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**ASPHALT PAVING SURFACE TREATMENT: Chip Seal (Single Bituminous Surface Treatment)**

|  |  |  |
| --- | --- | --- |
| **SECTION USAGE MATRIX** | | |
| C | NA | Seminary and Small Institute Standard Plan (CHURCH EDUCATION SYSTEM) - New Project |
| SM | NA | Standard MEETINGHOUSE and PHASED MEETINGHOUSE Standard Plan - New Project |
| R | SUP | OM/RI (REPLACEMENT & IMPROVEMENT) for Existing Meetinghouse / Seminary and Institute Project |
| CM | NA | Meetinghouse and Phased Meetinghouse Standard Plan with S&I MODULE ADDITION - New Project |
| SI | NA | S&I MODULE Addition to Existing Meetinghouse Building |
| MO | NA | MISSION OFFICE MODULE Addition to Existing Meetinghouse Building |
| UM | NA | URBAN MEETINGHOUSE for Custom Meetinghouse - New or Addition Project |
| FM | NA | Small Maintenance Project specification for FACILITY MANAGER |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **MODIFICATION LOG** | | |
| DATE | SOURCE | DESCRIPTION |
| 26 Apr 24 | Mike Molyneux | Reference Standards Updated. |
| 19 Feb 19 | Gail Olsen | Reference Standards Updated. |
| 19 Jul 16 | Chris Barker | Cleaning requirements updated in Surface Preparation in Part 3. |
| 27 Oct 15 | Chris Barker | Procedural Note, Definitions and Pre-Installation changes. Reference Standards Updated. |
| 19 May 14 | Chris Barker | Procedural Note Updated. |
| 25 Apr 14 | Chris Barker | General Upgrade. |
| 27 Nov 13 | Chris Barker | Asphalt Maintenance Checklists and Guideline Attachments eliminated and moved to AEC Webpage. General Upgrade. |
| 05 Nov 12 | Chris Barker | General Upgrade. |
| 24 Sep 12 | Chris Barkier | Asphalt Maintenance Checklists added as Attachment. Changed Procedural Note. |
| 02 Jul 12 | Chris Barker | Updated Pre-Installation Conferences. Updated Reference Standards. |
| 10 Feb 12 | Chris Barker | Updated requirements for Tack Coat and Paint Stripes. General Upgrade. |
| 09 Sep 11 | Gail Olsen | New Section Added. |

|  |
| --- |
| PROCEDURAL NOTES |
| COORDINATION GENERAL:   1. This Specification is written for small Maintenance Projects that use Division 01 Maintenance Project Specification instead of full Division 01 Specification. 2. Chip seal is to be used only with approval of Regional Facilities Manager (RFM). 3. Refer to 'Asphalt, Site Concrete and Pervious Concrete Maintenance Guidelines’ for preservation maintenance program and recommendations for each asphalt paving surface treatment at <http://aec.churchofjesuschrist.org/aec/design_guidelines/>. 4. Refer to *'Asphalt Maintenance Checklists for Facilities Manager and Contractor’* available at <http://aec.churchofjesuschrist.org/aec/design_guidelines> for project checklists. 5. Use the '*Agreement for Asphalt Maintenance'* available on MFD Resource Library for asphalt maintenance scoping, budgeting and for contracts. 6. Applicators: 7. By requiring mechanical application and information about prior Projects, this specification is intended to limit bidding to top, professional applicators and products available in Project area. 8. If Project is in remote area or for some other reason contractors of level required to meet specification requirements are not available, Section should be edited to specify requirements which can be met by top applicators available in Project Area. 9. This relaxation of standard requirements should be done with prior approval of Owner’s Representative. |
| **DESIGN INFORMATION AND BACKGROUND** |

SECTION 32 0113

ASPHALT PAVING SURFACE TREATMENT: Chip Seal (Single Bituminous Surface Treatment)

1. GENERAL
   * + 1. SUMMARY
          1. Includes But Not Limited To:

Furnish and install materials for applying emulsified asphalt, followed with application of cover material and bituminous fog seal (flush coat) on existing asphaltic concrete paving as described in Contract Documents.

* + - * 1. Related Requirements:

Section 01 0000: ‘General Requirements’:

Section 01 3100: ‘Project Management and Coordination’ for pre-installation conference.

Section 01 4000: ‘Quality Requirements’ for administrative and procedural requirements for quality assurance and quality control.

Section 01 4301: ‘Quality Assurance – Qualifications’ establishes minimum qualification levels required.

Section 01 7800: ‘Closeout Submittals’.

Section 32 0117.01: ‘Asphalt Paving Crack Seal’ for completion of crack repair.

Section 32 0117.02: ‘Asphalt Paving Crack Fill’ for completion of crack repair.

Section 32 0118: ‘Asphalt Paving Repair – Full Depth Patch’.

**EDIT REQUIRED:** Include following paragraph if included in Project.

Section 32 1713: 'Parking Bumpers'.

**EDIT REQUIRED:** Include following paragraph if included in Project.

Section 32 1723: 'Pavement Markings'.

* + - 1. REFERENCES
         1. Association Publications:

Asphalt Institute:

MS-4, ‘*The Asphalt Handbook’* (Seventh Edition).

MS-16, ‘*Asphalt in Pavement Preservation and Maintenance’* (Fourth Edition).

Asphalt Emulsion Manufacturers Association:

MS-19, ‘*Basic Asphalt Emulsion Manual’* (Fourth Edition). ).

International Slurry Surfacing Association (ISSA):

ISSA A165, ‘Recommended Performance Guideline For Chip Seal (November 2012).

* + - * 1. Definitions:

Aggregate: Granular material usually crushed and screened to appropriate gradations, which is used as cover stone in surface treatment.

Angular Aggregate: Aggregate possessing well defined edges at intersection of roughly planar faces.

Coarse Aggregate: Aggregate retained on or above 4.75 mm (No. 4) sieve.

Coarse-Graded Aggregate: Aggregate having predominance of coarse sizes.

Dense-Graded Aggregate: Aggregate having particle size distribution such that voids occupy relatively small percentage of total volume.

Fine Aggregate: Aggregate passing 4.75 mm (No. 4) sieve.

Fine-Graded Aggregate: Aggregate havin predominance of fine sizes.

Mineral Filler: Fine mineral product at least 70 percent of which passes 75 µm (No. 200) sieve.

Open-Graded / Gap-Graded Aggregate: Aggregate having particle size distribution such that voids occupy relatively large percentage of total volume.

Well-Graded Aggregate: Aggregate having an even distribution of particle sizes.

Asphalt Binder: Commonly referred to as asphalt cement, pure asphalt binders are graded based on viscosity and penetration.

Binder: Bituminous material that provides waterproof seal and also bonds cover stone to pavement.

Bitumen Emulsion Classification and Naming of Emulsions (as per ASTM D977 and ASTM D2397/D2397M):

Classification:

Anionic Emulsions: Emulsions with negatively charged droplets.

Cationic Emulsions: Emulsions with positive charged droplets.

Rapid-Setting (RS): Emulsions set quickly in contact with clean aggregates of low-surface area such as chippings used in chip seals (surface dressings):

Medium-Setting (MS): Emulsions set sufficiently less quickly that they can be mixed with aggregates of low surface area, such as those used in open-graded mixes.

Slow-Setting (SS): Emulsions will mix with reactive aggregates of high surface area.

Quick Setting (QS): Emulsions in reactivity between MS and SS, which do not need to pass cement mix test, and are used primarily in quick-set slurry surfacing applications.

Naming:

Rapid Setting:

Anionic: RS.

Cationic: CRS.

Medium-Setting:

Anionic: MS.

Cationic: CMS.

Slow-Setting:

Anionic: SS.

Cationic: CSS.

Quick Setting:

Anionic: QS.

Cationic: CQS.

Local authorities have many other naming schemes:

State DOT, letters such as HF may indicate high float, LM may indicate latex-modified, and P may indicate polymer-modified.

Bleeding: Upward movement of asphalt through chip seal. Bleeding, also commonly referred to as flushing, can be identified by dark patches of asphalt forming on surface, most commonly in wheel paths or intersections.

Blotter: Fine aggregate used to spread on flushed/bleeding chip seals as emergency repair measure to restore skid resistance.

Cape Seal: Chip seal followed by slurry seal that fill voids in surface of cover aggregate. Slurry seal increases aggregate retention and reduces tire noise.

Chip Seal: Bituminous surface treatment that can be single, double, or triple application of bituminous binder and cover aggregate on existing paved surface.

Chip Spreader: Also referred to as spreader box or aggregate spreader, machine that evenly applies aggregate to binder. Self-propelled spreaders with computerized rate controls are preferred.

Crumb Rubber: Modifier that can be blended into bitumen to enhance elasticity and adhesion characteristics of binder. Rubberized asphalt chip seals are successful at mitigating reflective cracking, improving aggregate retention, and reducing noise.

Distributor: Insulated tank with circulating and heating system that is mounted on truck and distributes binder through spray bar at rear. It is critical for distributor to apply binder at constant rate and to correct width. Distributors with computerized rate controls are desirable.

Embedment: Measured percentage of portion of aggregate enveloped by binder. Embedment checks are visual inspection of chip seal construction, with typical recommendations of at least 70 percent embedment.

Emulsified Binder: Liquid mixture of asphalt binder, water, and emulsifying agent. Emulsions are either anionic (negatively charged) or cationic (positively charged). Emulsions are not as sensitive to moisture, inherently contain antistripping agents, and require much lower application temperatures than do asphalt cements.

Emulsion Break: Point in time, shortly after application of emulsified binder, when emulsifying agent and water evaporate from asphalt cement, leaving behind asphalt cement that bonds aggregate particles to binder. “Breaking” emulsion can be observed when binder changes color from brown to black.

Flakiness: General description of shape of aggregate. Flakiness index can be used to determine how cubical aggregate used in chip seal is. Lower flakiness index indicates more cubical aggregate and better aggregate shape for chip seal.

Flush Coat: See Fog Seal.

Flushing: See Bleeding.

Fog Seal: Application of asphalt applied on top of pavement surface. Fog seals are commonly used on oxidized pavements to provide resistance to water intrusion and raveling. Fog seals are also used on newly constructed chip seals to promote adhesion and enhance aggregate retention.

Hunger Factor: Kearby chip seal design terminology to describe existing surface’s potential to absorb binder and thereby require adjustment in design binder application rate to ensure that either sufficient binder is applied to achieve desired embedment when surface is oxidized or that too much binder is not applied if surface is flushed.

Modified Binder: Binder modifiers that include polymers, latex, rubber crumb, and antistripping agents. Modifiers have proven successful at enhancing flexibility, minimizing bleeding, increasing aggregate retention, and extending service life of chip seals.

Pneumatic Roller: Pneumatic rollers have inflated tires that provide required forces to properly orient cover aggregate. Also referred to as rubber-tired roller.

Pocked: Condition in which surface of chip seal has lost aggregate in numerous localized areas.

Polymer-Modified Binders (PMBs): Polymer modification of binders reduces binder’s temperature susceptibility, provides increased adhesion characteristics, and increases overall flexibility of chip seal. Common polymers used are latex and crumb rubber.

Raveling: Commonly referred to as shelling, it is loss of aggregate from surface treatment. Low binder application rates, inadequate rolling, cool weather construction, and incompatible binder and aggregate types are common factors that lead to raveling.

Sand Seal: Application of binder followed by sand cover aggregate.

Sandwich Seal: Two-course surface treatment where aggregate is spread on existing binder rich surface, before application of single-course surface treatment.

Seal Coat: Bituminous surface treatment that is single application of bituminous binder and cover aggregate on existing paved surface. Seal coat is essentially single course chip seal.

Seal Coat: Thin surface treatment used to improve surface texture and protect asphalt surface. Main types of surface treatments are asphalt based emulsion seals, cape seals, chip seals, fog seals, micro surfacing, penetrating seals, refined coal tar emulsion seals, sand seals, sandwich seals and slurry seals. This specification is essentially for single course chip seal.

Shelling: See Raveling.

Streaking: Aesthetic and construction defect caused by non-uniform application of binder across the lane width. Streaking leads to considerable shortening of life expectancy of chip seal.

Stripping: Separation of binder from aggregate. See Raveling.

Surface Enrichment: Light application of bituminous material, without use of cover aggregate, to existing chip sealed surface to increase binder content of the seal. Essentially same as fog seal, surface enrichment can assist with aggregate retention on seals with insufficient binder.

Surface Treatment: Surface treatment, commonly referred to as bituminous surface treatment or asphalt surface treatment. It is an application of asphalt binder and cover aggregate on prepared gravel or crushed stone base.

Tack Coat: Very light application of liquid asphalt, cutback asphalt, or asphalt emulsion diluted with water applied to highly oxidized or weathered asphalt surfaces.

Void: Space between aggregate particles after they have been spread on road’s surface that is filled with binder.

Wheelpaths: Longitudinal areas of pavement’s surface where greatest proportion of vehicle tires track. Wheelpaths are particularly sensitive owing to bleeding and flushing when application rates are not strictly adhered to, or when flaky or elongated aggregate has been used.

* + - * 1. Reference Standards:

American Association of State and Highway Transportation Officials:

AASHTO M 6-13(2018), ‘Standard Specification for Fine Aggregate for Hydraulic Cement Concrete’.

AASHTO M 226-80 (2017), ‘Standard Specification for Viscosity Graded Asphalt Cement’.

AASHTO T 11-05 (2020), ‘Standard Method of Test for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing’ (ASTM C117).

AASHTO T 19M/T 19-14(2018), ‘Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregate’ (ASTM C29/C29M).

AASHTO D6683-19, ‘Standard Method of Test for Bulk Density (“Unit Weight”) and Voids in Aggregates’ (ASTM C136/C136M).

AASHTO T 50-14(2018), ‘Standard Method of Test for Float Test for Bituminous Materials’.

AASHTO D244-09(2017), ‘Standard Test Methods for Emulsified Asphalts’.

AASHTO T 90-20, ‘Standard Test Methods for Determining the Plastic Limit and Plasticity Index of Soils’.

AASHTO T 96-22, ‘Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’ (ASTM C131/C131M).

AASHTO T 104-99 (2016), ‘Standard Method of Test for Soundess of Aggregate by use of Sodium Sulfate or Magnesium Sulfate’.

AASHTO T 278-90 (2017), ‘Surface Frictional Properties Using the British Pendulum Tester’ (ASTM E303).

AASHTO T 279-18, ‘Accelerated Polishing of Aggregates Using the British Wheel’ (ASTM D3319).

AASHTO T 335-09 (2018), ‘Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate’.

ASTM International:

ASTM C29/C29M-17a, ‘Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate’.

ASTM C88-18, ‘Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate’.

ASTM C117-17, ‘Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing’.

ASTM C131/C131M-20, ‘Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’.

ASTM C136/C136M-19, ‘Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates’.

ASTM C142/C142M-17, ‘Standard Test Method for Clay Lumps and Friable Particles in Aggregates’.

ASTM D139-16, ‘Standard Test Method for Float Test for Bituminous Materials’.

ASTM D244-23, ‘Standard Test Methods and Practices for Emulsified Asphalts’.

ASTM D977-20, 'Standard Specification for Emulsified Asphalt’.

ASTM D2170/D2170M-10, ‘Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)’.

ASTM D2397/D2397M-20, 'Standard Specification for Cationic Emulsified Asphalt’.

ASTM D3319-11(2017), ‘Standard Practice for Accelerated Polishing of Aggregates Using the British Wheel’.

ASTM D3381/D3381M-18, ‘Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction’.

ASTM D3628-15(2021), ‘Standard Practice for Selection and Use of Emulsified Asphalts’.

ASTM D4318-17, ‘Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils’.

ASTM D4791-19(2023), ‘Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate’.

ASTM D5821-13(2017), ‘Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate’.

ASTM E303-22, ‘Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester’.

California Cleanness Test:

California Test 227, ‘Method of Test for Evaluating Cleanness of Coarse Aggregate’ (Caltrans Test 227).

Texas Asphalt Pavement Association:

Tex-217-F Part I, ‘Determining Deleterious Material and Decantation Test for Coarse Aggregates’.

Utah Department of Transportation (UDOT):

Manual of Instruction Part 8:

MOI 8-933 (2004), ‘Method for Determining Aggregate Flakiness Index’.

MOI 8-945 (2002), ‘Dynamic Stripping Test of Asphalt Material Aggregate Mixture’.

* + - 1. ADMINISTRATIVE REQUIREMENTS

**INFORMATION:** This conference is mandatory. Do not delete or cancel. See Section 01 3100 PROJECT MANAGEMENT AND COORDINATION.

* + - * 1. Pre-Installation Conferences:

Participate in pre-installation conference as specified in Section 01 3100:

**EDIT REQUIRED:** Include following paragraph if other related sections are used in Project. Include only section(s) used for Project. Delete sections not used.

Schedule emulsion seal pre-installation conference to be held jointly with any other 'Asphalt Surface Treatment' sections involving asphalt maintenance:

Section 32 0117.01: 'Asphalt Paving Crack Seal'.

Section 32 0117.02: 'Asphalt Paving Crack Fill'.

Section 32 0118.00: 'Asphalt Paving Repair - Full Depth Patch'.

In addition to agenda items specified in Section 01 3100, review following:

Review crack repair schedule and verify that other repairs will be completed before application of chip seal.

Review asphalt chip seal schedule.

Review asphalt chip seal mix design.

Review asphalt chip seal surface preparation requirements.

Review asphalt chip seal application requirements.

Review asphalt chip seal field quality control requirements.

Review safety issues.

* + - * 1. Scheduling:

Provide to Owner’s Representative at least seven (7) days before chip seal placement commences, approved Laboratory Report and Manufacturer’s Certificate of compliance covering specific materials to be used on this project.

* + - 1. SUBMITTALS
         1. Informational Submittals:

Design Data Submittals:

Mix Design:

Type and grade of asphalt binder to be used.

Aggregate gradation.

Asphalt/aggregate compatibility.

List of asphalt additives.

Test And Evaluation Reports:

Aggregate:

Provide test results indicating cover material meets specified requirements.

Asphalt binder:

Provide certified test reports for each shipment of asphalt binder.

Fog seal (flush coat):

Provide certified test reports for each shipment of fog seal (flush coat).

Special Procedure Submittals:

Submit list of construction equipment to be used.

Qualification Statement:

Installer:

Provide Qualification documentation if requested by Owner's Representative.

* + - * 1. Closeout Submittals:

Include following in Operations And Maintenance Manual specified in Section 01 7800:

Record Documentation:

Manufacturer’s documentation:

Aggregate:

1. Amount of aggregate used.

Asphalt binder:

1. Amount of asphalt binder used.

Fog seal (flush coat):

1. Amount of asphalt fog seal used.
   * + 1. QUALITY ASSURANCE
          1. Qualifications: Requirements of Section 01 4301 applies but not limited to following:

Installer:

Minimum five (5) years experience in asphalt surface treatment installations.

Minimum five (5) years satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding:

Upon request, submit documentation.

* + - 1. FIELD CONDITIONS
         1. Ambient Conditions:

Chip Seal:

Do not apply during wind of sufficient force to blow sand, dust, or other foreign matter into asphalt binder prior to application of aggregate.

Asphalt Binder and Aggregate:

Apply when shade temperature is at least 70 deg F (21 deg C) and rising.

Do not apply if pavement or ambient temperature is below 70 deg F (21 deg C.

Do not apply when pavement temperature exceeds 120 deg F (49 deg C).

Do not apply after 6 pm if temperatures can not be maintained throughout all night time hours.

Do not apply over wet pavement or when precipitation is imminent.

Fog seal (flush coat):

Apply when shade temperature is at least 50 deg F (10 deg C) and rising.

Do not apply over wet aggregate.

Allow four (4) weeks of warm weather cure time.

Limitations: This generally limits performance of work from May15 to August 31.

1. PRODUCTS
   * + 1. MANUFACTURERS
          1. Manufacturers:

Type One Acceptable Manufacturers and Products:

Meet following requirements:

Manufacturers whose products meet requirements including Design Criteria of this Section.

Equal as approved by Owner’s Representative before bidding. See Section 01 6200.

* + - 1. DESIGN CRITERIA
         1. Paving Asphalt:

Cationic or anionic emulsion.

Additives - Use any of following additives to match aggregate particle charge, weather conditions and mix design:

Anti-strip: To change or neutralize particle charges.

Enhancer: To promote greater film thickness on aggregate.

High float Agent: To improve temperature susceptibility of asphalt and impart get structure to asphalt.

Polymer: To reduce stripping, improve coating, decrease temperature susceptibility and increase stability of mix.

Rejuvenator: To adjust penetration of base asphalt or soften reclaimed asphalt.

* + - * 1. Mix Design:

Select type and grade of emulsified asphalt as per ASTM D3628.

* + - * 1. Quantities of Asphalt Binder and Aggregate for Single Surface Treatment:

Aggregate Size Requirements:

Quantities of asphalt binder cover average range of conditions that include primed granular bases and old pavement surfaces. Quantities and types of materials may be varied according to local condition and experience.

Lower application rates of asphalt binder listed in Aggregate Size Table should be used for aggregate gradations on fine side of specified limits.

It is important to adjust asphalt binder quantity for surface condition of road, increasing if road is absorbent, badly cracked, or raveled, and decreasing if road is flushed with asphalt.

It is important to adjust asphalt binder quantity for traffic count and conditions. Increase in traffic will mean a decrease in asphalt binder content.

Aggregate quantities are based on a specific gravity of 2.65. If aggregate specific gravity is outside of range 2.55 – 2.75, adjustments should be made by Engineer.

Aggregate is to be hot, clean and free of dust. If asphalt cement is used, aggregates are to be dry. If asphalt emulsions are used, aggregates are to be slightly damp.

**EDIT REQUIRED**: Select **ONE** of following **FOUR** Options as selected by Owner’s Representative. **OPTION TWO** is default **Option.**

**OPTION ONE**: Include followingparagraph if Option **ONE** is included on Project.

Aggregate Size Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AGGREGATE SIZE** | | | | |
| Nominal Aggregate Size | Size No. | Aggregate Quantity lb/yd2 (l/m2) | Asphalt Binder Quantity gal/yd2 (l/m2) | Asphalt Binder Grade |
| 1/2 inch to No. 4  (12.5 to 4.75 mm) | 7 | 25 – 30  (14 – 16) | 0.30 – 0.45  (1.4 – 2.0) | RS-2, CRS-2,  CRS-2P, CRS-2L, HFRS-2, PG |

**OPTION TWO**: Include followingparagraph if Option **TWO** is included on Project. (**Default Option**)

Aggregate Size Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AGGREGATE SIZE** | | | | |
| Nominal Aggregate Size | Size No. | Aggregate Quantity lb/yd2 (l/m2) | Asphalt Binder Quantity gal/yd2 (l/m2) | Asphalt Binder Grade |
| 3/8 inch to No. 8  (9.5 to 2.38 mm) | 8 | 20 – 25  (11 – 14) | 0.20 – 0.35  (0.9 – 1.6) | RS-2, CRS-2,  CRS-2P, CRS-2L, HFRS-2, PG |

**OPTION THREE**: Include followingparagraph if Option **THREE** is included on Project.

Aggregate Size Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AGGREGATE SIZE** | | | | |
| Nominal Aggregate Size | Size No. | Aggregate Quantity lb/yd2 (l/m2) | Asphalt Binder Quantity gal/yd2 (l/m2) | Asphalt Binder Grade |
| No. 4 to No. 16  (4.75 to 1.18 mm) | 9 | 15 – 20  (8 – 11) | 0.15 – 0.20  (0.7 – 0.9) | RS-1, MS-1, CRS-1, HFRS-1, PG |

**OPTION FOUR**: Include followingparagraph if Option **FOUR** is included on Project.

Aggregate Size Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AGGREGATE SIZE** | | | | |
| Nominal Aggregate Size | Size No. | Aggregate Quantity lb/yd2 (l/m2) | Asphalt Binder Quantity gal/yd2 (l/m2) | Asphalt Binder Grade |
| Sand | AASHTO M 6 | 10 – 15  (5 – 8) | 0.10 – 0.15  (0.5 – 0.7) | RS-1, MS-1, CRS-1, HFRS-1, PG |

* + - * 1. Aggregate Property Requirements:

Aggregate Property Requirement Table:

|  |  |  |
| --- | --- | --- |
| **AGGREGATE PROPERTY REQUIREMENT** | | |
| Description | Standard Test | Remarks |
| Unit Weight | AASHTO T 19M/T 19  ASTM C29/C29M | 100 lbs/ft3 (1600 kg/m3) minimum |
| Angularity  (One Fractured Face) | AASHTO T 335  ASTM D5821 | 95 percent minimum |
| Angularity  (Two Fractured Face) | AASHTO T 335  ASTM D5821 | 60 percent minimum |
| Hardness (toughness) | AASHTO T 96  ASTM C131/C131M | 30 percent minimum |
| Weight Loss (soundness) | AASHTO T 104  ASTM C88 | 12 percent maximum using NA2SO4  18 percent maximum using MgSO4 |
| Flat or Elongated Particles | ASTM D4791 | 10 percent maximum of a 3:1 ration for material retained above 3/8 inch sieve |
| Friable Particles | ASTM C142/C142M | 3 percent maximum by weight of aggregate passing No. 4 sieve |
| Stripping | UDOT Materials  MOI 8-945 | 10 percent maximum |
| Polishing | AASHTO T 278 & T 279  ASTM D3319 | 31 minute minimum |

* + - * 1. Aggregate Gradation Requirements:

Gradation:

Comply with ASTM C136/C136M. Graded by dry weight on percent passing basis. Gradation must not vary from high limit on one screen to low on next.

**EDIT REQUIRED**: Owner’s Representative to select Grade to be used on Project.

Aggregate Gradation Requirement Table:

|  |  |  |  |
| --- | --- | --- | --- |
| **ASPHALT GRADATION REQUIREMENTS** | | | |
| Sieve | Grade A | Grade B | Grade C |
| 1/2 inch | 100 percent | 100 percent | 100 percent |
| 3/8 inch | 85-100 percent | 100 percent | 70-90 percent |
| No. 4 | 0-20 percent | 100 percent | 0-5 percent |
| No. 8 | 0-5 percent | 85-100 percent | 0-3 percent |
| No. 16 |  | 10-25 percent |  |
| No. 50 |  | 0-5 percent |  |
| No. 200 | 0-1 percent | 0-2 percent | 0-2 percent |
| Notes:   * 1. Portion retained on No.4 sieve clean and free of clay coatings.   2. Portion passing No. 200 includes mineral filler, ASTM C117 | | | |

* + - * 1. Asphalt Content Adjustment:

Asphalt Content Adjustment for Surface Conditions (Hunger Factor) Table:

|  |  |  |
| --- | --- | --- |
| **ASPHALT CONTENT ADJUSTMENT FOR SURFACE CONDITIONS (Hunger Factor)** | | |
| Pavement Texture | Correction (gal/yd2)1 | Correction (l/m2)1 |
| Black, flushed asphalt | -0.01 to -0.06 | -0.04 to -0.27 |
| Smooth, non-porous | 0.00 | 0.00 |
| Absorbent – slightly porous, oxidized | 0.03 | 0.14 |
| Absorbent – slightly raveled, porous, oxidized | 0.08 | 0.27 |
| Absorbent – badly raveled, porous, oxidized | 0.09 | 0.40 |

1This correction must be made from observation at job site.

* + - * 1. Fog Seal (Flush Coat):

Emulsified Asphalt SS-1, SS-1h, CSS-1, or CSS-1h diluted two parts concentrate to one part water.

* + - 1. SOURCE QUALITY CONTROL
         1. Quality Control Tests:

Quality Control Tests for Chip Seal Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **QUALITY CONTROL TESTS FOR CHIP SEALS** | | | | |
| Name of Test | | Property Measures | Standard Test | |
| Manufacturing Control | | | | |
|  | Sieve analysis | Graduation | AASHTO T 27 | ASTM C136/C136M |
|  | Cleanness value | Fine materials | California Test 227 | |
|  | No. 200 washed sieve | Fine materials | AASHTO T 11 | ASTM C117 |
|  | Foreign materials | Clay and friable particles | AASHTO  T 19M/T 19 | ASTM C29/C29M |
|  | Decantation | Dust | Tex-217-F, Part 1 | |
|  | Plasticity index | Deleterious material | AASHTO T 90 | ASTM D4318 |
| Aggregate Soundness | | | | |
|  | Los Angeles abrasion | Abrasion resistance | AASHTO T 96 | ASTM C131/C131M |
|  | British pendulum test | Skid resistance | AASHTO T 278 | ASTM E303 |
|  | British wheel | Polishing | AASHTO T 279 | ASTM D3319 |
|  | Sodium sulfate loss | Freeze–thaw degradation | AASHTO T 104 | ASTM C88 |
|  | Magnesium sulfate loss | Freeze–thaw degradation | AASHTO T 104 | ASTM C88 |
| Aggregate Shape | | | | |
|  | Percent fracture | Roundness | AASHTO T 335 | ASTM D5821 |
|  | Flakiness index | Flatness/elongation |  | ASTM D4791 |
| Asphalt Binder | | | | |
|  | Emulsion penetration | Penetration | AASHTO T 59 | ASTM D244 |
|  | Emulsion viscosity | Saybolt viscosity | AASHTO T 59 | ASTM D244 |
|  | Emulsion sieve test | Gradation | AASHTO T 59 | ASTM D244 |
|  | Asphalt cements | Penetration | AASHTO M 226 | ASTM D3381/D3381M |
|  | Float test | Drain-off, high float | AASHTO M 50 | ASTM D139 |

1. EXECUTION
   * + 1. PREPARATION
          1. Owner Responsibilities:

Remove Scout Trailer(s) if needed.

* + - * 1. Protection Of In-Place Conditions:

Chip Seal:

Protect all structures and surrounding private property during preparation and application.

Protect sign posts, street lamp posts, trees, shrubs, ground cover, and tops of curbs and gutters from being discolored by splashing asphaltic material.

Cover manholes, valve boxes, drip inlets, and other service utility entrances before placing any chip seal.

* + - * 1. Surface Preparation:

General:

Significant deficiencies in pavement surface must be repaired before applying chip seal.

Repair cracks, repair raveled areas, patch potholes and repair base and subgrades, repair ruts and uneven areas, and repair damaged areas in existing paving prior to installing chip seal.

For asphalt paving crack seal, see Section 32 0117.01.

For asphalt paving crack fill, see Section 32 0117.02.

For asphalt paving, full depth patch, see Section 32 0118.

Curing of repair areas:

As schedule permits, apply crack seal or crack fill three (3) months before placing chip seal on newly sealed or filled surfaces to allow for proper curing of material.

As schedule permits, apply full depth patch six (6) months before placing chip seal on newly patched surfaces to allow for proper curing of material.

Paint Stripes:

Remove existing paint stripes and markings.

Stripes and markings using thermoplastics must be removed.

Grease or Oil Patches:

Remove grease or oil patches, and spillage of any material that has adhered to pavement. Do not place seal over unsound oil spots softened by fuel or oil.

Clean oil spots and treat with oil spot primer.

Seal areas damaged by oil or grease with oil spot primer compatible with seal being used in accordance with Manufacturer’s recommendations.

Cleaning:

Remove all debris, dirt, dust, leaves, loose material, moisture, mud spots, sand, silt spots, vegetation (including moss), water and other objectionable and foreign material from existing surface prior to placing tack coat. In areas where moss is prevalent, apply pre-herbicide.

Power brooms, power blowers, air compressors, vacuum sweepers, rotary brooms, water flushing equipment, and blowers, or by another approved method.

In event of objectionable material firmly packed on to asphalt surface that cannot be removed by initial brooming operation, scrape surface until good asphalt surface is exposed.

Dispose of removed material.

Additional broom work shall be used as necessary.

If water is used to clean surface, allow water to evaporate prior to installing chip seal.

Tack Coat (if required by pavement conditions):

Same type of asphalt binder used in chip seal is to be used for tack coat.

Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surface or to concrete or brick surfaces.

Follow chip seal Manufacturer's recommendations for substrate preparation and application of tack coat to substrate.

* + - 1. APPLICATION
         1. Asphalt:

Apply asphalt binder using power driven machine that continually mixes sealer and water and applies asphalt material uniformly at specified rate and proper temperature.

Keep viscosity between 50 and 100 centistokes as per ASTM D2170/D2170M, during application.

Use distributor equipped with hydrostatic system and full circulating spray bar capable of maintaining tolerance of +/- 0.03 gal/yd2 (0.14 l/m2). Equipment is subject to inspection and approval by Owner’s Representative.

* + - * 1. Aggregate:

Apply aggregate evenly and in specified quantities using tailgate spreader, mechanical spreader, or mechanical, self-propelled spreader immediately, no more than ten (10) minutes, behind asphalt binder application to achieve maximum possible chip wetting.

Seat aggregate into asphalt binder using self-propelled pneumatic-rubber tire roller with tire pressures in range of 60 to 90 pounds per square inch (415 to 620 kilopascals) immediately after placing aggregate using three (3) passes minimum. Eight (8) ton minimum weight roller is to be used:

After rolling and evaporation, aggregate particles are to be embedded to a depth of 50 percent to 70 percent.

Asphalt See-Through: Not more than 15 percent black (asphalt) is to be seen through newly laid and compacted rock ship after sweeping.

After asphalt binder has set, cured and good bond has developed, remove excess aggregate by light brooming with rotary power broom.

Pickup surplus aggregate material along islands curbs and gutters.

* + - * 1. Blotting:

If any bleeding occurs, apply blend of 25 to 50 percent hydrated lime with sand (blotting material). Blotter material shall have 90 percent to 100 percent pass the No. 4 sieve (4.75 mm).

Provide suitable equipment to perform sanding, no payment for blotting will be made.

* + - * 1. Fog Seal (Flush Coat):

After removal of surplus cover material apply fog seal:

Use distributor equipped with hydrostatic system and full circulating spray bar capable of maintaining tolerance of +/- 0.03 gal/yd2 (0.14 l/m2). Equipment is subject to inspection and approval by the Owner's Representative.

Spray fog seal on aggregate at rate of 0.12 gal/yd2 (0.54 l/m2). Application rate applies to diluted fog seal material.

Apply within twenty four (24) hours of placing aggregate.

Keep viscosity between 50 and 100 centistokes as per ASTM D2170/D2170M, ring application.

* + - * 1. Tack Coat (if required by pavement conditions):

Apply tack coat as per Manufacturer’s recommendations:

Use one (1) part undiluted emulsion binder and three (3) parts water at rate of 0.05 to 0.10 gal per sq yd (0.23 to 0.45 L per sq m).

* + - * 1. Paint Stripes:

Apply paint stripes after chip seal has been applied and cured.

* + - 1. FIELD QUALITY CONTROL
         1. Non-Conforming Work:

Non-conforming work as covered in the General Conditions applies, but is not limited to the following at no additional cost to the Owner:

Remove spatter or mar from curb, gutter, and sidewalk.

Remove any product found defective after installation and install acceptable product.

Fill any joints or cracks that are not covered by chip seal coat. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate underlying pavement.

Repair collateral damage caused by Work of this Section.

* + - 1. PROTECTION
         1. Keep traffic off at least four (4) hours or until moisture leaves aggregate and asphalt binder sets. Time until final setting varies with weather conditions.

END OF SECTION