**401-7 Plant Mix Seal Course (Revised 10-10-19)**

1. PLANT MIX SEAL COURSE [401] (REVISED 10-10-19)
   1. Description. This work is producing, furnishing, placing, and compacting plant mix seal course on an approved surface.
   2. Materials. Provide plant mix seal course with the specified asphalt cement, 1.4 percent hydrated lime, and aggregate meeting the following requirements. Use fillers or additives as necessary.

The Contractor is responsible for all sampling, testing and control of the aggregate. Furnish the Project Manager the quality control test results upon request.

Ensure that the aggregate, when combined at the job mix formula meets applicable Subsection 701.03.1 requirements. In addition to the applicable Subsection 701.03.1 requirements, ensure course aggregate absorption is 4 percent maximum as tested by AASHTO T 84.

Aggregate Requirements. Furnish aggregate from sources meeting the applicable Section 106 requirements.

Meet the aggregate gradation requirements shown in Table of Gradation – Aggregate Plant Mix Seal Course below as tested by MT 202.

Aggregate must not contain adherent films of clay and other matter that prevents thorough coating and adhesion with bituminous material.

Meet the following aggregate requirements at the job mix formula combined ratio:

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| --- | --- |
| Coarse Aggregate (No. 4 (4.75 Mm) And Larger) | |
| Angularity (AASHTO T 335 or ASTM D-5821) | 90% min. w/ 2 fractured faces |
| Wear (AASHTO T-96) | 30% max. |
| Flat and Elongated Particles (ASTM D-4791) | |
| (5:1 Ratio; by mass; No. 4 (4.75 mm) and larger) | 10% max. |

|  |  |
| --- | --- |
| Fine Aggregate (No. 8 (2.36 Mm) And Smaller) | |
| Angularity (AASHTO T-304 Method A) | 40% min. |
| Sand Equivalent (AASHTO T-176) | 45% min. |
| If aggregate cannot meet the Sand Equivalent, meet the following: | |
| Volume Swell, untreated aggregates (MT-305) | 10% max. |
| Aggregate must be non-plastic (AASHTO T-89 & T-90) | |

Asphalt Cement. Furnish performance grade asphalt binder (PGAB) meeting Section 702, Table 702-2 and the grade specified in the contract. Ensure PG 64-28, and PG 70-28 binders, after aging in the Rolling Thin Film Oven, and testing under AASHTO T 51 meet the following:

* Pull Rate: 5 cm/minute.
* Sample temperature: 25 ºC.
* Ductility: 30 cm, minute.

Notify the Project Manager in writing before making changes to the PGAB components.

Test Results. Provide current test results for all PGAB requirements for material furnished. Furnish the PGAB test data with the first delivery and for each 2000 tons (2000 mt) delivered to the project.

PGAB Shipping, Handling, and Storage. Ship, handle, and store the PGAB following the supplier’s requirements. Ensure that the supplier’s requirements are consistent with the material manufacturers. Reject any PGAB exhibiting separation, crusting, or foaming during delivery or in storage tanks.

Sampling. Sample the PGAB meeting Subsection 402.03.2 (B). A sample is two one-pint (two 500 ml) containers of PGAB. Sample fillers, hydrated lime, and additives, in accordance with MT 601.

Hydrated Lime. Furnish hydrated lime meeting Subsection 713.02 Include 1.4 percent hydrated lime by total weight of mix as part of the mix of the aggregate gradation.

Mix Design. Submit to the Project Manager four copies of the Plant Mix Seal Course mix design. Include superpave gyratory compactor (SGC) results at a design of 50 gyrations, and draindown test results tested by AASHTO T 305. SGC results will be used for informational purposes while the draindown test will be used to establish the design asphalt content. The design asphalt content is the asphalt content with a minimum draindown of 0.3 percent. For informational purposes, the design asphalt content typically ranges from 6.0 to 6.8 percent by total mass. Include the binder supplier’s recommended mixing and compaction temperature ranges. The mix design is produced on a total weight of mix basis. On projects with multiple gravel sources or a combination of gravel sources, provide a mix design and meet all the requirements in the provision for each source or combination of sources and suppliers. The mix design establishes the recommended asphalt content, mixing and laydown temperatures, and any additives required.

Furnish the following materials to the Department for mix design verification: 5 gallons (19L) of PGAB and sufficient quantities from each stockpile to produce an 800 pound (363 kg) sample when combined at the mix design blend ratio.

The Department has thirty calendar days from receipt of the mix design materials and signed mix design documents to review the mix design. Do not begin production until receiving notification that the Departments mix design verification is complete. Contract time will be extended for the actual contract time the contractor’s paving start date was delayed, as verified by their most recent submitted schedule, and only for contract time assessed after the 30 day verification time frame. No additional compensation is allowed for these Department-caused delays. Contract time will not be extended if the delay occurs between November 1 and April 15.

Table Of Gradation –

Aggregate For Plant Mix Seal Course

|  |  |
| --- | --- |
| Percentage By Weight Passing Square Mesh Sieves | |
| Sieve Size | Percent Passing |
| ½” (12.5 mm) | 100 |
| ⅜” (9.5 mm) | 95-100 |
| No. 4 (4.75 mm) | 40-65 |
| No. 16 (1.18 mm) | 12-22 |
| No. 200 (0.075 mm) | 0-5 |

Construction Requirements.

Aggregate Production. Produce and furnish material within the limits of Table of Gradations – Aggregate Plant Mix Seal Course. Furnish coarse aggregate composed of 100 percent crushed material. Aggregate gradation testing will be performed according to MT 320, and the aggregate tested will be recovered by MT 319. Be responsible for all sampling and testing to control gradations and mechanical fracture during aggregate production. Establish a process quality control plan addressing the following:

Equipment Maintenance;

Equipment Calibration;

Stockpiling and materials handling; and

Sampling and testing of component materials.

Aggregate Acceptance Sampling and Acceptance.

Sampling.

Mechanical Fracture. Mechanical fracture tests will be by AASHTO T 335 on random samples selected by the Project Manager. Each sample represents approximately 600 tons (600 mt). The Project Manager may require additional samples.

Aggregate gradation. Gradation test samples are randomly selected by the Project Manager. Each sample represents approximately 600 tons (600 mt). The Project Manager may require additional samples.

Five samples represent approximately 3000 tons (3000 mt) and constitute a lot whenever production schedules and material continuity permits. The project manager may establish a lot of the quantity represented by 3 to 7 consecutive random samples when there are short production runs, significant material changes, or other unusual characteristics of the work.

Acceptance.

Mechanical fracture. Plant Mix Seal Course is accepted on a lot by lot basis under Subsection 105.03.2.

Gradation. Plant Mix Seal Course is accepted on a lot by lot basis under Subsection 105.03.2.

Asphalt Cement.

Asphalt Cement Content. The Project Manager may adjust the asphalt content if plant mix seal course appears over or under-asphalted.

Sampling and Acceptance.

Asphalt Cement will be sampled as specified in B. 2) c).

Asphalt Cement will be accepted as specified in Subsection 402.03.8.

Equipment.

Mixing Plants. Use mixing plants that produce a mix meeting the contract requirements.

Weigh System.

Automatic Weighing. Use state certified automatic weigh systems to weigh materials. Ensure the weigh accuracy is within plus or minus 0.5 percent of the true weight throughout the use range.

Include in the system an automatic printer that provides the following information:

Contract Number.

Project No. (as shown on plans).

Item Name (as shown on detail estimate).

Date.

Time.

Ticket Number (consecutive).

Haul Unit No.

Net tons (metric ton) in load (to nearest 0.05 ton).

A subtotal of tons (metric tons) for each haul unit since the beginning of the shift.

An accumulated total for all haul units since the beginning of the shift.

Use a pre-programmed printer or one equipped to prevent manual override of any weight information. Have the weigh system tested, certified, and sealed by the State Bureau of Weights and Measures after each plant move and before production for a project. Immediately stop production should the printer malfunction or breakdown and do not resume until corrected. Delivery of material from storage or surge bins is permitted only if the weight can be maintained within weigh specifications.

If an independent certified scale is within a 20 mile (32 km) round trip distance from either end of the project, the Project Manager will randomly designate the re-weighing of loaded vehicles, at least three times per project.

Re-test the plant weigh system any time the difference between the re-check and the plant system exceeds plus or minus one half of one percent of the load. Any weight differences are addressed under Subsection 109.01.1.

Manual Weighing. The Contractor may manually weigh and record weights instead of using an automatic weigh system. Ensure manual weighing includes platform scales meeting Subsection 301.03.2(C), a competent weigh person, and dump person.

Direct the weigh person to record, on Department furnished forms, weights to the nearest 100 pounds (45.4 kilograms) as well as the other required information regarding delivery and placement.

Certify that weights and totals furnished are a true and correct record of materials delivered and placed in the work. Deliver the records and totals to the Project Manager before 10:00 a.m. the next work day following the shift.

Safety Requirements. Install and maintain stairs, ladders, walkways, and all other plant facilities meeting State and Federal safety requirements.

Provide access to the tops of truck bodies for taking samples and mix temperature data.

Burner Fuel Restrictions. Use one of the approved fuels below to heat and dry aggregates.

Propane.

Butane.

Natural Gas.

Fuel Oil (grades 1, 2, and 5 only).

Coal.

EPA Specification-Used Oil Fuel (EPA-UOF) may be used instead of the approved burner fuels provided the following requirements are met.

|  |  |
| --- | --- |
| Physical Properties | Property Range |
| API Gravity | 20-28 |
| Viscosity at 12˚F (6˚C) (Saybolt Flurol) | 10-20 |
| Pour Point ˚F ˚C | +10 (-12) |
| Flash Point, min. Point ˚F ˚C | 100 (37.8) |
| Water by Distillation % | Under 1 |
| Solids by Separation % | Under 1 |
| Ash % | Under 0.4 |
| Sulfur | Average 0.5% |
| Kinematic Viscosity at 10˚F (37˚C) (centistokes) | 54-100 |
| Kinematic Viscosity at 12˚F (60˚C) (centistokes) | 15-75 |

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| --- | --- |
| Chemical Properties  Element Or Compound | Permitted Level |
| Vanadium | Under 100 ppm (100 mg/L) |
| Cadmium | Under 2 ppm (2 mg/L) |
| Chromium | Under 10 ppm (10 mg/L) |
| Lead | Under 100 ppm (100 mg/L) |
| Arsenic | Under 5 ppm (5 mg/L) |
| Total Halogens | Under 1,000 ppm (1,000 mg/L) |
| PCB's | Under 2 ppm (2 mg/L) |

Furnish a copy of certified test results from the supplier for each load of EPA-UOF delivered to the project. Furnish plant manufacturer information showing the plant burner is designed and equipped to burn EPA-UOF or grade 5 fuel oil. Upon request, provide a one-quart (liter) sample of EPA-UOF or grade 5 fuel oil from the tank on the project.

Immediately stop using EPA-UOF or grade 5 fuel oil if burner flame outs or other evidence of incomplete combustion or mix contamination is evident. Begin using one of the other approved fuels to complete the work. Remove and replace all contaminated plant mix at contractor expense. No additional compensation will be allowed.

Hydrated Lime Feed System. Introduce the dry hydrated lime into drum dryer mixing plants just below the asphalt cement introduction point.

Use alternate lime introduction methods only with the Project Manager’s written approval.

Ensure the system provides positive, accurate material feed and is automatically synchronized to the aggregate feed. Ensure the system indicates the weight entering the mixing unit on a time-coordinated basis.

Weigh using an automatic indicating electronic system. The lime is weighed directly, or the storage container including lime may be weighed.

Provide a continuous digital readout showing the weight or rate of feed in tons (metric tons) per hour. Record the information using a production monitor/recorder system or by a de-cumulating balance ticket-printing system. Record the information at minimum five-minute intervals or as directed.

Silo or storage container system weights are not used for acceptance during filling or transfer. Limit filling or transfer periods to one hour per three hours of plant operation. Record and furnish start and finish times for filling or transfer and the total quantity added.

Suspend mixing for erratic feeding or failure to feed hydrated lime to a minimum of 85 percent of the job mix formula. Do not resume until corrected or repaired.

Flow Rate Meter. Measure the asphalt cement discharged into the mixing unit using a flow rate meter with totalizer and temperature compensation.

Ensure the totalizer records up to 1,000,000 gallons (3,785,000 L) and is certified to plus or minus 0.20 percent of the measured quantity.

Use a flow rate meter and totalizer that automatically corrects to a temperature of 60˚F (16˚C) with an operating range of +60˚F (16˚C) to +450˚F (232˚C).

Locate the totalizer readout in the plant control room so it is readily accessible to the inspector.

Ensure the flow rate meter automatically shuts off any time asphalt cement is diverted or stops entering the mixing unit.

Calibrate the flow rate meter and totalizer before the start of the project and as necessary during production. The Project Manager will witness the calibration.

Provide the equipment and assistance for initial and subsequent calibration checks and furnish the Project Manager a copy of all calibration checks.

Use a calibration volume of at least 3,000 gallons (11,355 L). Ensure the weigh scales have been tested and certified.

Furnish the Project Manager one copy of a test report showing the asphalt cement specific gravity.

Spot check failure will require re-testing and certification of the above. The Project Manager will establish the spot check interval.

Production Monitor-Recorder. Use recording equipment that automatically monitors and records on a time coordinated basis, the aggregate, lime, and asphalt cement weight entering the mixing unit. The records may be continuous (chart recorder) or digital printout.

Ensure that chart recorders clearly record asphalt cement content changes of 0.1 percent or more and aggregate feed rate changes of 1.5 percent or more.

Ensure the digital printout equipment records the day's total production at minimum five-minute intervals, or the interval directed by the Project Manager.

Digitally display the aggregate and asphalt cement rates in tons (metric tons) per hour and daily totals. Display lime by tons (metric tons) per hour or on a de-cumulating balance.

Ensure the monitor system operates on unprocessed signals from measuring devices.

Provide the Project Manager continuous access to the recorder during production.

Submit the permanent record to the Project Manager daily.

Operate the production/monitor recorder at all times during production. Stop production when the recorder is not operational.

Plant Mix Preparation.

Mix the aggregate and asphalt cement to produce a homogeneous mixture. Ensure all aggregates are thoroughly and uniformly coated with bitumen.

Remove, dispose of, and replace all mix that is damaged by burning, improper mixing, or fails to meet the specifications at Contractor expense.

Maintain the mix discharge temperature within the asphalt cement manufacturer’s recommended mix temperature range.

The discharge temperature are periodically checked and recorded.

Ensure the average of any three checks is within the specified limits.

Suspend plant operations when the mix discharge temperature is outside the range.

Roadway Equipment.

Pavers. Use self-propelled pavers that spread, shape, and finish the combined plant mix material to the specified profile and cross slope.

Immediately stop paving if the paver tears, shoves, segregates or otherwise damages the plant mix, and repair or replace the paver before resuming paving operations.

Equip the paver with a mobile grade reference system that provides a uniform pavement profile. Ensure the paver maintains the transverse slope at all times and is able to adjust the slope throughout super-elevated curves.

Ensure auger extensions are used to match the screed width.

Equip the paver with an attachment that produces joints meeting requirement q) below as the surfacing course is placed.

Do not use diesel fuel as a cleaning agent or as a release agent for any paving equipment or operations. Use a commercially manufactured release agent approved by the Project Manager.

Trucks. Remove trucks from service that leak fluids. When directed, cover each load with canvas or other approved material to protect the mix at Contractor expense. Do not use diesel fuel as a truck bed release agent. Use a commercially manufactured release agent approved by the Project Manager.

Rollers. Use non-vibrating, flat, smooth steel wheeled, self-propelled rollers weighing between 175 and 225 pounds per linear inch (79.5 to 102 kg per 25 mm) of rolling width per drum. Use lighter rollers if aggregate breakage occurs.

Traffic Control. Establish traffic control meeting the approved traffic control plan and Section 618.

Paving dates and Weather Limitations. Stop plant mix paving when the surface temperature is less than 60˚F (16˚C); the surface is wet; the roadbed is unstable or the Project Manager determines adverse weather conditions prevent the proper handling, finishing, or compacting of the mix. Place plant mix seal course during daylight hours. Do not place plant mix seal course from October 1 through May 15 of the following year.

The Project Manager may suspend paving due to weather considered detrimental to the work.

Preparation of Existing Surface. Ensure that existing surfacing is structurally sound with minimum cracks, ruts, bleeding, and depressions. Complete all required patching, leveling, and crack filling before placing the plant mix seal course.

Clean loose and defective material from holes and depressions to sound pavement. Coat the surface with an approved bituminous material tack coat, and fill with a hot-mix asphalt patching material. Compact areas to produce a tight, smooth surface matching the adjacent pavement area.

Apply a thin coat of bituminous material to the contact surfaces of curbing, gutters, manholes, and other structure surfaces before placing plant mix seal course.

Remove all dust, dirt, and foreign matter on the roadway before applying the first application of bituminous material.

Tack Coat. Apply a coat of emulsified asphalt meeting the applicable requirements of Section 407 before placing plant mix seal course. Dilute with water at a rate of 1:1 and apply at a rate of 0.20 to 0.30 gallons per square yard (0.90 to 1.35 L per square meter).

If the tack coat is applied too heavily, apply blotter material consisting of crusher reject natural fines as directed. Blotter is not measured and paid for; all costs are the responsibility of the contractor.

Apply tack coat in one or more passes, as necessary to prevent running.

Dumping. The plant mix seal course mixture may be dumped directly into the paver or windrowed onto the pavement ahead of the paver.

Spreading and Finishing. Place and spread the mix to the widest practical width on the approved surface placing joints as specified in requirement q) below.

Establish and maintain line control for paving. The Project Manager will furnish the contractor the necessary information to establish these controls. Maintain the paving control line tolerance within 0.25 foot (75 millimeters) of a true line from the existing reference points.

Failure to maintain the paver control line within the specified tolerance is cause for corrective action or pavement removal and replacement, as directed by the Project Manager, at Contractor expense.

Include the cost of furnishing horizontal line control in the plant mix pavement bid item.

On small or irregular areas, approaches, turnouts, around manholes, inlets, walls, and on other areas not readily accessible to a paver, plant mix may be spread to the specified thickness using a specialty paver or other approved methods. Compact these areas as directed.

Remove and replace all plant mix seal course that is segregated, loose, broken, contaminated, damaged, or otherwise defective at Contractor expense. Small patches may be performed using a dense graded asphalt mix. Larger areas are replaced with plant mix seal course.

Remove any plant mix dropped from equipment onto any existing or new plant mix surfacing as directed by the Project Manager.

Rolling. Roll the plant mix seal course with two complete coverages done by a static steel wheel roller. A complete coverage is defined as a roller pass forward and back within a given area. Operate rollers to prevent shoving, distortion, break rocks, or stripping under the roller.

Joints. Joints should be butted rather than lapped. Place longitudinal joints on the shoulder or at the edge of travel lanes.

Surface Tolerances. Finish the surface meeting Subsection 401.03.23(B) requirements.

Method of Measurement

Plant Mix Seal Course. Plant mix seal course is measured by the ton (metric ton) on approved scales after complete mixing of all ingredients. The pay weight includes the asphalt cement and hydrated lime in the mixture.

Asphalt Cement. Asphalt Cement is measured by the ton (metric ton) as specified to the nearest whole ton (metric ton), under Subsection 402.04.

Hydrated Lime. Hydrated lime is measured by the ton (metric ton) meeting Subsection 109.01. Hydrated lime exceeding 1.6 percent by total weight of mix is not measured for payment as hydrated lime.

Tack Coat. Tack coat is considered incidental to Plant Mix Seal Course and is not measured for payment.

Basis of Payment. Payment for the completed and accepted quantities is measure under the following:

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| --- | --- |
| Pay Item | Pay Unit |
| Plant Mix Seal Course | Ton (metric ton) |
| Asphalt Cement | Ton (metric ton) |
| Hydrated Lime | Ton (metric ton) |

Payment at the contract unit price is full compensation for all resources necessary to complete the item of work under the contract. Cleaning the roadway surface before placing the plant mix seal course is included in cost of Plant Mix Seal Course.