

Special Specification 3083

Emulsified Asphalt Base (Plant-Mixed)



1. DESCRIPTION

A process in which stockpiled flexible base material is mixed with emulsified asphalt, water, and when necessary cement using a pug mill mixer. The emulsified asphalt base is discharged directly into haul trucks and hauled to the project site, and compacted to density to construct a base layer.

2. MATERIALS

Furnish uncontaminated materials of uniform quality in accordance with the plans and specifications. Notify the Engineer of the proposed material sources, and before making changes to material sources to allow approval of the mix design. The Engineer will verify the specification requirements are met before approving the sources for use. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

- 2.1. **Emulsion.** Furnish standard or high yield asphalt emulsion in accordance with Table 1, unless otherwise shown on the plans. Provide emulsified asphalt that is homogenous and does not separate after thorough mixing.

Table 1
Emulsified Asphalt Properties

Property	Test Procedure	Standard Emulsion		High Yield Emulsion	
		Min	Max	Min	Max
Residue from distillation, %	AASHTO T 59	60	-	63	-
Oil distillate by distillation, %	AASHTO T 59	-	0.5	-	0.5
Sieve Test, %	AASHTO T 59	-	0.1	-	0.1
Penetration, 25°C, dmm	AASHTO T 49	55	95	120	-
Viscosity SFS @ 25°C, sec	AASHTO T 59	20	100	20	100
<i>Tests on rejuvenating agent:</i>					
BWOA, % ¹	***	-	-	2	-
Viscosity 140 °F, cSt	AASHTO T201	-	-	50	175
Flash Point, COC, °F	AASHTO T48	-	-	380	-
Solubility in n-pentane, % by weight	ASTM D2007	-	-	99	-

1. BWOA = By Weight of Asphalt. Provide a manufacturer's certificate of analysis with the percent of rejuvenator added.

2. When required, this material property will be determined by the Materials & Tests Division (MTD).

- 2.2. **Tack Coat.** Furnish CSS-1H or SS-1H in accordance with Item 300, "Asphalts, Oils, and Emulsions", unless otherwise directed. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.
- 2.3. **Flexible Base.** Furnish base material meeting the material requirements of Item 247, "Flexible Base" for the type and grade shown on the plans, before mixing with emulsion.
- 2.4. **Cement.** When shown on the plans, required by the mixture design, or as directed, furnish hydraulic cement in accordance with DMS-4600, "Hydraulic Cement," and the Department's Hydraulic Cement Quality Monitoring Program (HCQMP). Sources not on the HCQMP will require testing and approval before use.
- 2.5. **Water.** Furnish water free of industrial waste and other objectionable material.

- 2.6. **Mixture Design.** The Engineer will provide an approved mixture design using the Materials & Tests Division (MTD) mixture design procedure before the start of any work pertinent to this item. Provide the Engineer with samples of standard or high yield emulsified asphalt. The mixture design must meet the requirements listed in Tables 1 and 2 and report the optimum moisture content, maximum dry density, percent additive when applicable, percent of additional material when applicable, percent of existing material, type of emulsified asphalt, percent residue by distillation, and the optimum percent emulsion content.

Table 2
Laboratory Mixture Design Properties

Mixture Property ¹	Test Method	Minimum Requirement
Indirect Tensile Strength (IDT), psi	Provided by MTD	50
Moisture Conditioned ² IDT, psi		30
Moisture Conditioned ² Unconfined Compressive Strength (UCS) ³ , psi		120

- Oven dry test specimens at $104 \pm 5^\circ\text{F}$ for a minimum of 72 hr. after compaction.
- MTD will provide the procedure for moisture conditioning test specimens. Moisture conditioning will be performed by submerging test specimens in water for 24 ± 1 hour before IDT and UCS strength testing.
- Average of a minimum of two test specimens.

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when required.

- 3.1. **Storage Facility.** Store cement in closed, weatherproof containers.

- 3.2. **Mixing Plant.** Provide a stationary pugmill or continuous mixing plant as approved. Equip plants with automatic proportioning and metering devices that produce a uniform mixture of emulsion, flexible base, water, and when necessary cement, in the specified proportions determined from the mixture design.

Process the emulsion, flexible base, water, and when necessary cement to a homogeneous mixture at a minimum rate of 100 tons per hour. The mixing plant will be equipped with a belt scale for the continuous weighing of the flexible base and a coupled and interlocked computer-controlled liquid metering device certified and meeting requirements of Item 520, "Weighing and Measuring Equipment." The liquid metering device will be capable of automatically adjusting the flow of emulsion to compensate for any variation in the weight of the flexible base coming into the mixer. The metering device will deliver the amount of emulsion to within 0.2% of the optimum emulsion content.

Display automatic digital readings for both the flow rate and total amount of flexible base and emulsion in appropriate units of weight and time. Include a screening unit to remove possible contaminants or oversized material greater than 2-1/2", unless otherwise shown on plans. The mixing plant will be a continuous process from the screening unit to the pugmill to eliminate aggregate segregation of the finished product.

- 3.3. **Spreader Equipment.** Provide paving equipment that will spread the emulsified asphalt base in a uniform layer in one pass. When not using paving equipment, provide equipment that will spread the base material in a uniform layer in one pass. Equip paving equipment or spreaders with electronic grade controls when shown on the plans.

- 3.4. **Ride Quality.** Provide a high speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute. Provide equipment certification documentation. Display a current decal on the equipment indicating the certification expiration date.

4. STAFFING REQUIREMENTS

Provide staff onsite for a minimum of 3 days from the start of production or as deemed necessary by the Engineer. This staff must have a minimum experience of 2 years supervising plant or road-mixed operations using emulsion.

Provide Soils & Base 102 (SB102) Field Specialists certified by the Department-approved Soils and Base Certification Program to conduct all sampling and testing for the duration of the project. Supply the Engineer with a list of certified personnel and copies of their current certifications, either hardcopy or electronic files, before beginning production and when personnel changes are made.

5. CONTROL SECTION

Construct a control section at a location approved by the Engineer using the equipment specified in Section 3 in accordance with Section 6. Place and compact material in the control section for a full lane width, minimum 300 ft. in length, and to the thickness shown on the plans.

The Engineer will determine the moisture content of the emulsified asphalt base in accordance with Tex-103-E. This moisture content will be used to determine a correction factor for Section 6.7.2, Density and Moisture Control.

When directed, proof-roll the control section in accordance with Item 216, "Proof Rolling." Proceed to full construction when approved by the Engineer.

6. CONSTRUCTION

Construct the layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or established by the Engineer.

- 6.1. **Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data and pertinent information for the mixture design and process control testing. Obtain the current version of the templates at <http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. Record and electronically submit all test results and pertinent information on Department-provided templates.
- 6.2. **Preparation of Existing Pavement for Treatment.** Before placement, remove existing asphalt pavement in accordance with Item 105, "Removing Treated and Untreated Base and Asphalt Pavement," when shown on the plans or as directed. Shape existing material in accordance with applicable bid items to conform to typical sections shown on the plans and as directed.
- 6.3. **Weather Restrictions.** Do not start production of the emulsified asphalt base when the surface temperature is below 60°F. Suspend operations when the Engineer determines that weather conditions are unsuitable.
- 6.4. **Mixing.** Apply the emulsion within 0.2% of the optimum percent emulsion content by the dry weight of material as determined from the mixture design. Thoroughly mix the material using approved equipment. Mix until a homogenous mixture is obtained. Upon completion of mixing, measure the moisture content of the emulsified asphalt base material before delivery to the project site in accordance with Tex-103-E. When the moisture content of the emulsified asphalt base is more than 2.0% of the optimum moisture content determined from the mixture design, suspend mixing and proceed as directed.

Do not stockpile or store any produced emulsified asphalt base. Discharge the material directly into hauling equipment to prevent segregation and haul to the project site. The Engineer will determine the emulsion content of the emulsified asphalt base stockpile using meter readings at a minimum of 1 per day of production.

6.5. **Individual Loads.** The Engineer can reject individual truckloads of emulsified asphalt base material. When a load of hot-mix is rejected for reasons other than contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results meet the laboratory mixture design properties shown in Table 2, payment will be made for the load. If test results do not meet, no payment will be made for the load.

6.6. **Placing.** Place the emulsified asphalt base in accordance with details shown on the plans. Haul the mixture to the roadway in clean trucks to ensure that it is not contaminated. Use an asphalt release agent shown on the Department's MPL to coat the inside of the truck when necessary. Begin placement immediately after hauling. Place the mixture only on an area where compacting and finishing can be completed during the same working day. Use paving equipment or spreaders to spread and shape the base material in a uniform layer in one pass, unless otherwise directed. When using paving equipment, do not exceed a thickness of 6". When constructing two individual lifts to the thickness of the base layer shown on the plans, complete construction for each section with both lifts within the same working day. Correct or replace segregated areas as directed, at no additional expense to the Department.

Construct vertical joints between new emulsified asphalt base and emulsified asphalt base that has been in place for 4 hrs. or longer. The vertical face may be created by using a header or by cutting back the face to approximately vertical.

Prepare the surface by removing vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.

6.7. **Compaction.** Compact the emulsified asphalt base mixture in one lift using density control, unless otherwise shown on the plans.

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Begin rolling at the low side and progress toward the high side on super elevated curves. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph, as directed.

Rework material that fails to meet or loses the required density, stability, or finish within 24 hrs of completion of compaction. Reworking includes loosening, adding material, or removing unacceptable material if necessary; mixing; compacting; and finishing as directed. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

When an area fails to meet or loses required density, stability, or finish more than 24 hrs after completion of compaction and before the next course is placed or the project is accepted, remove the unacceptable material and replace with new emulsified treated base or as directed. Compact and finish until specification requirements are met. Perform the work at no additional expense to the Department.

Before final acceptance, the Engineer will select the locations of tests and measure the depth of the emulsion treatment layer in accordance with Tex-140-E at a minimum of 1 per 3,000 CY or 1 per lift. Correct areas deficient by more than 1/2 in. in thickness by planing in accordance with Section 6.11, unless otherwise directed.

6.7.1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.

6.7.2. **Density and Moisture Control.** The Engineer will determine the roadway density and moisture content of completed sections in accordance with Tex-115-E using the correction factor from Section 5. The Engineer will perform testing for each day of production at a minimum of 1 per 3,000 CY or 1 per lift. The full depth of

the layer must be compacted to a minimum of 95.0% of the maximum density. The moisture content must be within 2.0 percentage points below the optimum moisture content and no more than 0.5 percentage points above the optimum moisture content determined from the mixture design in Section 2.6.

Perform additional compaction or rework the emulsified asphalt base, unless otherwise directed, when the material does not meet the density but meets the moisture content. Aerate and recompact when the moisture content is more than 0.5 percentage points above the optimum moisture content. Rework, add moisture, and recompact when the moisture content is more than 2.0 percentage points below the optimum moisture content.

- 6.8. **Tack Coat.** When using a paver to spread the emulsified asphalt base in multiple lifts to achieve the total base thickness as shown on the plans, use tack coat to bond the two lifts.
- 6.8.1. **Application.** Clean the surface by removing any objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply the tack coat to all surfaces that will come in contact with the subsequent lift, unless otherwise directed. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to structures. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.
- 6.8.2. **Sampling.** The Engineer will obtain at least one sample of the tack coat binder per project in accordance with [Tex-500-C, Part III](#), and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will notify the Contractor when the sampling will occur and will witness the collection of the sample from the asphalt distributor immediately before use.
- For emulsions, the Engineer may test as often as necessary to ensure the residual of the emulsion is greater than or equal to the specification requirement in Item 300, "Asphalts, Oils, and Emulsions."
- 6.9. **Curing.** Cure the finished section until the moisture content is a minimum of 2 percent below the optimum moisture content as measured for the full depth of the compacted layer, or as directed, before applying the next successive course. The Engineer may allow traffic on the finished section during curing when proof rolling indicates adequate stability.
- Proof-roll the roadbed in accordance with Item 216, "Proof Rolling". If deformation occurs, do not allow traffic to return to the finished section until the mixed material is firm enough to accommodate traffic without deformation. Apply seal coat or additional courses within 14 calendar days of final compaction.
- 6.10. **Irregularities.** Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities and areas where the mixture does not bond to the existing pavement.
- If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.
- 6.11. **Planing.** Plane the final compacted emulsified asphalt base after meeting the requirements in Section 6.7 of no more than 1" in accordance with Item 354 to meet the ride quality requirements in Section 6.12.
- 6.12. **Ride Quality.** Measure the ride quality of the base course before placement of the surface treatment. Use a certified profiler operator from the Department's MPL. When requested, furnish the Engineer documentation for the person certified to operate the profiler. Provide all profile data to the Engineer in electronic data files

within 3 days of measuring the ride quality using the format specified in [Tex-1001-S](#). The Engineer will use Department software to evaluate longitudinal profiles to determine areas requiring corrective action. Correct 0.1-mi.sections for each wheel path with an average international roughness index (IRI) value greater than 100 in. per mile to an IRI value of 100 in. per mile or less by planing, unless otherwise directed.

Re-profile and correct sections that fail to maintain ride quality, as directed. Correct re-profiled sections until specification requirements are met, as approved. Perform this work at no additional expense to the Department.

7. PROCESS CONTROL

Perform process control testing of the completed emulsified asphalt base stockpile in accordance with Table 3 at locations independent from the Engineer's testing locations, unless otherwise directed. Test results from process control will not be used for acceptance. Contractor may perform additional testing as they deem necessary for process control. Report test results and all pertinent information in accordance with Section 6.1. When test results do not meet specification requirements, modify mixing operations and perform the test methods required in Table 3. Suspend operations when any of the test results performed after the modifications do not meet specification requirements.

Table 3
Minimum Testing Frequency

Description	Test Method	Minimum Frequency
Emulsion Content	Meter Readings	1 per day of production
Moisture Content	Tex-103-E	2 per day of production

- 7.1. **Emulsion Content.** Verify the percentage of emulsion added to the flexible base material using meter readings. Changes in the emulsion content, type, or supplier must be approved before the start of production. Notify the Engineer when adjustments to the emulsion content are made during any day's production.

Moisture Content. Before the start of mixing, measure the moisture content of the flexible base stockpile in accordance with Tex-103-E. Upon completion of mixing, measure the moisture content of the emulsified asphalt base stockpile in accordance with Tex-103-E. Verify the moisture content when precipitation occurs after testing and before the emulsion is added.

8. MEASUREMENT

Emulsified asphalt base will be measured by the cubic yard in final position or square yard as a composite mixture of emulsion, flexible base, and when necessary cement.

Measurement by the cubic yard in final position and by the square yard is plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows:

- 8.1. **Cubic Yard in Final Position.** Emulsified asphalt base will be measured by the cubic yard in its final position. The volume of each course will be computed in-place between the original subgrade surfaces and the lines, grades, and slopes of the accepted base course as shown on the plans and calculated by the method of average end areas.
- 8.2. **Square Yard.** Emulsified asphalt base will be measured by the square yard of surface area. The dimensions for determining the surface area are established by the dimensions shown on the plans.

9. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Emulsified Asphalt Base (Plant-Mixed)," of the flexible base type, grade, and thickness (for square yard measurement) specified. For cubic yard measurement, "Final Position" will be specified. This price is full compensation for furnishing and disposing of materials (including cement and base); emulsion, storing, mixing, hauling, placing, tack coat, planing, sprinkling, compacting, finishing, curing, and maintaining and reworking of treated base; and equipment, labor, tools, and incidentals.

Rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item, unless otherwise shown on the plans. When proof rolling is shown on the plans or directed by the Engineer, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade or base courses are constructed under this Contract, correction of soft spots will be at the Contractor's expense. Where subgrade or base is not constructed under this Contract, correction of soft spots will be in accordance with pertinent Items or Article 4.4., "Changes in the Work."

Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Items or Article 4.4., "Changes in the Work."

9.1. **Thickness Measurement for Cubic Yard In Final Position and Square Yard Payment Adjustment.**

Before final acceptance, the Engineer will select the locations of tests within each unit and measure the treated base depths in accordance with [Tex-140-E](#).

9.1.1. **Units for Payment Adjustment.**

9.1.1.1. **Roadways and Shoulders.** Units for applying a payment adjustment for thickness to roadways and shoulders are defined as 1,000 ft. of treated base in each placement width. The last unit in each placement width will be 1,000 ft. plus the fractional part of 1,000 ft. remaining. Placement width is the width between longitudinal construction joints. For widening, the placement width is the average width placed of the widened section that is deficient in thickness.

9.1.1.2. **Ramps and Other Areas.** Units are defined as 2,000 sq. yd. or fraction thereof for establishing an adjusted unit price for ramps, intersections, irregular sections, crossovers, entrances, partially completed units, transitions to ramps, and other areas designated by the Engineer.

9.2. **Price Adjustments of Deficient Areas.**

9.2.1. **Thickness Deficiency \leq 1.0 in.** Table 2 will govern the price adjustment for each unit with deficient areas \leq 1.0 in.

Table 2
Measurements and Price Adjustment for Each Unit

Thickness Deficiency	Additional Measurements	Average Thickness Deficiency of 3 Measurements		Price Adjustment
≤ 0.5 in.	None	N/A		Full Payment
> 0.5 in.	2	≤ 0.5 in.		Full Payment
		> 0.5 in.	≤ 0.8 in.	75% Payment
		> 0.8 in.	≤ 1.0 in.	50% Payment
		> 1.0 in.		In accordance with Section 9.2.2, "Thickness Deficiency ≥ 1.0 in."

- 9.2.2. **Thickness Deficiency ≥ 1.0 in.** Remove and replace areas of treated base found deficient in thickness by more than 1.0 in., unless otherwise directed. Take exploratory measurements at 50-ft. intervals parallel to the centerline in each direction from the deficient measurement until a measurement is not deficient by more than 1.0 in. The minimum limit of non-pay will be 100 ft.
- 9.3. **Excess Thickness and Width.** For cubic yard in final position and square yard measurement, no additional payment will be made for thickness or width exceeding that shown on the plans.