# Recommended
# Quality Control Sampling and Testing Guidelines
# For
# Full Depth Reclamation Using Bituminous Stabilizing Agents
## FDR301

**9/12/2017**

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## NOTICE

**It is not intended or recommended that these guidelines be used verbatim within a specification. Owner Agencies should use them to help establish their particular project specification. Owner Agencies should understand that all geographical areas and pavement rehabilitation/preservation projects are unique and the availability of materials and equipment may vary as well. ARRA assumes no liability for utilization of these guidelines by any Individual or Entity. Contact ARRA for answers to questions and for a list of ARRA member Contractors and Suppliers.**

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## 1. General

Quality Control (QC) sampling, testing and inspection shall be conducted by the Contractor to ensure optimum performance of the full depth reclamation (FDR) material. QC shall be conducted in accordance with the procedures outlined in Table 1 and below. Additional sampling and testing shall be conducted if significant changes in reclaimed material characteristics are observed, such as a change in the percentages of Reclaimed Asphalt Pavement (RAP) and underlying materials, a much coarser or finer gradation, a noticeable difference in binder content, or when considerable variability is occurring in field test results.

The Contractor's testing personnel and laboratory shall be certified in the applicable test methods and/or approved by the Owner Agency prior to beginning FDR. All testing performed by the Contractor shall be provided to the Owner Agency, when requested, within two business days of obtaining results.

If test results conducted during the placement of the FDR do not meet requirements presented in Table 1 the Owner Agency shall be immediately notified. The roadway shall then be inspected and monitored prior to the application of the surface course and any resultant deficiencies shall be rectified in accordance with the requirements of the plans and specifications.

**User Note:** These QC guidelines identify suggested material sampling and testing methods that are related to FDR process control to maximize final product performance. To adjust for varying field conditions during FDR pavement production, changes in rolling patterns, moisture content, stabilizing agent content and additive content may be necessary to obtain optimum performance. When taking material samples the time between sampling and testing may affect the results obtained. The Contractor should consult with the Material Supplier to ensure proper timelines are followed so as to ensure accurate test results.

## 2. Mixing Equipment Calibration

Mixing equipment shall be calibrated at the start of every year and monitored throughout the year to ensure accuracy, as outlined in Section 2.0 of Table 1. Mixing equipment shall be calibrated by delivering known quantities of reclaimed materials, bituminous stabilizing agent and water through the reclaiming equipment to verify that the materials are delivered to the accuracy specified. If during construction the actual delivery rates, determined by volumetric distribution, vary by more than 10% of the desired application rate the equipment shall be recalibrated.

**User Note:** FDR equipment should be checked for accuracy during construction. However, due to practical constraints such as varying unit weights of materials, irregular widths during reclaiming, and non-level surfaces for tank measurements, a 10% tolerance is normally sufficient to verify the equipment remains properly calibrated.

## 3. Bituminous Stabilizing Agent Compliance

The bituminous stabilizing agent shall be established by a mix design prior to the start of full depth reclamation in accordance with guidelines presented in FD*R201A - Recommended Mix Design Guidelines for Full Depth Reclamation (FDR) Using Emulsified Asphalt Stabilizing Agents* or *FDR201B - Recommended Mix Design Guidelines for Full Depth Reclamation (FDR) Using Foamed (Expanded) Asphalt Stabilizing Agents*. If actual test results conducted during FDR do not meet the requirements of Section 3 of Table 1, the Owner Agency shall be immediately notified. The roadway shall then be inspected and monitored prior to the application of any surface course. Resultant deficiencies shall be rectified in accordance with the requirements of the plans and specifications.

**User Note:** Bituminous stabilizing agents used for the FDR process should be selected to obtain optimum performance and mix workability. They should be established by a mix design prior to the start of the process. The stabilizing agent selected for a particular project will depend on environmental conditions and material availability, and should follow guidelines presented in *ARRA FDR201A* or *ARRA FDR201B*.

### 3.1 Bituminous Stabilizing Agent Injection Rate

At the start of production the optimum bituminous stabilizing agent rates established by the mix design shall be followed and, when necessary, modified to within the tolerances established in the mix design to adjust for changing field conditions. Bituminous stabilizing agents shall be transported to the site in bulk tankers. The application rate of bituminous stabilizing agent shall be checked by evaluating the mass of reclaimed material against the volume of stabilizing agent used for a single tanker, as presented in Section 3.1 of Table 1. If field conditions or performance indicate the need for an adjustment to the application rate, adjustments shall be made in no more than 0.2 percent increments. If the actual applied rate does not fall within the mix design tolerance, the performance of the roadway shall be monitored prior to application of the surface course. Resultant deficiencies shall be rectified in accordance with the requirements of the plans and specifications.

### 3.2 Foamed Asphalt Compliance

Asphalt binder used for foaming shall be the same Performance Grade (PG), from the same source, as used in the mix design. A certificate of analysis (COA) shall be provided by the Material Supplier with each delivery of asphalt or a sample from the delivery tanker may be tested for verification in lieu of the COA. Asphalt shall comply with the QC procedures outlined in Section 3.2.1 of Table 1. Asphalt temperature shall comply with the QC procedures outlined in Section 3.2.2 of Table 1. Before connecting a tanker to the reclaiming unit, the temperature of the asphalt shall be checked using a thermometer independent of that fitted to the tanker. A means of subsequent heating shall be available on site in the event that the asphalt is not delivered at the appropriate temperature. Any asphalt that has been heated above the maximum specified temperature of 375 °F (190 °C) shall not be used and shall be removed from the site.

**User Note:** Hand-held digital thermometers have been found to be the most effective way to obtain this temperature measurement.

Foamed asphalt expansion ratio and half-life shall be checked using the test nozzle on the reclaiming unit according to Section 3.2.3 of Table 1 for each load of asphalt delivered to the site. If a test nozzle is not present, the asphalt temperature shall be maintained within ± 9 °F (5 °C) of the specified application temperature designated by the mix design. The asphalt temperature shall be recorded and foam testing performed in the laboratory at the recorded temperature to verify foaming characteristics.

### 3.3 Emulsified Asphalt Stabilizing Agent Compliance

Emulsified asphalt supplied in the field shall meet the penetration, percent residue, and polymer modification (if applicable) properties presented in the mix design and within the tolerances prescribed in Section 3.3.1 of Table 1. A COA shall be provided by the Material Supplier with each delivery of emulsified asphalt or a sample from the delivery tanker may be tested for verification in lieu of the COA. Emulsified asphalt temperature shall comply with the QC procedures outlined in Section 3.3.2 of Table 1.

## 4. Stabilizing Additive Compliance

Stabilizing additives shall be cement (dry or slurry), lime slurry, corrective aggregate or a combination thereof. The need for a stabilizing additive shall be established by a mix design prior to the start of reclamation in accordance with guidelines presented in *ARRA FDR201A* or *ARRA FDR201B*.

**User Note:** Stabilizing additives are used when the gradation can be improved, as is the case for corrective aggregate, or for faster cure or early strength gain, as is the case for cement or lime. The stabilizing agent selected for a particular project will depend on environmental conditions and material availability, and should follow the guidelines presented in *ARRA FDR201A* or *ARRA FDR201B*. It is important that stabilizing additives be injected at the rate specified in the mix design to ensure that optimal performance of the FDR material is achieved. Improper addition of cement or lime can result in a structurally weak layer, poor durability, excessive cracking or a brittle layer.

**4.1 Cement**

When required by the mix design, cement (portland or blended hydraulic) shall comply with the QC procedures outlined in Section 4.1.1 of Table 1.

When dry cement is spread using a spreader, it shall be applied to the road prior to reclaiming and the application rate verified according to Section 4.1.2 of Table 1. Dry cement shall be spread to the full width of the reclaiming drum to ensure uniform cement distribution throughout the mix. When spreading cement to the full width of the drum a standard “canvas patch” test, or similar procedure, shall be used to check the application rate as prescribed in Section 4.1.2 of Table 1. A canvas of known area shall be placed on the existing pavement prior to application of cement. After the cement is spread on the existing pavement, the canvas shall be weighed to verify the application rate.

When cement is applied by means of slurry injection, the consumption of cement (and water) shall be obtained from the computer that controls the slurry mixing unit. A volumetric distribution shall also be performed using the weight of dry cement used in the slurry mixer per load as prescribed in Section 4.1.3 of Table 1.

**4.2 Lime**

When required by the mix design, lime shall comply with the QC procedures outlined in Section 4.2.1 of Table 1. Lime shall be applied by means of slurry injection. The consumption of lime (and water) shall be obtained from the computer that controls the slurry mixing unit. A volumetric distribution shall also be performed using the weight of dry lime used in the slurry mixer per load, as prescribed in Section 4.2.2 of Table 1.

**4.3 Corrective Aggregate Compliance**

When required by the mix design, corrective aggregate shall meet the gradation dictated by the mix design and the physical properties presented in Table 2 of *ARRA FDR101* and shall comply with the QC procedures outlined in Section 4.3.1 and Section 4.3.2 of Table 1. A COA from an Owner Agency certified Aggregate Supplier may be used in lieu of QC testing.

Corrective aggregate addition rate shall be determined by volumetric distribution utilizing weigh tickets from the haul trucks and the applied area, and shall comply with QC procedures outlined in Section 4.3.3 of Table 1.

**User Note:** Corrective aggregates may be incorporated into the mix to obtain the desired mix characteristics or desired gradation. The gradation of the material will depend on the desired effect but are typically unwashed screenings, chips, continuously graded aggregate or RAP. There should be a

quantifiable improvement in measured mix properties to justify the added expense of corrective aggregates.

## 5. Reclaimed Pavement Material

Reclaimed pavement material shall consist of reclaimed asphalt pavement (RAP) and underlying materials. RAP shall consist of asphalt coated material. Underlying materials can consist of aggregate base, subbase or subgrade materials. The reclaimed pavement materials shall be sampled and tested in accordance with Section 5.1 of Table 1 for maximum particle size, and with Section 5.2 for air dried or wet field gradation. Samples may be obtained prior to or after the addition of stabilizing agent.

**User Note:** Maximum particle size is important to ensure that the texture and consistency in the final FDR mat is optimized. It is not possible to reduce the maximum size of the FDR material to less than the maximum size of the in-situ materials. A wet sieve analysis in the field provides an indication of the consistency of the FDR material and can be used for comparison with the mix design gradation to adjust the bituminous stabilizing agent rate.

## 6. Water

Moisture content shall be controlled to ensure adequate dispersion of the stabilizing agent and any additives, and to ensure optimum compaction of the FDR mixture. Moisture content monitoring shall comply with the QC procedures outlined in Section 6.0 of Table 1. In the event that the rate of emulsified asphalt is modified on site, the rate of water addition shall also be modified to ensure that the total fluids injected remains consistent with the mix design. When foamed asphalt is used, the water injection rate shall not be adjusted unless the modified proctor analysis dictates a change is necessary for adequate compaction of the foamed asphalt mixture.

**User Note:** FDR mixtures with emulsified asphalt and foamed asphalt need to properly cure to reach their full strength. By measuring the moisture content of the FDR material, the quality and properties of the FDR mixture can be better controlled and adjusted as needed.

## 7. Construction

**User Note:** Performance testing (indirect tensile strength, tensile strength ratio, raveling, and Marshall stability) of field produced and either field or laboratory compacted samples as a QC testing requirement for FDR materials is not recommended. Variations in environmental conditions (ambient temperatures, curing rates, moisture levels, solar influence, wind, etc.) produce inconsistent test results which make it difficult to establish and control testing results.

Immediate coring of FDR materials is not recommended for obtaining performance test samples as a significant amount of time, weeks to months, can be required for the material to fully cure and develop sufficient strength to withstand coring forces.

ARRA is investigating ways to implement performance testing; however, additional research is required to determine reliable field performance testing methods and procedures. At this time, if field testing is mandated by the Owner Agency, specimens must be compacted within the same timeframe and ambient conditions as field compaction, and should be used for information purposes only. Onsite compacted specimens are the only way to simulate actual construction conditions.

**7.1 Pulverization**

Before the stabilization process begins, the area to be stabilized shall be pre-pulverized, graded, and/or shaped to the lines and grades as shown on the plans and specifications. Pulverization depth measurements of reclaiming shall be obtained at available longitudinal joints according to Section 7.1 of Table 1.

**7.2 Bituminous Application and Mixing**

Removal and disposal of excess material, if required, shall be performed on the pulverized asphalt, base and subgrade material prior to bituminous treatment. Following pulverization and any trimming, if necessary, the bituminous material shall be applied to the pulverized material in accordance with the requirements of the mix design and the requirements of section 3 of Table 1.

Apply bituminous stabilizing agent only when the anticipated weather meets the requirements of section 7.2.1 of Table 1.

Mixing shall continue until the entire mixture, RAP, base and/or subgrade material is pulverized and gradation requirements are met.

Mixing depth measurements of reclaiming shall be obtained at available longitudinal joints according to Section 7.2.2 of Table 1.

**7.3 Control Strip**

A control strip shall be constructed to determine the optimum rolling pattern required to achieve the specified percent compaction. The control strip shall be established in accordance with the procedures outlined in FDR101 and the QC procedures outlined in Section 7.3 of Table 1.

**7.4 Compaction**

Compacted density shall be determined by evaluating the achieved density in relation to the maximum density obtained from a field compacted, modified Proctor, determined in accordance with AASHTO T 199 (ASTM D1556). The FDR material shall be compacted to a minimum of 95% of the field compacted, modified Proctor density. Testing for compaction shall be in accordance with Section 7.4 of Table 1.

**7.5 Cross-Slope and Mat Width**

FDR mat cross-slope shall be measured across the mat width after compaction to ensure that the desired cross-slope is achieved, according to Section 7.5.1 of Table 1.

**User Note:** Cross-slope requirements for a roadway will vary depending on condition of the existing roadway and operations prescribed in the plans and specifications. For roadways that exhibit a loss of profile outside of a 0.5% tolerance from the desired FDR profile, the plans and specifications should stipulate either a constant pulverization depth or desired cross-slope i.e. the existing cross-slope is 3.0% and the maximum specified is 2.5%. In this scenario a pre-milling line item should be included where the profile of the existing roadway prohibits obtaining both a depth and cross-slope. In the event that the existing roadway profile is consistent with the desired FDR profile, both a pulverization depth and cross-slope may be specified.

Mat width shall comply with the QC procedures outlined in Section 7.5.2 of Table 1.

**User Note:** Measurement of FDR mat width is important where the desired mat width is wider than the existing asphalt pavement.

### 7.6 Mat Moisture Content after Curing

Moisture content of the FDR pavement shall be measured prior to placement of the surface course. Mat moisture content shall comply with QC procedures outlined in Section 7.6 of Table 1.

**User Note:** Research and development is currently underway to assess other methods to determine timing of surface course placement that are non-destructive and assess in-place strength of the pavement.

## 8. Surface Tolerance and Smoothness

Surface tolerance shall be measured as a pavement deviation within a 10 foot (3 m) straight edge utilizing a wedge ruler that can slide between the pavement/straight edge interface to accurately measure the gap. Surface tolerance shall comply with QC procedures outlined in Section 8.0 of Table 1.

**User Note:** Surface tolerance is important to ensure that end user comfort is maximized and expected long-term performance of the FDR pavement is realized. Use of the International Roughness Index (IRI), Mean Roughness Index (MRI), Profile Index (PI), or Ride Number (RN) for FDR pavements has grown as a measurement of smoothness due to acceptance of these methods for both asphalt and concrete pavements. ARRA believes that these techniques can be used successfully for FDR pavements; however, substantial evidence does not currently exist to determine specification guidelines for the results obtained. ARRA plans to compile results to establish suggested guidelines in the future.

## Table 1. Quality Control Requirements by Contractor

| Section | Type of Testing | Method | Frequency | Sample Location & Size | Target | Means of Rectification |
|---|---|---|---|---|---|---|
| 2.0 | Mixing Equipment Calibration | Determination of stabilizing agent and water injection rate as % of weighed FDR Material | Prior to beginning of work each year and additional, as required[1] | 20 tons (metric tons) of FDR Material | Stabilizing agent meter: ± 2%<br>Water meter: ± 5% | Perform maintenance on affected system |
| 3.1 | Bituminous Stabilizing Agent Injection Rate | Verify amount of stabilizing agent per mix design and accuracy of meter readings by volumetric distribution | Confirm meter reading every hour and tank distribution once per day | By tank gauging, truck weighing or meter readings and FDR material weight by volumetric measurement and material unit weight | Within the tolerances specified in the mix design | Adjust application rate and complete non-conformance report if section outside mix design tolerance |
| 3.2.1 | Asphalt for Foaming | Supplier generated COA[2] or laboratory testing to comply with mix design parameters | Before use of every delivery load | Sample in accordance with AASHTO T 40 or ASTM D140 from delivery truck, 1 gal (4 L) minimum[3] | Meet PG grade requirements | Adjust production settings |
| 3.2.2 | Asphalt Temperature for Foaming | Probe or infrared temperature gun | Before use of every delivery load | Prior to foaming from delivery truck or after inline heating system | Minimum to meet desired expansion ratio and half-life requirements of mix design but not to exceed maximum requirements | Adjust in the field if possible if temperature is too low, return to Supplier if too high |
| 3.2.3 | Foamed Asphalt | Expansion Ratio and Half-life | Before use of every delivery load | Perform with test nozzle into a 5 gal bucket | Maximize both expansion ratio and half-life to meet or exceed the mix design parameters | Adjust temperature and/or water to obtain optimum foaming |
| 3.3.1 | Emulsified Asphalt | Visual sieve test on site[4]<br>Supplier generated COA[2] or laboratory testing to comply with mix design parameters | Before use of every delivery load | Sample in accordance with AASHTO T 40 or ASTM D140 from delivery truck, 1 gal (4 L) minimum[3] | Penetration: ± 25%<br>% Residue: ± 2%<br>Elastic Recovery: 10% at 10 °C, 20 cm, 5 min relax (Elastic Recovery for polymer modification only) | Adjust production settings |
| 3.3.2 | Emulsified Asphalt Temperature | Probe or infrared temperature gun | Before use of every delivery load | From delivery truck | As per the Supplier's recommendations. | Adjust production settings |

| Section | Type of Testing | Method | Frequency | Sample Location & Size | Target | Means of Rectification |
|---|---|---|---|---|---|---|
| 4.1.1 | Cement (portland or blended hydraulic) | Supplier generated COA[2] | Before use of every delivery load | N/A | According to *ARRA FDR101* and mix design | Do not use and remove material on site |
| 4.1.2 | Cement Dry Spread Rate | Volumetric distribution | Every half mile (0.8 km) | From pavement. One canvas patch test | ± 10% of mix design application rate | Adjust application rate and complete non-conformance report if outside tolerance |
| 4.1.3 | Cement Slurry Application Rate | Volumetric distribution<br>% solids by drying or hydrometer | Once for every delivery load | Application rate: one delivery load over area applied<br>% solids from batch tank, 1 qt (1 L) | ± 10% of mix design application rate | Adjust application rate and complete non-conformance report if outside tolerance |
| 4.2.1 | Lime | Supplier generated COA[2] | Before use of every delivery load | N/A | According to *ARRA FDR101* and mix design | Do not use and remove material on site |
| 4.2.2 | Lime Slurry Application Rate | Volumetric distribution<br>% solids by drying or hydrometer | Once for every delivery load | Application rate: one delivery load over area applied<br>% solids from batch tank, 1 qt (1 L) | According to *ARRA FDR101* and mix design | Adjust application rate and complete non-conformance report if outside tolerance |
| 4.3.1 | Corrective Aggregate Gradation | Supplier generated COA[2] or laboratory analysis (AASHTO T 11 and T 27 or ASTM C117 and C136) | Before the start of placement and once every 1,000 tons (metric tons) thereafter | From stockpile, in accordance with AASHTO T 2 or ASTM D75 requirements | According to mix design tolerance in *ARRA FDR201A* or *ARRA FDR201B* | Alternate source |
| 4.3.2 | Corrective Aggregate Physical Properties | Supplier generated COA[2] or laboratory analysis (AASHTO T 96, T 176 and T 85 or ASTM C131, D2419 and C127) | Once before placement | From stockpile, in accordance with AASHTO T 2 or ASTM D75 requirements | According to Table 2 of *ARRA FDR101* and mix design | Alternate source |

| Section | Type of Testing | Method | Frequency | Sample Location & Size | Target | Means of Rectification |
|---|---|---|---|---|---|---|
| 4.3.3 | Corrective Aggregate Addition Rate | Volumetric distribution | Every 1/2 mile (0.8 km) | Application rate: one delivery load over area applied | ± 10% of mix design application rate | Adjust aggregate placement |
| 5.1 | FDR Maximum Particle Size | AASHTO T 27<br>ASTM C136<br>Air dried or wet gradation | Start of day and every 1/2 mile (0.8 km) thereafter | Sample in accordance with AASHTO T 168 or ASTM D979 from mat, minimum weight of 5 lbs. (2.5 kg) | 100% passing specified maximum size | Reduce speed of reclaimer and/or adjust mixing chamber door openings |
| 5.2 | FDR Gradation | Air dried or wet gradation | Twice/day for first two days and once/day thereafter or if visual change in gradations occurs | Sample in accordance with AASHTO T 168 or ASTM D979 from mat, minimum weight of 22 lbs. (10 kg) | According to mix design tolerance in *ARRA FDR201A* or *ARRA FDR201B* | Reduce speed of reclaimer and/or adjust mixing chamber door openings |
| 5.3 | Ambient Temperature | Any Owner Agency approved method | At the start of each day and every two hours thereafter | N/A | > 45 °F (7 °C) | Suspend reclaiming until temperature increases |
| 6.0 | Moisture Content of Reclaimed Mixture | AASHTO T 329<br>AASHTO T 265, ASTM D2216 or ASTM D4643 | Once per every 1/2 mile (0.8 km) minimum | Sample in accordance with AASHTO T 168 or ASTM D979 after all additives have been added to mixture, minimum weight of 20 lbs. (9 kg) | ±2% of mix design recommended amount for proper mixing and compaction[5] | Adjust water |
| 7.1 | Depth of Pulverization[6] | Depth probe measurement | Every 500 ft. (150 m) | Across mat width | Minimum plan or specified depth | Modify as required |
| 7.2.1 | Ambient Temperature | Any Owner Agency approved method | At the start of each day and every two hours thereafter | N/A | > 45 °F (7 °C) and no freezing temperatures within 7 days of completion of FDR | Suspend reclaiming until temperature requirements can be met |
| 7.2.2 | Depth of Stabilized Material | Depth probe measurement | Every 1,000 ft (300 m), recording every 10th measurement | Vertical measurement adjacent to longitudinal joints | Minimum plan and specified depth | Adjust mixing depth |

| Section | Type of Testing | Method | Frequency | Sample Location & Size | Target | Means of Rectification |
|---|---|---|---|---|---|---|
| 7.3 | Control Strip | Nuclear gauge per AASHTO T 355 (ASTM D2950) or Owner Agency approved method[67] | During the first day and if significant changes in reclaimed mix properties occur | One tanker load or 1,000 ft. (300 m) | Rolling pattern necessary to meet specified percent compaction | N/A |
| 7.4 | Reclaimed Material Compacted Density[8] | Nuclear gauge AASHTO T 355 (ASTM D2950) or Owner Agency approved method[6] | One per 1/4 lane mile (200 m) | Random sampling as per ASTM D3665 | ≥ 95% of field compacted modified Proctor | Establish new rolling pattern |
| 7.5.1 | Cross-slope[6] | 4 ft. (1 m) Smart level | Every 1000 ft. (300 m) | Across mat width after grading and after rolling | ± 0.1% of desired cross fall | Regrade as necessary |
| 7.5.2 | Mat Width | Tape measurement | Ongoing, recording every 1000 ft. (300 m) | Across mat width | ± 2 inches (50 mm) | Adjust reclaimer passes/overlaps |
| 7.6 | Mat Moisture Content After Curing | AASHTO T 329 AASHTO T 265, ASTM D2216 or ASTM D4643 | Equivalent to one per day of production | Through full lift depth, minimum weight of 3 lbs. (1.4 kg) | ≤ 50% of optimum moisture content from mix design or <2.0% total moisture | Wait to dry |
| 8.0 | Surface Tolerance | 10 ft. (3 m) Straight edge | Ongoing, recording every 1000 ft. (300 m) | At joints and ongoing | < 1/2 in. (12 mm) longitudinal, < 3/8 in. (10 mm) transverse | Trimming, milling or abrasive grinding |

**Notes for Table 1**

1. Based on the mixer computer meter readings and other checks, additional calibration may be required. **User Note:** If 4.0% stabilizing agent required, based on the allowable tolerance, the stabilizing agent must be delivered between 3.92% and 4.08%. If the FDR is being performed throughout the calendar year, the Mixing Equipment Calibration shall be performed annually.

2. A Certificate of Analysis (COA) provided by the Material Supplier that includes test results that verify that the product supplied meets the minimum specified quality standards.

3. Samples shall be stored at non-freezing, non-agitated conditions and they should be stirred and heated if necessary to achieve homogeneity prior to testing. Emulsified asphalt samples must be tested within 10 days of sampling.

4. Visual sieve test on site according to AASHTO T 59, Section 12, or ASTM D244 using the No.20 sieve modified to only determine if build up exists on the screen.

5. When determining moisture content of the reclaimed mixture the water component of the emulsified asphalt must also be recognized; however, evaporation of moisture occurs immediately upon injection of emulsified asphalt into the FDR material and, therefore, the total amount of water may not be measured during the testing process.

6. Both pulverization depth and cross-slope requirements for a roadway may not be achievable as described in Sections 7.1 and 7.2. FDR material will not compact to the pulverized thicknesses as the RAP will fluff after pulverization and bituminous binder injection, depending on material, methods and environmental factors. Because of this material expansion, the elevation of the final FDR pavement may increase compared to the existing pavement. Depending on the road geometry this additional material may be removed and placed in areas where minor cross fall corrections are required. Premilling may also be performed if the final FDR elevation is to match the existing pavement elevation.

7. It has not been determined at this time if electromagnetic gauges are suitable for use on full depth reclamation mixtures; therefore, they are not recommended for use.

8. Target densities for FDR mix compaction are established using field compacted, modified Proctor samples compacted in accordance with AASHTO T 180 (ASTM D1557) as per FDR101. The compacted density is measured with a nuclear density/moisture gauge in accordance with AASHTO T 355 (ASTM D2950) or local agency approved method, since it is generally not possible to obtain cores during construction. The density obtained will be a “wet density” as conversion to a true “dry density” by the gauge is not possible with FDR mixes. A dry density may be obtained by sampling the reclaimed mix at the nuclear gauge test location, determining the moisture content by drying and correcting the gauge wet density using the sample moisture content.