall be 1.0.

Regardless of QL, the maximum PF in relation to Pn is limited in accordance with Table 105-3.

As test results become available, they will be used to calculate accumulated QL and PF numbers for each process. The process I/DP's will then be calculated and accumulated for each element and for the item. The test results and the accumulated calculations will be made available to the Contractor upon request.

Numbers from the calculations will be carried to significant figures and rounded according to AASHTO Standard Recommended Practice R-11, Rounding Method.

- (f) *Evaluation of Work*. When the PF of a process is 0.75 or greater, the finished quantity of work represented by the process will be accepted at the appropriate pay factor. If the PF is less than 0.75, the Engineer may:
1. Require complete removal and replacement with specification material at the Contractor's expense; or

-4-

**REVISION OF SECTIONS 105 AND 106
 CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
 (LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)**

2. Where the finished product is found to be capable of performing the intended purpose and the value of the finished product is not affected, permit the Contractor to leave the material in place.

If the material is permitted to remain in place the PF for the process will not be greater than 0.75. When condition red, as described in Section 106, exists for any element, resolution and correction will be in accordance with Section 106. Material, which the Engineer determines is defective, may be isolated and rejected without regard to sampling sequence or location within a process.

If removal and replacement is required because the joint density PF for a process is below 0.75, the Contractor shall remove and replace the full lane width adjacent to and including at least 6 inches beyond the visible joint line for the entire length of joint representing the process. If the lane removed is adjacent to another joint, that joint shall also be removed to a point 6 inches beyond the visible joint line. When a single joint density core is more than 2V outside the tolerance limits, the removal and replacement limits shall be identified by coring the failing joint at 25 foot intervals until two successive cores are found to be 1V or less below the minimum tolerance limit. If removal and replacement is required, the Contractor shall submit documentation identifying the process to be used to correct the area in question in writing. The process will be approved by the Engineer before commencing the corrective work.

**Table 105-2
 “W” and “V” Factors For Various Elements**

Hot Mix Asphalt		
Element	V Factor	W Factor
2.36 mm (No. 8) mesh and larger sieves	2.80	N/A
600 µm (No. 30) mesh sieve	1.80	N/A
75 µm (No. 200) mesh sieve	0.80	N/A
Gradation	N/A	15
Asphalt Content	0.20	25
In-place Density	1.10	45
Joint Density	1.60	15

-5-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

Table 105-3
Formulas for Calculating PF Based on Pn

Pn	When Pn as shown at left is 3 to 9, or greater than 200, use designated formula below to calculate Pay Factor, PF = ..., when Pn is 10 to 200, use formula (1) above:	Maximum PF
3	$0.31177 + 1.57878 (QL/100) - 0.84862 (QL/100)^2$	1.025
4	$0.27890 + 1.51471 (QL/100) - 0.73553 (QL/100)^2$	1.030
5	$0.25529 + 1.48268 (QL/100) - 0.67759 (QL/100)^2$	1.030
6	$0.19468 + 1.56729 (QL/100) - 0.70239 (QL/100)^2$	1.035
7	$0.16709 + 1.58245 (QL/100) - 0.68705 (QL/100)^2$	1.035
8	$0.16394 + 1.55070 (QL/100) - 0.65270 (QL/100)^2$	1.040
9	$0.11412 + 1.63532 (QL/100) - 0.68786 (QL/100)^2$	1.040
10 to 11	$0.15344 + 1.50104 (QL/100) - 0.58896 (QL/100)^2$	1.045
12 to 14	$0.07278 + 1.64285 (QL/100) - 0.65033 (QL/100)^2$	1.045
15 to 18	$0.07826 + 1.55649 (QL/100) - 0.56616 (QL/100)^2$	1.050
19 to 25	$0.09907 + 1.43088 (QL/100) - 0.45550 (QL/100)^2$	1.050
26 to 37	$0.07373 + 1.41851 (QL/100) - 0.41777 (QL/100)^2$	1.055
38 to 69	$0.10586 + 1.26473 (QL/100) - 0.29660 (QL/100)^2$	1.055
70 to 200	$0.21611 + 0.86111 (QL/100)$	1.060
> 201	$0.15221 + 0.92171 (QL/100)$	1.060

(g) Process I/DP Computation.

$$I/DP = (PF - 1)(QR)(UP)(W/100)$$

Where:

I/DP	=	Incentive/Disincentive Payment
PF	=	Pay Factor
QR	=	Quantity in Tons of HMA Represented by the Process
UP	=	Unit Bid Price of Asphalt Mix
W	=	Element Factor from Table 105-2

-6-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

When AC is paid for separately UP shall be:

$$UP = [(TonHMA)(UPHMA) + (TonAC)(UPAC)]/TonHMA$$

Where: TonHMA = Tons of Asphalt Mix
 UPHMA = Unit Bid Price of Asphalt Mix
 TonAC = Tons of Asphalt Cement
 UPAC = Unit Bid Price of Asphalt Cement

For the joint density element:

$$UP = UPHMA$$

Where: UPHMA is as defined above.

When AC is paid for separately UP shall be:

$$UP = [(BTonHMA)(BUPHMA) + (BTonAC)(BUPAC)]/BTonHMA$$

Where: BTonHMA = Bid Tons of Asphalt Mix
 BUPHMA = Unit Bid Price of Asphalt Mix
 BTonAC = Bid Tons of Asphalt Cement
 BUPAC = Unit Bid Price of Asphalt Cement

- (h) *Element I/DP*. The I/DP for an element shall be computed by accumulating the process I/DP's for that element.
- (i) *I/DP for a Mix Design*. The I/DP for a mix design shall be computed by accumulating the individual I/DP's for the asphalt content, in-place density, and gradation elements for that mix design. The accumulated quantities of materials for each element must be the same at the end of I/DP calculations for a mix design.
- (j) *Project I/DP*. The I/DP for the project shall be computed by accumulating the mix design I/DP's and the joint density I/DP's. The accumulated quantities of materials for each element must be the same at the end of I/DP calculations for the project.

Delete subsection 106.05 and replace with the following:

106.05 Sampling and Testing of Hot Mix Asphalt. All hot mix asphalt, Item 403, including Hot Mix Asphalt (Patching) but excluding temporary pavement, shall be tested in accordance with the following program of process control testing and acceptance testing:

The Contract will specify whether process control testing by the Contractor is mandatory or voluntary.

-7-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

(a) *Process Control Testing.*

1. **Mandatory Process Control.** When process control testing is mandatory the Contractor shall be responsible for process control testing on all elements and at the frequency listed in Table 106-1. Process control testing shall be performed at the expense of the Contractor.

After completion of compaction, in-place density tests for process control shall be taken at the frequency shown in Table 106-1. The results shall be reported in writing to the Engineer on a daily basis. Daily plots of the test results with tonnage represented shall be made on a chart convenient for viewing by the Engineer. All of the testing equipment used for in-place density testing shall conform to the requirements of acceptance testing standards, except nuclear testing devices need not be calibrated on the Department's calibration blocks.

For elements other than in-place density, results from quality control tests need not be plotted, or routinely reported to the Engineer. This does not relieve the Contractor from the responsibility of performing such testing along with appropriate plant monitoring as necessary to assure that produced material conforms to the applicable specifications. Quality control test data shall be made available to the Engineer upon request.

2. **Voluntary Process Control.** The Contractor may conduct process control testing. Process control testing is not required, but is recommended on the elements and at the frequency listed in Table 106-1.

All of the testing equipment used for in-place density testing shall conform to the requirements of acceptance testing standards, except nuclear testing devices need not be calibrated on the Department's calibration blocks.

- (b) *Acceptance Testing.* Acceptance testing is the responsibility of the Department. For acceptance testing the Department will determine the locations where samples or measurements are to be taken and as designated in Section 403. The maximum quantity of material represented by each test result, the elements, the frequency of testing and the minimum number of test results will be in accordance with Table 106-1. The location or time of sampling will be based on the stratified random procedure as described in CP 75. Acceptance sampling and testing procedures will be in accordance with the Schedule for Minimum Materials Sampling, Testing and Inspection in the Department's Field Materials Manual. Samples for project acceptance testing shall be taken by the Contractor in accordance with the designated method. The samples shall be taken in the presence of the Engineer. Where appropriate, the Contractor shall reduce each sample to the size designated by the Engineer. The Contractor may retain a split of each sample which cannot be included as part of the Contractor's process control testing. All materials being

-8-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

used are subject to inspection and testing at any time prior to or during incorporation into the work.

Table 106-1
SCHEDULE FOR MINIMUM SAMPLING AND TESTING

Element	Process Control	Acceptance
Asphalt Content	1/500 tons	1/1000 tons
Theoretical Maximum Specific Gravity	1.1000 tons, minimum 1/day	1/1000 tons, minimum 1/day
Gradation	1/Day	1/2000 tons
In-Place Density	1/500 tons	1/500 tons
Joint Density	1 core/2500 linear feet of joint	1 core /5000 linear feet of joint
Aggregate Percent Moisture (2)	1/2000 tons or 1/Day if less than 2000 tons	1/2000 tons
Percent Lime (2) (3)	1/Day	Not applicable
Notes: (1) Process control tests for gradation are not required if less than 250 tons are placed in a day. The minimum number of process control tests for gradation shall be one test for each 1000 tons or fraction thereof. (2) Not to be used for incentive/disincentive pay. Test according to CP 60B and report results from Form 106 or Form 565 on Form 6. (3) Verified per Contractor's QC Plan.		

(c) *Reference Conditions.* Three reference conditions can exist determined by the Moving Quality Level (MQL). The MQL will be calculated in accordance with the procedure in CP 71 for Determining Quality Level (QL). The MQL will be calculated using only acceptance tests. The MQL will be calculated on tests 1 through 3, then tests 1 through 4, then tests 1 through 5, then thereafter on the last five consecutive test results. The MQL will not be used to determine pay factors. The three reference conditions and actions that will be taken are described as follows:

1. Condition green will exist for an element when an MQL of 90 or greater is reached, or maintained, and the past five consecutive test results are within the specification limits.

-9-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

2. Condition yellow will exist for all elements at the beginning of production or when a new process is established because of changes in materials or the job-mix formula, following an extended suspension of work, or when the MQL is less than 90 and equal to or greater than 65. Once an element is at condition green, if the MQL falls below 90 or a test result falls outside the specification limits, the condition will revert to yellow or red as appropriate.
3. Condition red will exist for any element when the MQL is less than 65. The Contractor shall be notified immediately in writing and the process control sampling and testing frequency increased to a minimum rate of 1/250 tons for that element. The process control sampling and testing frequency shall remain at 1/250 tons until the process control QL reaches or exceeds 78. If the QL for the next five process control tests is below 65, production will be suspended.

If gradation is the element with MQL less than 65, the Department will test one randomly selected sample in the first 1250 tons produced in condition red. If this test result is outside the tolerance limits, production will be suspended. (This test result will not be included as an acceptance test.)

After condition red exists, a new MQL will be started. Acceptance testing will stay at the frequency shown in Table 106-1. After three acceptance tests, if the MQL is less than 65, production will be suspended.

Production will remain suspended until the source of the problem is identified and corrected. Each time production is suspended, corrective actions shall be proposed in writing by the Contractor and approved in writing by the Engineer before production may resume.

Upon resuming production, the process control sampling and testing frequency for the elements causing the condition red shall remain at 1/250 tons. If the QL for the next five process control tests is below 65, production will be suspended again. If gradation is the element with MQL less than 65, the Department will test one randomly selected sample in the first 1250 tons produced in condition red. If this test result is outside the tolerance limits, production will be suspended.

- (d) *Mix Verification Testing.* After the mix design has been approved and production commences, the Department will perform a minimum of three volumetric verification tests for each of the following elements to verify that the field produced hot mix asphalt conforms to the approved mix design:

- (1) Air Voids
- (2) Voids in Mineral Aggregate (VMA).

-10-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

(3) Asphalt Content (AC).

The test frequency shall be one per day unless altered by the Engineer.

The test results will be evaluated and the Contractor shall make adjustments if required in accordance with the following:

1. Target Values. The target value for VMA will be the average of the first three volumetric field test results on project produced hot mix asphalt or the target value specified in Table 403-1 and Table 403-2 of the specifications, whichever is higher. The target value for VMA will be set no lower than 0.5 percent below the VMA target on Form 43 prior to production. The target values for the test element of air voids and AC shall be the mix design air voids and mix design AC as shown on Form 43.
2. Tolerance Limits. The tolerance limits for each test element shall be:

AC	± 0.3 percent
Air Voids	± 1.2 percent
VMA	± 1.2 percent

3. Quality Levels. Calculate an individual QL for each of the elements using the volumetric field verification test results. If the QL for VMA or AC is less than 65 or if the QL for air voids is less than 70, the production shall be halted and the Contractor shall submit a written proposal for a mix design revision to the Engineer. Production shall only commence upon receipt of written approval from the Engineer of the proposed mix design revision.

After a new or revised mix design is approved, three additional volumetric field verification tests will be performed on asphalt produced with the new or revised mix design. The test frequency shall be one per day unless altered by the Engineer.

If the QL for VMA or AC is less than 65 or the QL for the test element of air voids is less than 70, then production shall be halted until a new mix design has been completed in accordance with CP 52 or CP 54, a new Form 43 issued, and the Contractor demonstrates that he is capable of producing a mixture meeting the verification requirements in accordance with A or B below:

- A. The Contractor shall produce test material at a site other than a CDOT project. The Contractor shall notify the Engineer a minimum of 48 hours prior to the requested test. The location and time of the test are subject to the approval of the Engineer, prior to placement. Three samples will be tested for volumetric properties. If the QL for VMA or AC is equal or greater than 65 and the QL for the element of air voids is equal or greater than 70, full production may resume or;

-11-

REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)

- B. The Contractor may construct a 500 ton test strip on the project. Three samples in the last 200 tons will be tested for volumetric properties. After construction of the test section, production shall be halted until the testing is complete and element QLs are calculated. If the QL for VMA or AC is equal or greater than 65 or the QL for the element of air voids is equal or greater than 70, full production may resume. If the QL for VMA or AC is less than 65 or the QL for the element of air voids is less than 70, the material shall be removed and replaced at no cost to the Department. The time count will continue, and any delay to the project will be considered to have been caused by the Contractor and will not be compensable.

The costs associated with mix designs shall be solely at the Contractor's expense.

If the Contractor fails to verify the new mix design in accordance with A or B, then production shall be halted until a new mix design has been completed in accordance with CP 52 or CP 54, a new Form 43 issued, and the Contractor demonstrates they are capable of producing a mixture meeting the verification requirements in accordance with A or B.

4. New or Revised Mix Design. Whenever a new or revised mix design is used and production resumes, three additional volumetric field verification tests shall be performed and the test results evaluated in accordance with the above requirements. The test frequency shall be one per day unless altered by the Engineer.
 5. Field Verification Process Complete. When the field verification process described above is complete and production continues, the sample frequency will revert back to a minimum of 1/10,000 tons. The Engineer has the discretion to conduct additional verification tests at any time.
- (e) *Stability Verification Testing.* After the mix design has been approved and production commences, the Department will perform a minimum of three stability verification tests to verify that the field produced HMA conforms to the approved mix design:

The test frequency shall be one per day unless otherwise directed by the Engineer.

The test results will be evaluated and the Contractor shall make adjustments if required in accordance with the following:

1. The minimum value for stability will be the minimum specified in Table 403-1 of the specifications. There will be no tolerance limit.
2. Quality Level. Calculate a QL for stability. If the QL for stability is less than 65, then production shall be halted and the Contractor shall submit a written proposal for a mix

-12-

**REVISION OF SECTIONS 105 AND 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
(LESS THAN 5000 TONS WITH VOLUMETRIC VERIFICATION)**

design revision to the Engineer. The Engineer shall give written approval to the proposed mix design revision before production continues.

After a new or revised mix design is approved, three additional stability tests will be performed on asphalt produced with the new or revised mix design. The test frequency shall be one per day unless altered by the Engineer.

If the stability QL is less than 65, then production shall be halted until a new mix design has been completed and approved using plant produced material or the Contractor shall submit a written proposal for a mix design revision to the Engineer. The Engineer shall give written approval to the proposed mix design revision before production continues.

3. New or Revised Mix Design. Whenever a new or revised mix design is used and production resumes, three additional stability field verification tests shall be performed and the test results evaluated in accordance with the above requirements. The test frequency shall be one per day unless altered by the Engineer.
4. Field Verification Process Complete. When the field verification process described above is complete and production continues, the sample frequency will revert back to 1 per 10,000 tons.

**REVISION OF SECTION 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT**

Section 106 of the Standard Special Provisions is hereby revised for this Project as follows:

Subsection 106.05 shall include the following:

For this Project, Contractor process control testing of HMA is mandatory.

**REVISION OF SECTION 401
HOT MIX ASPHALT COMPACTION
(PNEUMATIC TIRE ROLLERS)**

Section 401 of the Standard Specifications is hereby revised for this project as follows:

In subsection 401.17, first paragraph, delete the second sentence and replace with the following:

Both steel wheel and pneumatic tire rollers will be required on this project. If the Contractor has demonstrated that all of the manufacturer's recommendations were followed and the pneumatic tire roller is detrimental to the finished surface of the HMA, the Engineer, in cooperation with the Contractor and the Region Materials Engineer, may waive the pneumatic tire roller requirement.

REVISION OF SECTION 403
HOT MIX ASPHALT

Section 403 of the Standard Specifications is hereby revised for this project as follows:

Subsection 403.02 shall include the following:

The design mix for hot mix asphalt shall conform to the following:

Table 403-1							
Property	Test Method	Value For Grading					
				SX (75)			Patching
Air Voids, percent at: N (design)	CPL 5115			3.5 - 4.5			3.5 - 4.5
Lab Compaction (Revolutions): N (design)	CPL 5115			75			75
Stability, minimum	CPL 5106			28			28
Aggregate Retained on the 4.75 mm (No. 4) Sieve for S, SX and SG, and on the 2.36mm (No. 8) Sieve for ST and SF with at least 2 Mechanically Induced fractured faces, % minimum*	CP 45			70			70
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman), minimum	CPL 5109 Method B			80			80
Minimum Dry Split Tensile Strength, kPa (psi)	CPL 5109 Method B			205 (30)			205 (30)
Grade of Asphalt Cement, Top Layer				PG 58-28			PG 58-28
Grade of Asphalt Cement, Layers below Top				PG 58-28			PG 58-28
Voids in the Mineral Aggregate (VMA) % minimum	CP 48			See Table 403-2			See Table 403-2
Voids Filled with Asphalt (VFA), %	AI MS-2			65-80			65-80
Dust to Asphalt Ratio Fine Gradation Coarse Gradation	CP 50			0.6 - 1.2 0.8 - 1.6			0.6 - 1.2 0.8 - 1.6
<p>Note: AI MS-2 = Asphalt Institute Manual Series 2</p> <p>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.</p> <p>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 3/4" to 3/8" are considered a coarse gradation if they pass below the maximum density line at the #8 screen. Gradations for mixes with a nominal maximum aggregate size of #4 or smaller are considered a coarse gradation if they pass below the maximum density line at the #16 screen.</p> <p>*Fractured face requirements for SF may be waived by RME depending on project conditions.</p>							

-2-
REVISION OF SECTION 403
HOT MIX ASPHALT

All mix designs shall be run with a gyratory compaction angle of 1.25 degrees and properties must satisfy Table 403-1. Form 43 will establish construction targets for Asphalt Cement and all mix properties at Air Voids up to 1.0 percent below the mix design optimum.

Table 403-2

Nominal Maximum Size*, mm (inches)	Minimum Voids in the Mineral Aggregate (VMA)			
	***Design Air Voids **			
	3.5%	4.0%	4.5%	5.0%
37.5 (1½)	11.6	11.7	11.8	N/A
25.0 (1)	12.6	12.7	12.8	
19.0 (¾)	13.6	13.7	13.8	
12.5 (½)	14.6	14.7	14.8	
9.5 (⅜)	15.6	15.7	15.8	
4.75 (No. 4)	16.6	16.7	16.8	16.9
	* 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.

CDOT approved Warm Mix Asphalt (WMA) may be allowed on this project in accordance with CP 59. WMA mixes shall utilize additives from the CDOT Approved Products List (APL). Unique requirements for WMA design, production and acceptance testing as documented during CDOT WMA approval shall be submitted and approved prior to creation of the Form 43 and before any WMA production on the project. Delays to the project due to WMA submittal and review will be considered within the Contractor's control and will be non-excusable.

The hot mix asphalt shall not contain any reclaimed asphalt pavement.

-3-

**REVISION OF SECTION 403
HOT MIX ASPHALT**

Hot mix asphalt for patching shall conform to the gradation requirements for Hot Mix Asphalt (Grading SX)(75)(PG 58-28). All patching shall be per the Engineer.

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

Subsection 403.03 shall include the following:

The Contractor shall use an approved anti stripping additive. The amount of additive used shall be a minimum of 0.5 percent by weight of the asphalt cement. The additive shall be added at the refinery or at the hot plant. If liquid anti stripping additive is added at the plant, an approved in line blender must be used. The blender shall be in the line from the storage tank to the drier drum or pugmill. The blender shall apply sufficient mixing action to thoroughly mix the asphalt cement and anti-stripping additive.

Delete subsection 403.05 and replace with the following:

403.05 The accepted quantities of hot mix asphalt will be paid for in accordance with subsection 401.22, at the contract unit price per ton for the bituminous mixture.

Payment will be made under:

Pay Item	Pay Unit
Hot Mix Asphalt (Patching)(Asphalt)	Ton

Aggregate, asphalt recycling agent, additives, hydrated lime, and all other work necessary to complete each hot mix asphalt item will not be paid for separately, but shall be included in the unit price bid. When the pay item includes the PG binder grade, the asphalt cement will not be measured and paid for separately, but shall be included in the work. When the pay item does not include the PG binder grade, asphalt cement will be measured and paid for in accordance with Section 411. Asphalt cement used in Hot Mix Asphalt (Patching) will not be measured and paid for separately, but shall be included in the work.

Excavation, preparation, and tack coat of areas to be patched will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 403
HOT MIX ASPHALT TICKET COLLECTION**

Section 403 of the Standard Specifications is hereby revised for this project as follows:

Subsection 403.05 shall include the following:

The Contractor shall collect the scale ticket on each load when it is delivered to the project site, and ensure that the information required in subsection 109.01 is shown on each ticket:.

The scale tickets shall be available on site for CDOT personnel to inspect.

Each day the Contractor shall provide to the Engineer envelopes which contain the previous day's signed tickets and the following:

1. On each envelope: Project number, date of paving, type of material, daily total and cumulative total.
2. One of the following:
 - A. Two adding machine tape tabulations of the weight tickets with corresponding totals run and signed by different persons,
 - B. One signed adding machine tape tabulation of the weight tickets that has been checked and signed by a second person,
 - C. Signed check tape of computer scale tickets that have a cumulative total. These scale tickets must be consecutive and without voids adjustments.
3. A listing of any overweight loads on the envelope, including ticket numbers and amount over legal limit.
4. A comparison of the actual yield for each day's placement to the theoretical yield. Theoretical yield shall be based on the actual area paved, the planned thickness, and the actual density of the mixture being placed. Any variance greater than +2.5% shall be indicated on the envelope and a written explanation included.

The Contractor shall provide a vehicle identification sheet that contains the following information for each vehicle:

- (1) Vehicle number
- (2) Length
- (3) Tare weight
- (4) Number of axles
- (5) Distance between extreme axles
- (6) All other information required to determine legal weight
- (7) Legal weight limit