

Section 2319. Slurry Leveling, Slurry Wedge, and Strip Slurry Treatment

2319.01 DESCRIPTION.

Evenly spread a properly proportioned mixture of emulsified asphalt, mineral aggregate, and water on a prepared surface as specified in the contract documents. When crack cleaning and filling is a part of this work, that work will be covered by a separate specification.

- A. **Slurry Leveling:** use fine slurry mixtures to fill shallow depressions in the pavement and adjacent to cracks.
- B. **Slurry Wedge (Edge Rut Treatment):** place a fine or coarse slurry mixture in a narrow wedge-shaped strip to correct the differential elevation between the pavement edge and the shoulder, as designated in the contract documents.
- C. **Strip Slurry Treatment:** longitudinal applications of fine or coarse slurry mixtures as designated in the contract documents.

2319.02 MATERIALS.

- A. **Asphalt Emulsion.**
Use a Grade CSS-1H or SS-1H emulsified asphalt meeting the requirements of [Section 4140](#).
- B. **Aggregate.**
Use a mineral aggregate consisting of crushed stone or a combination of crushed stone and mineral filler meeting the below requirements. The use of other crushed aggregates will be allowed when the Engineer approves. This may require the addition of an approved anti-strip additive to the slurry mixture.
 - 1. **Crushed Stone.**
Use crushed aggregates meeting the requirements of [Section 4124](#).
 - 2. **Mineral Filler.**
Mineral filler may be required to obtain the desired mixture consistency and the addition rate will be established by the Engineer, based on laboratory or field trials. Use mineral filler meeting the requirements for Type I Portland Cement.
 - 3. **Gradation.**
Use composite aggregate, excluding mineral filler, that complies with the following gradation limits for the specified slurry mixture required:
 - a. **Fine Slurry Mixture.**
Use aggregate meeting the requirements for Gradation No. 22 of the Aggregate Gradation Table in [Section 4109](#).
 - b. **Coarse Slurry Mixture.**
Use aggregate meeting the requirements for Gradation No. 23 of the Aggregate Gradation Table in [Section 4109](#).

C. Water.

Use fresh water which is free of sediment and salt contaminants. If the water is not compatible with the slurry mixture, the Contractor may be required to use water from another source.

2319.03 CONSTRUCTION.

A. Slurry Mixture

1. Composition and Quality of Mixture.

- a. Aggregate proposed for use on the project will be sampled by representatives of the Contracting Authority to determine a job-mix formula. After consulting with the Contractor, the Engineer will establish a job-mix formula for the mixture on the basis of gradation, asphalt content, durability, stability, and asphalt compatibility. This formula remains in effect until modified in writing by the Engineer. When noncomplying results or other unsatisfactory conditions make it necessary, the Engineer will establish a new job-mix formula, after consulting with the Contractor. Should a change in sources of materials be made, set a job-mix formula before the new material is used.
- b. Provide the Engineer with a copy of the certified gradations of aggregate proposed for use.

2. Asphalt Binder Content.

Requirements:

- a. Estimated asphalt residue content: 7% to 14% of the dry weight (mass) of the aggregate.
- b. Mixture design film thickness: 7.5 microns (190 μm) (target value) with a ± 0.75 microns (29 μm) permissible range.

B. Handling and Sampling Slurry Materials.

1. Stockpiling of Aggregate.

- a. Take precautions to prevent stockpile contamination with oversized rock, clay, silt, or moisture in excess of that which would interfere with the amount of asphalt emulsion required in producing the desired homogeneous slurry mixture.
- b. Place the stockpile in a well drained area. Do not allow the aggregate to become segregated.
- c. Control the moisture in the aggregate to be within $\pm 1.5\%$ of the moisture content of the aggregate at the time of calibration.

2. Storage.

- a. Provide suitable storage facilities for the asphalt emulsion. Use a container equipped to prevent water from entering the emulsion.
- b. Provide suitable and adequate heat to prevent freezing and to facilitate handling of the asphalt emulsion.

3. Sampling.

Furnish samples of materials during the process of the work as directed by the Engineer.

C. Equipment.

Obtain the Engineer's approval for all equipment, tools, and machines and maintain in satisfactory working order at all times.

1. Slurry Mixing Equipment.

- a.** Use a continuous flow mixing unit capable of:
 - Accurately delivering a predetermined proportion of aggregate, water, and asphalt emulsion to the mixing chamber, and
 - Discharging the thoroughly mixed product on a continuous basis.
- b.** Pre-wet the aggregate immediately prior to mixing with the emulsion. Use a pugmill capable of thoroughly blending all ingredients together.
- c.** Use a mixing machine equipped with an approved fines feeder that provides an accurate metering device, or method, to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed. Use a fines feeder to add mineral filler when required as part of the aggregate blend.
- d.** Use an aggregate feed to the mixer equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time.
- e.** Use a positive displacement type emulsion pump equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.
- f.** For adding water to the mixer, use a pump equipped with a valve to establish the required water flow.
- g.** Mechanically tie all controls to ensure accurate proportioning of all materials at all times, including starts and stops. On some machines, this can be a simultaneous start and stop of all materials. On other machines, depending on where the materials are introduced into the mixing chamber, the feeds must be properly synchronized.
- h.** Use a one-lever or one-button operation with no means for the operator to adjust the mix proportions, except for the water.
- i.** Use revolution counters that count 0.1 revolutions on mechanisms which turn less than 100 rpm.
- j.** Attach a metering device to the slurry machine for the addition of additive to the mixture or any component material. Use a device that has positive, quick-acting controls, is easily calibrated, and maintains accurate and uniform flow.
- k.** Provide a means for calibrating the mixer. Calibrate and properly mark the controls for proportioning each material to be added to the mix. Use equipment with controls placed so they are readily accessible for calibration and so the Engineer may determine the amount of each material being used at any time. A minimum of three aggregate gate settings will be required for calibration and, if changes in emulsion delivery are necessary, a minimum of three pump changes will be required.

- I. Use a mixing machine that:
 - Is equipped with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding spreading equipment,
 - Is controllable to an application range of 0.05 gallon per square yard (0.25 L/m²), and
 - Provides sufficient machine storage capacity to properly mix and apply a minimum of 5 tons (4.5 Mg) of the slurry, except when the mixing machine is operated in a continuous manner and is supplied by separate nurse type equipment.
2. **Slurry Spreading Equipment.**
 - a. **Slurry Wedge, Strip Slurry Treatment.**
 - 1) Use a mixer machine with an attached mechanical type squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor. Maintain the squeegee to prevent loss of slurry on varying grades and crown. Include a steering device and a flexible strike off.
 - 2) Use a spreader box capable of placing the slurry mixture to the width specified in the contract documents. Use a spreader box equipped with vertical adjustment devices attached to horizontal support devices (such as runners) located a minimum of 6 inches (150 mm) inside both ends at the side of the box. This is to ensure uniform distribution on varying grades and crowns. Use vertical adjustment devices of sufficient weight (mass) to keep the horizontal support devices in contact with the roadway surface during operation. Use flexible strike off material of sufficient stiffness to produce the desired texture and rate of application.
 - 3) Keep the spreader box clean. Do not allow build up of asphalt and aggregate on the box.
 - b. **Slurry Leveling.**

Use metal lutes of varying widths for spreading the slurry mixture in the depressed areas. Ensure the face of each lute is indented (arched) slightly (1/8 inch to 3/16 inch (3 mm to 5 mm)) to aid in controlling the spread. The Contractor may contact the Office of Maintenance Operations concerning design of these lutes.
3. **Cleaning Equipment.**

Use power brooms, power blowers, air compressors, water flushing equipment, or hand brooms for cleaning the surface and cracks.
4. **Auxiliary Equipment.**

Furnish hand squeegees, shovels, and other equipment as necessary to perform the work.
5. **Screening Unit.**

Use a screening unit to remove objectionable oversize and foreign material that may be encountered. Screen material before loading the slurry machine and/or weighing for payment.

D. Preparation of Surface.

1. Clean all loose material, soil tracked on the roadway surface, vegetation, and other objectionable material from the surface and cracks immediately prior to applying the slurry material. Clean cracks to a depth of 1 inch (25 mm) if they have not been completely filled prior to applying the slurry treatment.
2. Any standard cleaning method used to clean pavements, such as power brooms, compressed air, high-pressure water, and hand tools will be acceptable.
3. Water flushing will not be permitted in areas where considerable cracks are present in the pavement surface.
4. Obtain the Engineer's approval for surface preparation.

E. Tack Coat.

1. After surface preparation, tack coat the surface using a diluted emulsion of the same type and grade used in the slurry mixture. Dilute the emulsion (3 parts water to 1 part emulsion) and apply to the surface at a rate between 0.05 to 0.10 gallon per square yard (0.25 L/m² to 0.45 L/m²).
2. Obtain the Engineer's approval for the rate of application used.
3. Apply the tack coat the same day as the slurry seal.

F. Composition Rate and Application of the Slurry Mix.

1. Blend the amount of asphalt emulsion with the aggregate as determined by the laboratory mix design and after final adjustment.
2. Water may be added as necessary to obtain a fluid and homogeneous mixture.
3. Obtain the Engineer's approval for the mixture design application methods and rate of application.

G. Application of the Slurry Material.

1. **General.**
 - a. The Engineer may direct that the surface of the pavement be fogged with water, approximately 0.05 gallon per square yard (0.25 L/m²), immediately preceding the pass of the spreader. Ensure the mixture is of a consistency such that it "rolls" in the spreader in a continuous mass. Slurry that segregates in the spreader box so that flowing of liquids (water and emulsion) is evident is not acceptable, so do not apply to the surface.
 - b. Do not allow the total time for mixing aggregate and emulsion to exceed 4 minutes. Ensure a sufficient amount of slurry is present in

the spreader at all times to ensure that complete coverage is obtained. Lumping, balling, or unmixed aggregate will not be permitted. Do not allow emulsion and aggregate fines to become segregated from the coarse aggregate. If the coarse aggregate settles to the bottom of the mix, remove the slurry from the pavement.

- c. Keep breaking of the emulsion in the spreader box to a minimum to allow for a uniform distribution of the slurry mixture on the pavement. Do not leave streaks, such as those caused by oversized aggregate, in the finished surfaces.
- d. Apply Strip Slurry Treatment parallel to the center line, edge line, or other reference using a guide extending at least 3 feet (1 m) ahead of the application equipment.
- e. A mechanical device, such as an auger, may be used to distribute the slurry in the spreader box. The use of a mechanical device in the slurry distribution box for strip slurry treatment and slurry wedge application will generally not be required. The contract documents will state if a mechanical device is required.

2. Mix Consistency.

- a. To obtain a workable mix consistency and to eliminate overwatering, test the mix consistency according to Iowa Test Method 508, using Procedure B.2, Slurry Flow Test. The Engineer will determine the maximum flow for each slurry mixture.
- b. Once the maximum flow has been established, remove all slurry mix from the roadway that is found to exceed this maximum and replace with an approved mixture, at no additional cost to the Contracting Authority.
- c. Testing for consistency will be at the Engineer's discretion. The Engineer will inform the Contractor of the boundaries represented by the test sample when a change in the mixture is apparent.

3. Joints.

- a. Excessive build-up or unsightly appearance will not be permitted on longitudinal or transverse joints. Obtain the Engineer's approval for the use of burlap drags or other types of drags.
- b. A stringline will be required to obtain a neat appearing, straight line, longitudinal alignment. The Engineer will establish reference points. Set, follow, maintain, and remove the stringline. The stringline may be referenced to the mixing machine or the spreader box.

4. Hand Work.

Use approved squeegees to spread slurry in areas inaccessible to the slurry mixer. Do not leave an unsightly appearance from hand work.

5. Curing and Opening to Traffic.

- a. Allow the treated area to cure until it may be opened to traffic without pick-up or raveling of the slurry mixture.
- b. Repair any damage caused to the slurry surface by premature opening to traffic at no additional cost to the Contracting Authority.

6. Application of Slurry Leveling.

- a.** Ensure the surface to which the slurry leveling is to be applied is moist and clean of dust and foreign material. Scraping and brooming may be necessary.
- b.** Spread the slurry leveling mixture in depressions at and adjacent to cracks in the pavement. Spread to the full width of the depression. Level the slurry with a metal lute of the proper width to provide a smooth riding surface. Ensure the slurry leveling is neat in appearance. Do not allow spillage around and between leveled areas. Keep excess material at the pavement edge to a minimum. Scatter excess material across the adjacent shoulder.
- c.** Allow the slurry leveling to cure until such time as the area may be open to traffic without pick-up or raveling of the leveling mixture.
- d.** Ensure the cured slurry has a homogeneous appearance and a uniform texture, fills all cracks in the application area, and adheres to the surface.

H. Limitations.

- 1.** Schedule slurry placement to ensure the traffic lanes are opened to traffic 30 minutes before sundown of the same working day. When traffic is maintained, keep the entire roadbed free of construction equipment during non-working hours.
- 2.** Work will not be permitted on days described in [Article 1108.03](#).
- 3.** Do not place slurry mixture when the temperature on a shaded portion of the road is less than 50°F (10°C). Do not place slurry mixture after October 1 without written permission from the Engineer.
- 4.** When this work is done in conjunction with crack cleaning and filling, clean and fill cracks before performing slurry work. The application of slurry and the crack cleaning and filling activity may be done as one coordinated operation.
- 5.** When placing a strip slurry treatment, both edges of the slurry box must run on the pavement surface. Replace all pavement markings the day they are obliterated. Payment for pavement markings will be at contract unit price for this work.
- 6.** When the installation of strip slurry treatment is required at a pavement centerline or lane line, the Engineer may require such placement in two separate applications.
- 7.** When performing slurry wedge placement, one edge of the slurry box must run on the edge of the pavement surface. Do not allow this work to obliterate the pavement edge line. Replace all obliterated pavement markings the day they are obliterated and at no additional cost to the Contracting Authority.

I. Maintenance of Traffic.

1. Maintain Traffic Control according to the contract documents.
2. Repair damage to uncured slurry due to traffic at no additional cost to the Contracting Authority.

2319.04 METHOD OF MEASUREMENT.

Measurement will be as described below. Materials used for calibration purposes will be included in quantities measured for payment. These amounts are not to exceed 5 tons (5 Mg) of aggregate and 100 gallons (400 L) of asphalt emulsion.

A. Slurry Leveling.

Computed from the number of centerline miles (kilometers), measured to the nearest 0.1 mile (0.1 km), of slurry leveling based on the two-lane pavement width which exists in the limits of the work area. Application of slurry leveling work to auxiliary lanes within the limits of the project will not be measured for payment.

B. Slurry Wedge.

1. Slurry Wedge Aggregate.

- a. Tons (megagrams) of the type specified, measured to the nearest 0.1 ton (0.1 Mg), will be the quantity by weight (mass) of individual loads of aggregate used in accepted portions of the work.
- b. Deduction will not be made for moisture naturally occurring in the aggregate.
- c. The quantity of mineral filler will be included with the aggregate quantity.

2. Surface Preparation for Slurry Wedge.

Shoulder miles (kilometers) measured to the nearest 0.1 mile (0.1 km).

C. Strip Slurry Treatment.

1. Aggregate for Strip Slurry Treatment.

- a. Tons (megagrams) of the type specified, measured to the nearest 0.1 ton (0.1 Mg), will be the quantity by weight (mass) of individual loads of aggregate used in accepted portions of the work.
- b. Deduction will not be made for moisture naturally occurring in the aggregate.
- c. The quantity of mineral filler will be included with the aggregate quantity.

2. Surface Preparation for Strip Slurry Treatment.

Miles (kilometers) placed.

D. Asphalt Emulsion for Slurry Leveling, Slurry Wedge, and Slurry Treatment.

1. Gallons (liters). This volume will be computed using a calibrated tank stick or by the weight (mass) of asphalt emulsion used.

2. No deduction will be made for water in approved emulsion.
3. The gallons (liters) will be corrected for temperature to 60°F (16°C).

E. Tack Coat for Slurry Wedge and Strip Slurry Treatment.

The undiluted asphalt emulsion used for tack coat is incidental to asphalt emulsion, and will not be measured separately for payment.

2319.05 BASIS OF PAYMENT.

Payment will be the contract unit price as follows:

A. Slurry Leveling.

1. Per mile (kilometer).
2. Payment is full compensation for furnishing all the materials for the slurry mixture except the asphalt emulsion. It includes surface preparation, mixing, placing the mixture, and furnishing all equipment, tools, and labor.

B. Slurry Wedge.

1. **Slurry Wedge Aggregate.**
 - a. Per ton (megagram) of aggregate of the type specified used measured as provided above.
 - b. Payment is full compensation for furnishing all materials except the asphalt emulsion and tack coat. It includes all equipment and labor necessary to mix and apply the slurry.
2. **Surface Preparation for Slurry Wedge.**

Per mile (kilometer) for the number of miles (kilometers) of surface preparation satisfactorily completed.

C. Strip Slurry Treatment.

1. **Aggregate for Strip Slurry Treatment.**
 - a. Per ton (megagram) of aggregate of the type specified used measured as provided above.
 - b. Payment is full compensation for furnishing all materials except asphalt emulsion and tack coat. It includes all equipment and labor necessary to mix and apply the slurry.
2. **Surface Preparation for Strip Slurry Treatment.**

Per mile (kilometer) for the number of miles (kilometers) of surface preparation satisfactorily completed.

D. Asphalt Emulsion for Slurry Leveling, Slurry Wedge, and Slurry Treatment.

1. Per gallon (liter) for the number of gallons (liters) of asphalt emulsion used, measured as provided above.

2. Payment is full compensation for furnishing the asphalt emulsion.

E. Tack Coat for Slurry Wedge and Strip Slurry Treatment.

The undiluted asphalt emulsion used for tack coat is incidental to asphalt emulsion and the cost is to be included in the contract unit price for asphalt emulsion.