Emulsion Chip Seal Quality Assurance Guide

Emulsion Task Force – Subcommittee on Quality Assurance
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Description: - Quality Assurance (QA)

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. Chip Seal Contractor 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 but is not limited to sampling, testing, inspection, monitoring, documentation, and corrective action procedures during transport, stockpiling, and placement operations.

   A written Quality Control Plan (QCP) shall be developed which details the Contractor's QC program that meets the requirements of these specifications. The QCP shall be contract specific and signed by the Contractor's representative. Chip seal construction shall not proceed without Agency approval of the QCP 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 operations are in compliance with these requirements.

2. **Reference Documents**
    a. AASHTO R 18 Quality Management System for Testing Laboratories
    b. AASHTO R 38 Quality Assurance of Standard Mfd Materials
    c. AASHTO R77 Certifying Suppliers of Emulsified Asphalt
    d. AASTHO T 11 Test for Material Finer than 75 µm
    e. AASHTO T 19 Bulk Density
    f. AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregate
    g. AASHTO T 44 Solubility of Bituminous Materials
    h. AASHTO T 49 Penetration of Asphalt Materials
    i. AASHTO T 51 Ductility of Asphalt Materials
    j. AASHTO T 59 Tests for Emulsified Asphalt
    k. AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate
    l. AASHTO T 111 Mineral Matter or Ash in Asphalt Materials
    m. AASHTO T 112 Clay Lumps and Friable Particles in Aggregates
    n. AASHTO T 301 Elastic Recovery of Asphalt Materials
    o. AASHTO T 335 Determining Percentage Fracture of Coarse Aggregate
    p. FLH T 508 Flakiness Index
    q. 23 CFR 637

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.** At a minimum, the QC staff shall include the following. For each, provide their name, telephone number, and duties.
    a. QCP Administrator. The person responsible for the overall administration of the QCP.
    b. QCP Manager. The person responsible for the execution of the QCP and liaison with the Agency. This person shall be on the job, and have the authority to stop or suspend construction operations.
    c. QC Technicians. The person(s) responsible for conducting QC tests and inspection to implement the QCP. QC Technicians shall have Level 2 Aggregate Testing certification from the American Concrete Institute (ACI), or other accrediting body approved by the agency

d. Certified Crew Members. At a minimum, one crew member (job foreman or other with decision making authority) possessing a valid chip seal certification shall be on the job at all times the chip seal is being constructed. The chip seal certification is administered by the National Center for Pavement Preservation (NCPP) on behalf of AASHTO TSP2.

5. **QC Testing Facilities and Equipment.** The Contractor shall provide the name of the lab that will be conducting the required QC testing. This lab shall maintain accreditation by the AASHTO Accreditation Program (AAP) or other accrediting body approved by the agency for all tests within the relevant scope of testing. Sampling, testing, 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 accreditation program.

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, including but not limited to:
   a. Component materials
   b. Transportation
   c. Design process
   d. Placement and Finishing
   e. Performance
   f. Review of material certifications supplied by vendors and suppliers.

   The minimum QC activities and frequencies required are listed as follows:

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 or every change of source.
Unit Weight	AASHTO T 19	Prior to construction for design, then every change of source.
Bulk Sp Gravity	AASHTO T 85	Once, prior to construction for design, 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.
Agg Absorption	AASHTO T 85	Once, prior to construction for design, then every change of source.
Fractured Faces	AASHTO T335	Once, prior to construction, then every change of source.
Deleterious Material	AASHTO T 112	Once, prior to construction, then every change of source.
Application Rate	Truckload Yield Check, Tarp on Roadway	Once at startup each production day.

MINIMUM ASPHALT EMULSION QC REQUIREMENTS		
Process Control Test	**Test Method**	**Minimum Frequency**
Viscosity	AASHTO T 59	Once per 200 tons of material placed.
Temperature	N/A	Once delivery tanker.
Residue	AASHTO T 59	Once per 200 tons of material placed.
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.
MSCR, Jnr	AASHTO M332	Once per 500 tons of material placed.
% Recovery MSCR	AASHTO M332	Once per 500 tons of material placed.
Ductility	AASHTO T 51	Once per 500 tons of material placed.
Elastic Recovery	AASHTO T 301	Once per 500 tons of material placed.
Penetration	AASHTO T 49	Once per 200 tons of material placed.
Ash Content (Cationic Emulsions)	AASHTO T 111	Once per 200 tons of material placed.
Solubility (Anionic Emulsions)	AASHTO T 44	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.

A material certification from the supplier shall be supplied with each delivery tanker.

7. **Contractor's Quality Control Plan (QCP).** The Contractor shall submit a written, signed QCP to the Agency for approval at least 15 days prior to placement. The QCP 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 QCP 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 QCP shall detail the following:

   a. **Scope of the QC Plan.** Reference all applicable specifications.

   b. **QC Organization.** Include a QC organizational chart identifying all personnel responsible for implementing the QCP 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.

c. **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.

d. **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.

e. **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.

f. **Chip Seal Placement and Workmanship.** Describe methods, equipment and materials for construction of the chip seal. Identify methods to ensure proper workmanship:
    a. Equipment calibration
    b. Monitoring application rates
    c. Ensure proper spread patterns
        i. Excessive or inadequate aggregate
        ii. Emulsion drilling or flushing
        iii. Longitudinal joint overlap
        iv. Transverse joints
    d. Rolling operations, proper number of passes and coverage
    e. Sweeping operations and Schedule
    f. Method to control traffic

g. **Documentation.** Describe documentation and reporting procedures for all QC activities. Include samples of all QC test forms, inspection and test reports.

h. **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, 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 be available to the Agency at all times, 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. Chip Seal Agency Acceptance (QA)

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 to ensure material quality, correct application rates, rolling and sweeping techniques.

2. **Acceptance Activities**
   a. Materials – monitor all contractor QC testing.

   b. Agency to sample and test:
      i. Aggregate – Gradation and deleterious materials, once per day or at the discretion of the Agency
      ii. Asphalt Emulsion –Once per job 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.

   c. Surface Preparation
      Monitor and approve sweeping methods, verify surface is clean and dry, inlets and manhole covers protected.

   d. Asphalt Distributor
      Verify equipment has been calibrated and is in proper operating condition. Monitor even application of material.

   e. Aggregate Spreader
      Verify equipment has been calibrated and is in proper operating condition. Monitor even application of material. Ensure spreader is proper distance from asphalt distributor.

   f. Pneumatic Rollers
      Verify equipment is in proper operating condition. Ensure proper rolling pattern and number of coverages.

   g. Sweepers
      Verify equipment is in proper operating condition. Ensure loose material is removed without damaging fresh chip seal.

   h. Application Rates
      Monitor and verify correct application rates of asphalt emulsion and cover aggregate.

i. Post Placement Inspection of Chip Seal, to be completed after final sweeping:
    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 be the sole responsibility of the Agency or owner, performed to ensure an independent verification of the reliability of Acceptance data obtained by the Agency and the QC data obtained by the contractor. The results of the IA testing are not to be used as a basis for material acceptance.

2. The IA program shall evaluate the qualified sampling and testing personnel and the testing equipment. The program shall cover sampling procedures, testing procedures, inspection and testing equipment. Each IA program shall include a schedule of frequency for IA evaluation, and in accordance with the Agency or owner's master schedule of sampling and testing. The schedule may be established based on either a project basis or a system basis. The frequency can be based on either a unit of production or on a unit of time.

    a. The testing equipment shall be evaluated by using one or more of the following: Calibration checks, split samples, or proficiency samples.
    b. Testing personnel shall be evaluated by observations and split samples or proficiency samples.
    c. A prompt comparison and documentation shall be made of test results obtained by the tester being evaluated and the IA tester. The Agency shall develop guidelines including tolerance limits for the comparison of test results.