

# Emulsion Chip Seal Quality Assurance Guide

## ***Description: Chip Seal***

Emulsion Chip Seal is an application of an emulsified asphalt binder covered with an application of clean graded aggregate to an existing asphalt surface. The emulsified asphalt binders may be modified with various polymers such as latex, tire and natural rubbers. Aggregate must be durable consisting of crushed stone, gravels, or manufactured aggregates varying in size from  $\frac{5}{8}$  inch to a minimum of  $\frac{1}{4}$  inch.

## ***Quality Assurance (QA)***

AASHTO R 10 provides standard definitions for terms used in quality assurance procedures.

QA is defined as all those planned and systematic actions taken by the Agency and Contractor to provide the necessary confidence that the procured material and workmanship will satisfy the quality requirements of the contract.

QA includes Quality Control (QC), Acceptance and Independent Assurance (IA).

QC is the system used by the Contractor to monitor, assess and adjust production and placement processes to ensure that the material and workmanship will meet the specified quality. QC is the responsibility of the Contractor.

Acceptance is the system used by the Agency/ Engineer to measure the degree of compliance of the quality of the materials and workmanship with the Contract requirements. Acceptance is the responsibility of the Agency/Engineer and will be conducted in accordance with these Specifications.

IA is an unbiased and independent system used to assess all sampling, testing and inspection procedures used for QA. IA is the responsibility of the Agency/Engineer and is conducted in accordance with these Specifications.

### ***I. Quality Control (QC)***

- 1. General.** The chip seal contractor (the Contractor) shall establish, implement and maintain a QC program to control all equipment, materials, workmanship and processes during chip seal construction. The Contractor's QC program shall include preconstruction activities including chip seal design, site preparation, material handling and transportation, and stockpiling. The program shall include procedures required for

sampling, testing, inspection, monitoring, documentation, and corrective action procedures during transport, stockpiling, placement and finishing operations.

A written Quality Control Plan shall be developed which details the Contractor's QC program that meets the requirements of these specifications. The QC Plan shall be contract specific and signed by the Contractor's representative. Chip seal construction shall not proceed without Agency acceptance of the QC Plan and QC personnel present on the job. Failure to comply with the provisions of this provision will result in shutdown of the operation until such time as the Contractor's operation is complying.

## **2. Reference Documents**

- a. AASHTO R 10 Standard Practice for Definition of Terms Related to Quality and Statistics as Used in Highway Construction
- b. AASHTO R 18 Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- c. AASHTO R 38 Standard Practice for Quality Assurance of Standard Manufactured Materials
- d. AASHTO R 66 Standard Practice for Sampling Asphalt Materials
- e. AASHTO R 77 Standard Practice for Certifying Suppliers of Emulsified Asphalt
- f. AASHTO R 78 Standard Practice for Recovering Residue from Emulsified Asphalt Using Low-Temperature Evaporative Techniques
- g. AASHTO M 140 Standard Specification for Emulsified Asphalt
- h. AASHTO M 208 Standard Specification for Cationic Emulsified Asphalt
- i. AASHTO M 316 Standard Specification for Polymer-Modified Emulsified Asphalt
- j. AASTHO T 11 Standard Method of Test for Materials Finer Than 75-micro m (No. 200) Sieve in Mineral Aggregates by Washing
- k. AASHTO T 19 Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregate
- l. AASHTO T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregate
- m. AASHTO T 44 Standard Method of Test for Solubility of Bituminous Materials
- n. AASHTO T 49 Standard Method of Test for Penetration of Asphalt Materials
- o. AASHTO T 51 Standard Method of Test for Ductility of Asphalt Materials
- p. AASHTO T 59 Standard Method of Test for Emulsified Asphalts
- q. AASHTO T 85 Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
- r. AASHTO T 96 Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine (ASTM C 131-01)
- s. AASHTO T 104 Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- t. AASHTO T 111 Standard Method of Test for Mineral Matter or Ash in Asphalt Materials

- u. AASHTO T 112 Standard Method of Test for Clay Lumps and Friable Particles in Aggregate
- v. AASHTO T 301 Standard Method of Test for Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer
- w. AASHTO T 335 Standard Method of Test for Determining Percentage Fracture of Coarse Aggregate
- x. AASHTO T 350 Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
- y. AASHTO T 382 Standard Method of Test for Determining the Viscosity of Emulsified Asphalt by a Rotational Paddle Viscometer
- z. Federal Lands Highway (FLH) T 508 Flakiness Index Value
- aa. 23 CFR 637 Construction Inspection and Approval

### **3. Definitions.**

- a. Agency – a state highway agency, other agency or owner responsible for the final acceptance of the project.
- b. Calibration – any calibration, standardization, check or verification as required by the test method or standard.
- c. Contractor – the prime contractor who has ultimate control of the project.
- d. Supplier – one who produces the final product materials (i.e. aggregates and asphalt emulsion) used on the project.
- e. Standard – any standard, specification, test method, practice, etc. utilized to achieve compliance with the contract.
- f. Testing Lab – the laboratory conducting quality control tests (contractor or supplier) and acceptance tests (agency).

### **4. Personnel.**

- a. Responsibilities and Requirement of QC Staff - at a minimum, provide the name of the person responsible for each position listed below, including their telephone number, email, and their qualifications/certifications.
  - i. QC Plan Manager. The person responsible for the execution of the QC Plan and liaison with the Agency. This person shall be on the job and have the authority to stop or suspend construction operations.
  - ii. QC Technicians. The person(s) responsible for conducting QC tests and inspection to implement the QC Plan. QC Technicians shall have Level 2 Aggregate Testing certification from the American Concrete Institute (ACI), or other certification program approved by the agency
- b. Certified Contractor Staff - at a minimum, one crew member (job foreman or other with decision making authority) possessing a valid chip seal certification shall always be on the job while the chip seal is being constructed. The chip seal certification is administered by the National Center for Pavement Preservation (NCP) on behalf of AASHTO TSP-2.

### **5. QC Testing Laboratories and Equipment.**

- a. The laboratory that performs the QC for production can be either qualified or agency approved. The Contractor shall provide the name of the agency approved lab for all tests within the relevant scope of testing.
  - b. Testing and sampling equipment and measuring devices shall meet the requirements of the specified standards and test methods. The lab shall maintain records of the calibration and maintenance of all sampling, testing, and measuring equipment, and all documents required by the agency. .
  - c. Placement Equipment Calibration – prior to the commencement of work, the asphalt emulsion distributor and aggregate spreader shall be calibrated in the presence of the Agency representative utilizing the materials to be used on the project. Calibration will be performed consistent with procedures in FHWA-HIF-19-029, Chip Seal Checklist, 2019.
- 6. QC Activities.** QC activities shall include monitoring, inspection, sampling and testing. The Contractor’s QC activities shall cover all aspects that affect the quality of the materials and workmanship of the chip seal. If there is no agency specific requirement, the minimum QC activities and frequencies required are listed as follows:
- a. Component materials
  - b. Transportation material handling
  - c. Mix Design by a qualified lab
  - d. Test strip construction and assessment
  - e. Placement and Finishing
  - f. Performance
  - g. Review of material certifications supplied by vendors and suppliers.

MINIMUM AGGREGATE QC REQUIREMENTS		
Process Control Test	Test Method	Minimum Frequency
Gradation*	AASHTO T 27 AASHTO T 11	Prior to construction for design, then once per day of placement and every change of source.
Unit Weight	AASHTO T 19	Prior to construction for design, then every change of source.
Bulk Specific Gravity	AASHTO T 85	Once, prior to construction for design, then every change of source.
Aggregate Absorption	AASHTO T 85	Once, prior to construction for design, then every change of source.
L.A. Abrasion	AASHTO T 96	Once, prior to construction for design, then every change of source.
Soundness	AASHTO T 104	Once, prior to construction for design, then every change of source.
Deleterious Material	AASHTO T 112	Once, prior to construction, then every change of source.
Fractured Faces	AASHTO T335	Once, prior to construction, then every change of source.
Flakiness Index	FLH T 508	Prior to construction for design, then every other day of placement or change of source.

Application Rate	Truckload Yield Check, Tarp on Roadway	Once at startup each production day.
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\* Aggregate samples will be taken at the project stockpile site using AASHTO R 90 Method B. Gradation test results should be provided within 24 hours.

MINIMUM ASPHALT EMULSION QC REQUIREMENTS		
Tests on Emulsion*		
Process Control Test	Test Method	Minimum Frequency
Viscosity	AASHTO T 59 or T 382	Once per 200 tons of material placed.
Temperature	N/A	Once delivery tanker.
Particle Charge	AASHTO T 59	Prior to loading emulsion distributor
Demulsibility	AASHTO T 59	Once per 200 tons of material placed.
Sieve	AASHTO T 59	Once per 200 tons of material placed.
Storage Stability	AASHTO T 59	Once per 200 tons of material placed.
Residue**	AASHTO R 78-16	Once per 200 tons of material placed.
Application Rate	Computer Printout, Volumetric Measurement, Plate on Roadway	Once at startup each production day, then each 500 tons of aggregate placed.
Tests on Residue		
Process Control Test	Test Method	Minimum Frequency
Solubility	AASHTO T 44	Once per 200 tons of material placed.
Penetration	AASHTO T 49	Once per 200 tons of material placed.
Ductility	AASHTO T 51	Once per 500 tons of material placed.
Ash Content	AASHTO T 111	Once per 200 tons of material placed.
Elastic Recovery	AASHTO T 301	Once per 500 tons of material placed.
MSCR, Jnr, % Recovery	AASHTO T 350	Once per 500 tons of material placed.

\* A material certification from the supplier shall be provided with each delivery tanker. Asphalt emulsion samples will be taken at the point of delivery from the delivery tanker using AASHTO R 66.

\*\*Determined by either AASHTO T 59 or agency approved method.

- 7. Contractor's Quality Control Plan.** The Contractor shall submit a written project specific, signed QC Plan to the Agency for acceptance at least 15 days prior to placement. The QC Plan shall detail the Contractor's plans, policies, procedures and organization deemed necessary to measure and control materials, equipment, and the chip seal placement process.

The QC Plan shall be maintained to reflect the current status of the operations. Changes must be approved by the agency prior to implementation.

At a minimum, the QC Plan shall detail the following:

- a. **Scope of the QC Plan.** Reference all applicable specifications.
- b. **Definitions.** Terms used in the QC Plan shall be clear and distinct.
- c. **QC Organization.** Include a QC organizational chart identifying all personnel responsible for implementing the QC Plan and how they integrate and communicate within the Contractor's management structure and the Agency. Include a list of QC personnel with their names, qualifications, responsibilities, certifications, telephone number and e-mail address.
- d. **QC Testing Facilities and Equipment.** Include the location and qualifications of QC testing facilities, and a listing of all QC testing equipment with the frequency of calibration and verification.
- e. **Materials Control.** Include the sources of all materials used in construction of the chip seal. Describe stockpile management practices, including segregation mitigation, loading, and transport procedures.
- f. **QC Activities.** Describe QC activities deemed necessary to control all aspects of chip seal construction. Include the locations, methods, frequency and personnel responsible for conducting QC sampling, testing, and inspection. Identify lot/sublot sizes, sample identification system and sampling storage/retention procedures.
- g. **Chip Seal Placement and Workmanship.** Describe methods, equipment and materials for construction of the chip seal. Identify methods to ensure proper workmanship:
  - i. Equipment calibration for distributor and aggregate spreader
  - ii. Monitoring application rates
  - iii. Ensure proper spread patterns
    - a) Proper embedment without excessive or inadequate aggregate
    - b) Emulsion drilling or flushing
    - c) Longitudinal joint overlap
    - d) Transverse joints
  - iv. Rolling operations, proper number of passes and coverage
  - v. Sweeping operations and Schedule
  - vi. Method to control traffic
- h. **Documentation.** Describe testing procedures and determine when corrective action is required. The contractor will provide examples of reporting forms, production QC test results, daily production records, non-conformance reports, and document retention details.
- i. **Non-Conformance and Corrective Action.** Establish and maintain an effective and positive system for controlling non-conforming materials as indicated by inspection and test results. Investigate the cause of any non-conformance to prevent recurrence and take prompt corrective action to correct conditions that have resulted, or could result, in the incorporation of non-conforming materials into the work. All non-conforming materials shall be positively identified to prevent use and intermingling with conforming materials. Include procedures

and personnel responsible for directing corrective action including suspension of work and disposal or reworking of non-conforming materials. Detail how the results of QC inspections and tests will be used to determine corrective actions, define rules to gauge when a process is out of control and associated corrective action to be taken. At minimum establish corrective action procedures for each control requirement listed above.

- 8. Records and Documentation.** The Contractor shall maintain complete records of all QC tests and inspections.

All QC test results shall be submitted to the Agency within 24 hours or upon request. A material certification shall be submitted from each supplier for each batch of material delivered to the jobsite, including test results.

The QC records shall contain all test and inspection reports, forms and checklists, equipment calibrations, supplier material certificates, and non-conformance and corrective action reports. The QC records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities conforming and non-conforming, and the nature of corrective action taken as appropriate for materials as well as workmanship. The QC records shall always be available to the Agency and shall be retained for the life of the contract. The Contractor's documentation procedures will be subject to approval by the Agency prior to the start of work, and to compliance checks by the Agency during the progress of the work.

- 9. Compliance with Specifications.** At the conclusion of the project, the Contractor shall attest in writing to the Agency that the chip seal has been constructed in accordance with and meets the requirements of the specifications.

## **II. Agency Acceptance**

- 1. General.** As the owner of the final chip seal, the Agency must ensure the contractor has constructed the project in accordance with the specifications. The Agency will conduct acceptance sampling, testing, and inspections consistent with AASHTO R 10. The agency may conduct verification testing if QC results are used for Acceptance.

### **2. Acceptance Activities**

- a. Assure the Contractor has followed the approved QC Plan.
- b. Materials – monitor all contractor QC testing.
- c. Agency to sample and test:
  - i. Aggregate – Gradation, moisture content, and deleterious materials, once per day or at the discretion of the Agency.
  - ii. Asphalt Emulsion – Once per project or at the discretion of the Agency.



Note: Actual frequency and lot size will be per each Agency's Frequency Guide Schedules for Verification, Sampling and Testing.

- d. Traffic control conforms to plans and specifications and complies with the Manual on Uniform Traffic Control Devices.
- e. Surface Preparation – Monitor and approve sweeping methods, verify surface is clean and dry, inlets and manhole covers are protected.
- f. Calibration – Witness the calibration of the asphalt emulsion distributor and aggregate spreader.
- g. Asphalt Emulsion Distributor – Verify equipment has been calibrated and is in proper operating condition. Monitor for an even application of material.
- h. Aggregate Spreader – Verify equipment has been calibrated and is in proper operating condition. Monitor for an even application of material. Ensure spreader is proper distance from asphalt distributor.
- i. Pneumatic Rollers – Verify equipment is in proper operation condition and rollers are positioned in echelon so the entire width of the pavement lane is covered. Roll three complete passes over the aggregate, with one pass defined as the roller moving over the chips in either direction .
- j. Sweepers – Verify equipment is in proper operating condition. Ensure loose material is removed without damaging fresh chip seal.
- k. Application Rates – Monitor and verify correct application rates of asphalt emulsion and cover aggregate.
- l. Production Inspection - to be completed after final sweeping to check for unacceptable conditions, such as:
  - i. Bleeding/flushing
  - ii. Raveling/stone loss
  - iii. Crushed/Broken Aggregate
  - iv. Excessive longitudinal joint overlap
  - v. Transverse joint overlap

### **III. Independent Assurance Program (IA)**

1. The IA program shall follow Tech Brief: Independent Assurance Programs, FHWA-HIF-12-001 2011 and shall be the responsibility of the Agency or Owner. The IA Program consists of activities that are an unbiased and independent evaluation of all the observations, sampling and testing procedures and equipment used in the acceptance program. The IA Program is staffed by qualified agency personnel or an accredited laboratory not involved with acceptance testing. It ensures the sampling and testing is performed correctly and the testing equipment used in the program is operating correctly and remains calibrated. It involves a separate and distinct schedule of sampling, testing, and observation. The results of the IA testing shall not be used for material acceptance.