## Section 311. — Stabilized Aggregate Surface Course

03/31/16– FP-14

WFL Specification 03/31/16

Include the following when work is required in this Section.

Delete this Section and substitute the following:

Description

### 311.01

This work consists of constructing a stabilized aggregate layer with imported aggregate. The aggregate layer is stabilized by incorporating a solid form of calcium chloride.

Aggregate stabilization is designated as imported surface course aggregate.

Material

### 311.02

Conform to the following Subsections:

Calcium chloride (flake/pellet) 725.02

Imported surface course aggregate 703.05A

Water 725.01

Construction Requirements

### 311.03 Proportioning.

Determine the maximum density and optimum moisture content according to AASHTO T 180, method D for the imported surface course aggregate in two ways; first for the aggregate without calcium chloride, and second for the aggregate mixture including calcium chloride at the target percentage. The proctor with calcium chloride will be used to monitor yield and final compaction of the mixture. The target calcium chloride content is 1.7 percent by weight of the material at 95 percent of the maximum dry density. The target water content at the time of mixing is from 2 percent below the optimum moisture content to optimum moisture content.

### 311.04 General.

Store calcium chloride in closed, weatherproof containers. Schedule the work according to Section 155 to include a 7-day cure period after calcium chloride is incorporated, during which the mean daily temperature is not expected to fall below 40 °F (4 °C). Begin application or mixing operations only when the ambient air temperature is 40 °F (4 °C) or above, and is not expected to fall below 40 °F (4 °C) within 48 hours. Do not construct the stabilized aggregate layer when the underlying surface is frozen, muddy, during precipitation, or if precipitation is forecasted within 24 hours. Do not discharge calcium chloride into any waters of the U.S.

Prepare the surface on which the imported surface course aggregate is placed according to Section 303. Start the placement of imported surface course aggregate within 5 days of completing road reconditioning, unless otherwise approved by the CO.

Prior to calcium chloride placement, schedule a review of the project with the CO to determine areas that need calcium chloride content adjustments due to environmental or drainage conditions. Site specific calcium chloride content adjustments within the specification range will be considered if requested in writing after the review and prior to calcium chloride placement.

The CO will arrange an off-site informational session prior to stabilization work to discuss aggregate stabilization practices. The attendance of the project superintendent, work foreman, key stabilization personnel, and QCM is required at the informational session. Conduct an on-site pre-work meeting according to Subsection 153.04, prior to beginning work on calcium chloride stabilization.

### 311.05 Mixing and Placing.

**(a) Tolerances.** Maintain the accuracy of the amounts of calcium chloride and water content within the following tolerances during pugmill or in-place mixing:

Calcium chloride: ±0.2 percent by mass (maintain calcium chloride content from 1.5 percent to 1.9 percent as determined in Subsection 311.03).

Water: ±1.0 percent by mass (maintain moisture content from 2 percent below optimum to optimum as determined in Subsection 311.03).

Continuously monitor aggregate and calcium chloride yield during placement. Report yield daily to the CO according to Subsection 153.04(b)(1). Adjust placement operations to ensure an accurate yield is maintained.

Calculate the calcium chloride yield according to the following formulas:

Where:

T = Target calcium chloride content in decimal percent

= Maximum dry density of aggregate, lb/ft3

W = Width of calcium chloride application, ft

D = Depth of mixing calcium chloride, ft

**(b) Pugmill.** Use a stationary pugmill with weighing or metering equipment capable of accurately controlling the material entering the mixer. Interlock the metering controls for the aggregate feed with those of the calcium chloride and water to ensure uniform introduction of material into the mixer. Maintain the accuracy of the amount of aggregate within the following tolerance:

Aggregate ±2.0 percent by mass

Immediately after mixing, haul and spread the material on the prepared surface in a uniform layer. Shape the road to the required cross section. Route hauling equipment uniformly over the full width of the surface to minimize rutting or uneven compaction.

(c) In-place mixing. Transport and place the imported surface course aggregate after preparation of the surface and acceptance of the surface by the CO. Process the aggregate with a motor grader into a uniform windrow within one hour of delivery on the roadway, adjusting the moisture content to obtain a homogenous mixture with a moisture content within 2 percent below the optimum moisture content to optimum moisture content. Spread the material on the prepared surface in a uniform layer. Shape the road to the required cross section. Compact according to Subsection 311.06(c) by the end of the shift. Do not allow hauling vehicles to drive on the placed aggregate prior to windrow processing except when required to allow traffic to pass or in order to dump subsequent loads, as approved by the CO.

Apply calcium chloride in a uniform layer across the full width of the surface to be mixed. Incorporate calcium chloride within 14 days of placement of imported aggregate, unless otherwise approved by the CO. Use distributor equipment capable of closely metering the application rate from the operator’s cab. As an alternative, rotary mixing machines capable of closely metering calcium chloride and additional mixing water into the mixing process may be used, provided the required application rates are met and the application rates can be continuously monitored from the operator’s cab.

Verify the application rate by performing calcium chloride weight yield test panels daily for each distributor. If yield test panel results indicate a rate outside the contract tolerances, then correct the application rate and perform additional yield testing. The CO may increase the test frequency. Do not spread more calcium chloride than can be incorporated within one hour.

Use rotary mixing equipment to uniformly incorporate the calcium chloride and additional mixing water into the imported surface course aggregate to a compacted depth of 4 inches (100 millimeters) +0.0 inch/-0.5 inch (13 millimeters). Mix the material one-lane at a time. Do not mix material across the crown of the road as shown in the plans.

Use the quality control program to monitor and achieve the specified amount of calcium chloride additive and moisture content. If calcium chloride yield calculations, moisture content measurement, or other observations indicate an application rate that is outside of the allowable range, stop production and provide immediate corrective action to the process to achieve application within the allowable range.

After mixing is complete, ensure a uniform product free of segregation, streaking, and inconsistent moisture content by processing the treated material with a motor grader to full depth and width. Shape the road to the required cross section. Compact according to Subsection 311.06(c). To the extent practicable, prevent hauling equipment from traveling on recently placed calcium chloride treated aggregate. If not practicable, route hauling equipment uniformly over the full width of the surface to minimize rutting or uneven compaction.

### **311.06 Compacting and Finishing.**

Maintain the moisture content from optimum to 2 percent below optimum. Additional water to facilitate compaction and finishing may be added after mixing and spreading if approved by the CO. Compact each layer full width. Roll from the sides to the center, parallel to the centerline of the road. Along curbs, headers, walls, and all places not accessible to the roller, compact the material with approved tampers or compactors.

(a) Equipment. Furnish pneumatic tired rollers for initial compaction that have a minimum ballasted weight of 15 tons (15 metric tons) and have a minimum tire overlap of 1.5 inches (37.5 millimeters). Furnish single smooth drum rollers for final compaction to provide a smooth and uniform finished surface.

**(b) Pugmill.**  Compact each layer to at least 95 percent of maximum dry density according to the proctor performed with calcium chloride. Meet compaction requirements for all sections of roadway prior to the end of the work shift. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures.

**(c) In-place mixing.** Compact the untreated imported surface course aggregate placed each shift to at least 95 percent of maximum dry density of the respective proctor by the end of shift. The CO may approve alternative test procedures if requested and if calcium chloride is to be incorporated within 2 days of aggregate placement.

After calcium chloride incorporation, compact each layer to at least 95 percent of maximum dry density as determined in Subsection 311.03 for aggregate combined with calcium chloride. Meet compaction requirements for all sections of roadway where calcium chloride is incorporated prior to the end of the work shift. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures.

**(d) Finishing.** Finish the mixture to produce a surface that is smooth, dense, and free of compaction planes, ridges, or loose material. Compact the aggregate foreslopes to ensure they are dense and recoverable. Wheel-rolling with grading equipment tires may be approved by the CO for foreslope compaction. Shape the surface to the required template and check the surface with a 10-foot (3-meter) straightedge. Defective areas are surface deviations in excess of ½ inch (12 millimeters) in 10 feet (3 meters) between any two contacts of the straightedge with the surface, or noticeable dips, bumps or other undulations identified through visual inspection.

Correct all defective areas by loosening the material full depth, adding or removing material as required, adjusting moisture content, reshaping, and compacting. Alternative methods of correction, including patching or filling of potholes, may be submitted in writing for approval by the CO. If areas corrected by alternative methods remain defective after correction activities, corrective methods according to the first sentence in this paragraph will be required.

### 311.07 Acceptance.

See Table 311-1 for sampling and testing requirements, including the acceptance quality characteristic category.

**(a) Stabilization agent.** Calcium chloride will be evaluated under Subsections 106.02 and 106.03.

**(b) Imported surface course aggregate**. Aggregate gradation, plasticity index, and liquid limit will be evaluated under Subsection 106.05. Other aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

**(1) Aggregate gradation.** The upper and lower specification limits are equal to the calculated mean of all test results plus or minus the allowable deviations shown in Table 703-3A, except as follows:

(a)If the calculated mean value for any tested sieve exceeds the maximum gradation value shown in Table 703-3A, the upper specification is equal to the maximum gradation value plus the allowable deviation, and the lower specification is equal to the maximum gradation value minus the allowable deviation.

(b)If the calculated mean value for any tested sieve is less than the minimum gradation value shown in Table 703-3A, the upper specification is equal to the minimum gradation value plus the allowable deviation and the lower specification is equal to the minimum gradation value minus the allowable deviation.

**(2) Fractured faces.** When aggregate is produced from a gravel source, use the specification limit shown in Subsection 703.05A(f).

**(3) Liquid limit.** The specification limit is shown in Subsection 703.05A(g).

**(4) Plasticity index.** The specification limit is shown in Subsection 703.05A(h).

**(c) Construction**. Aggregate stabilization construction will be evaluated under Subsections 106.02 and 106.04. Imported aggregate compaction will be evaluated under Subsection 106.04.

**(d) Project Inspections.** An intermediate inspection of each road will take place within 15 days of aggregate stabilization completion. The results of the intermediate inspection are not to be interpreted as final acceptance of the road. Correct all defects that arise after the intermediate inspection and prior to final acceptance by the CO, according to 311.06(d).

**(e) Reconditioning.** Preparation of the surface on which the imported surface course aggregate is placed will be evaluated under Section 303.

Measurement

### 311.08

Measure the Section 311 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

When measuring surface course aggregate by the ton, deduct the computed mass of calcium chloride from the measured quantity, if the material is pugmill mixed and weighed as a mixture. In this case, compute the mass of calcium chloride using the actual percentage added to accepted quantities of surface course aggregate.

Payment

### 311.09

The accepted quantities will be paid at the contract price per unit of measurement for the Section 311 pay items listed in the bid schedule, except the stabilized aggregate surface course contract price will be adjusted according to Subsection 106.05. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 311-1

Sampling, Testing, and Acceptance Requirements

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Remarks |  | Not required when using Government- provided sources | | “ | “ | " | " | − | " |
| Reporting Time |  | Before using in work | | “ | “ | End of shift | " | " | " |
| Split Sample |  | Yes, when requested | " | “ | “ | Yes, when requested | " | " | " |
| Point of Sampling |  | Source of material | " | “ | “ | Flowing aggregate stream (bin or belt discharge) or conveyor belt | " | " | " |
| Sampling Frequency | **Source** | 1 per type & not less than 5 per source of material(2) | | “ | “ | 1 for each 6 hours of production but not less than 2 per day per stockpile, min | " | " | " |
| Test Methods Specifications | AASHTO T 96 | AASHTO T 104 | AASHTO T 210 | WFLHD-DMSO | AASHTO T 27 & T 11 | ASTM D5821 | AASHTO T 87 & T 89, Method A | AASHTO T 87 & T 90 |
| Category | − | − | − | − | − | − | − | − |
| Characteristic |  | LA abrasion (coarse) | Soundness using sodium sulfate (course & fine) | Durability Index (course & fine) | Accelerated weathering | Gradation | Fractured faces | Liquid limit | Plasticity index |
| Type of Acceptance (Subsection) |  | Measured and tested for conformance (106.04 & 105) | |  |  | Process control (153.03) | |  |  |
| Material or Product (Subsection) |  | Imported aggregate source quality (703.05A) | |  |  | Imported aggregate (703.05A) | |  |  |

Table 311-1 (continued)

Sampling, Testing, and Acceptance Requirements

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Remarks | **Proportioning** | Report proportion of aggregate, calcium chloride, & water | **Production** | When using imported aggregate | | |  |  | − | " | " |
| Reporting Time | Before using in work | 4 hours |  |  |  |  | " | " | " |
| Split Sample | Yes, when requested | Yes, when requested |  |  |  |  | " | " | " |
| Point of Sampling | Processed material before incorporating in work | In-place mixing: from windrow immediately after processing  Pugmill mixing: flowing aggregate stream (bin or belt discharge) or conveyor belt prior to adding stabilizer | | | | | " | " | " |
| Sampling Frequency | 1 for each mixture or change in material | 1 per 1000 tons (900 metric tons) | | |  |  | " | " | " |
| Test Methods Specifications | AASHTO  T 180, Method D(1) | AASHTO T 27 & T 11 | |  |  |  | AASHTO T 87 & T 89, Method A | ASTM D5821 | AASHTO T 87 & T 90 |
| Category | − |  | I | I | I | II | II | I | I |
| Characteristic | Moisture- density | Gradation | No. 4 (4.75 mm) | No. 40 (425 μm) | No. 200 (75 μm) | Other specified sieves | Liquid limit | Fractured faces | Plasticity index |
| Type of Acceptance (Subsection) | Measured and tested for conformance (106.04) | Statistical (106.05) | |  |  |  |  |  |  |
| Material or Product (Subsection) | Proportioning (311.03) | Imported aggregate (703.05A) | | |  |  |  |  |  |

Table 311-1 (continued)

Sampling, Testing, and Acceptance Requirements

|  |  |  |
| --- | --- | --- |
| Remarks | **Production** (continued) | −  (1) Minimum of 5 points per proctor.  (2) Furnish at least five reports, but not less than one report per rock type for each source. Reports must be dated within 1 year of intended use. Obtain samples representative of aggregates being furnished. Include rock type and sample location on test reports. |
| Reporting Time | 4 hours |
| Split Sample | No |
| Point of Sampling | In-place, after compaction |
| Sampling Frequency | 1 per 500 tons (450 metric tons) or 3000 yd2 (2500 m2) |
| Test Methods Specifications | AASHTO T 310 or other approved procedures |
| Category | − |
| Characteristic | In-place density & moisture content |
| Type of Acceptance (Subsection) | Measured and tested for conformance (106.04) |
| Material or Product (Subsection) | Mixture (311.03) |