Revision of Section 403

Stone Matrix Asphalt Pavement

**Revise Section 403 of the Standard Specifications for this project as follows:**

**Subsection 403.01 shall include the following:**

This work includes placing a Stone Matrix Asphalt (SMA) pavement as shown on the plans.

**Subsection 403.02 shall include the following:**

The SMA gradation for this project shall be \_\_\_\_\_\_\_\_\_●

Mixture design and field control testing of SMA shall be performed using either the SuperPave (CPL 5115, 100 Gyrations) or the Marshall Method (AASHTO T245, 50 Blow).

A minimum of two weeks before the proposed use of any Stone Matrix Asphalt pavement on the project, a pre-paving conference will be conducted. At that time, the Contractor shall submit to the Engineer, a mix design meeting the appropriate specification requirements for one of the following:

The SuperPave SMA mix design shall conform to the requirements of Table 403-1a:

**Table 403-1a**

| Property | Test Method | Value for SMA |
| --- | --- | --- |
| Air Voids, percent at: N(Design) | CPL 5115 | 3.0 – 4.0 |
| Lab compaction (Revolutions)  N(Design) | CPL 5115 | 100 |
| Accelerated Moisture Susceptibility, tensile strength  Ratio, (Lottman), minimum | CPL 5109,  Method B | 70 |
| Minimum Dry Split Tensile Strength, psi | CPL 5109,  Method B | 30 |
| Grade of Asphalt Cement |  | PG 76-28 |
| Voids in the Mineral Aggregate (VMA) %, minimum | CP 48 | 17 |
| Draindown at Production Temperature | AASHTO T305 | 0.3 maximum |
| % VCA\*MIX | AASHTO  R 46 | Less than VCADRC# |

Note: The current version of CPL 5115 is available from the Region Materials Engineer

Note: Copies of AASHTO R 46 and M 325 can be obtained from the Region Materials Engineer

Note: \*Voids in the Coarse Aggregate

Note: #Dry-rodded condition

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. CDOT will establish the production asphalt cement and volumetric targets based on the Contractor’s mix design and the relationships shown between the Stone Matrix Asphalt mixture volumetric properties and asphalt cement contents on the Form 429.  CDOT may select a different AC content other than the one shown at optimum on the Contractor’s mix design in order to establish the production targets as contained on the Form 43. Historically, Air Voids adjustments typically result in asphalt cement increases from 0.1 to 0.5 percent. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

The Marshall SMA mix design shall conform to the following:

| Mix Properties | Value |
| --- | --- |
| Stability, Marshall Compactor | 1400 lbs., min |
| % Voids in Total Mix | 3 – 4% |
| VMA (% Voids in the Mineral Aggregate) | 17 min. |
| Lottman, CPL 5109, Method B | 70% min |
| Dry Tensile Strength, (CPL 5109) | 30 psi, min. |

Regardless of mix design method, a minimum of 1 percent hydrated lime by weight of the combined aggregate shall be added to the aggregate for all Stone Matrix Asphalt.

The SMA Mix design must be approved by the Engineer before any pavement is placed on the project. In addition, the Contractor shall provide field control testing during production of the SMA mix and for the demonstration control strip. The Contractor shall perform the following tests and provide the results to the Engineer during production:

If a SuperPave SMA mix design is used, the Contractor shall perform the following tests and provide the results to the Engineer during production:

| Superpave Mix Property | Frequency |
| --- | --- |
| Draindown (AASHTO T 305) | 1/1000 tons or fraction thereof |
| Percent Voids in the total mix @ N(design) | 1/1000 tons or fraction thereof |
| VMA (Percent Voids in the Mineral Aggregate) @ N(design) | 1/1000 tons or fraction thereof |
| Lottman, CPL 5109, Method B | 1/5000 tons or fraction thereof |
| Dry Tensile Strength, CPL 5109 | 1/5000 tons or fraction thereof |
| Percent AC & Aggregate Gradation CP 5120 | 1/1000 tons or fraction thereof |

If a Marshall SMA mix design is used, the Contractor shall perform the following tests and provide the results to the Engineer during production:

| Marshall Mix Property | Frequency |
| --- | --- |
| Draindown (AASHTO T 305) | 1/1000 tons or fraction thereof |
| Stability (Marshall) | 1/1000 tons or fraction thereof |
| Percent Voids in the total mix | 1/1000 tons or fraction thereof |
| VMA (Percent Voids in the Mineral Aggregate) | 1/1000 tons or fraction thereof |
| Lottman, CPL 5109, Method B | 1/5000 tons or fraction thereof |
| Dry Tensile Strength, CPL 5109 | 1/5000 tons or fraction thereof |
| Percent AC & Aggregate Gradation CP 5120 | 1/1000 tons or fraction thereof |

**▲** CDOT approved Warm Mix Asphalt (WMA) may be allowed on this project per CP 59. Unique requirements for WMA design, production and acceptance testing as documented during CDOT WMA approval shall be submitted and approved before 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.

**Subsection 403.03 shall include the following:**

The mineral filler for SMA shall be stored in a separate silo and added automatically in the correct proportion. The mineral filler addition equipment shall be electronically or mechanically interlocked to the aggregate feed sensors so that the proper amount of mineral filler is added whenever SMA is produced.

The SMA mineral filler shall be added at the same point the asphalt cement is added to the aggregate.

Tack coat between the existing pavement and Stone Matrix Asphalt pavement shall be placed at a rate between 0.03 and 0.05 gallons per square yard.

Before proceeding with SMA placement, the Contractor shall demonstrate the ability to produce and place a satisfactory mix in a Demonstration Control Strip (DCS). The Contractor will coordinate with the Engineer on the proposed location of the DCS. The DCS shall consist of a minimum quantity of 500 tons placed in one lane, full width. Within the last 200 tons of SMA placed in the DCS, the Contractor and CDOT shall determine properties (VMA, Voids, in-place density, AC content, gradation, and Marshall Stability, if required) of the project produced SMA mix used in the DCS and provide the results to the Engineer. The Contractor may proceed with full production if all mixture properties are within the specified tolerances.

To determine the in-place density and roller pattern, one core shall be taken at three random locations within the last 200 tons of the DCS. The Engineer will determine the coring locations using a stratified random sampling process. The cores shall be immediately submitted to the Engineer and will be used for determining acceptance of the DCS. Densities of the random samples will be determined by cores according to CP 44. Coring shall be performed by the Contractor under CDOT observation. Coring will not be measured and paid for separately but shall be included in the work.

The DCS will be designated as a separate process. Payment for the DCS will be made per Subsection 105.05, Conformity to the Contract of Hot Mix Asphalt.

Subsection 403.04 shall include the following:

Stone Matrix Asphalt will be measured by the actual number of tons that are completed and accepted.

Subsection 403.05 shall include the following:

**Pay Item Pay Unit**

Stone Matrix Asphalt Ton

♦ Mix design, furnishing, hauling, preparing, and placing all materials, including aggregates, asphalt cement, limestone dust, alternate mineral filler, hydrated lime, tack coat, and approved demonstration control strip; labor, equipment tools, setting of lines and guides where specified, and all other work and materials necessary to complete the item will not be paid for separately but shall be included in the unit bid price. Any change to the submitted mix design optimum asphalt cement content to establish production targets on the Form 43 will not be measured and paid for separately but shall be included in the work. No additional compensation will be considered or paid for any additional asphalt cement, plant modifications and additional personnel required to produce the HMA as a result in a change to the mix design asphalt cement content.  Historically, typical asphalt cement increases reflected on the Form 43 are from 0.1 to 0.5 percent. However, the Contractor should anticipate the AC increases typical of his mixes. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**Instructions to Designers** (delete instructions and symbols from final draft):

● As determined by the Region, select one of these nominal maximum aggregate sizes: No. 4, 3/8 inch, 1/2 inch, 3/4 inch.

▲ Include this paragraph when allowed by the Region Materials Engineer. Contractors proposing to use WMA shall supply detailed design, production and acceptance testing requirements before completion of the Form 43. Approved WMA submittals shall contain all of this information before CDOT approval. Only CDOT Approved WMA will be allowed for use on the project.

♦ If asphalt cement is to be paid for separately, the above note should read:

Mix design, furnishing, hauling, preparing, and placing all materials, including aggregates, limestone dust, alternate mineral filler, hydrated lime, tack coat, and approved demonstration control strip; labor, equipment tools, setting of lines and guides where specified, and all other work and materials necessary to complete the item will not be paid for separately but shall be included in the unit bid price. Any change to the submitted mix design optimum asphalt cement content to establish production targets on the Form 43 will not be measured and paid for separately but shall be included in the work. No additional compensation will be considered or paid for any additional asphalt cement, plant modifications, or additional personnel required to produce the HMA as a result in a change to the mix design asphalt cement content. Historically, typical asphalt cement increases reflected on the Form 43 are from 0.1 to 0.5 percent. However, the Contractor should anticipate the AC increases typical of his mixes. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

Asphalt Cement will be measured and paid for per Section 411.

Delete unused paragraphs. Delete the units not used.

NOTE: The Sample Project Special Provision, Revision of Sections 401 and 703, Stone Matrix Asphalt Pavement, must be used along with this specification.

In addition, the Standard Special Provision for gradation acceptance of HMA must be included with this specification to provide construction and acceptance requirements. If there are fewer than 5000 tons of SMA, include the standard special provision Revision of Section 106, Conformity to the Contract of Hot Mix Asphalt (Less Than 5000 Tons).