

400 FLEXIBLE PAVEMENT

ITEM 414 – MICRO-SURFACING

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414.01 Description. *This work consists of constructing a cold laid polymer modified emulsified asphalt pavement course to fill ruts and/or provide an intermediate or surface course for existing pavements. The paving mixture is composed of a polymer modified emulsified asphalt binder, crushed aggregate, mineral filler, water and other additives.*

414.02 Materials.

1. **Bituminous Material.** *Latex modified emulsified asphalt cationic, conforming to 702. The emulsified asphalt shall be a quick-set, polymer modified CSS-1h emulsion conforming to the requirements specified in AASHTO M 208 except the cement mixing test is waived. The polymer material shall be milled or blended into the asphalt or blended into the emulsifier solution prior to the emulsification process. The minimum polymer solids content will be 3.0% based on the residual of the emulsion. Additional requirements shall be:*

<i>Residue (1)</i>	<i>62+</i>	<i>AASHTO T-59</i>
<i>Test on Residue</i>		
<i>Softening point</i>	<i>140°F (60°C)</i>	<i>AASHTO T-53</i>
<i>Viscosity @ 140°F (60°C)</i>	<i>8,000 Poises</i>	<i>AASHTO T-202</i>

- A. *The temperature for this test shall be held below 180°F (82°C). The sample is oven evaporated on a glass plate at 77°F (25°C) for 24 hours (Forced Draft Oven). Material is then scraped from the plate with a razor blade tool.*
2. **Mineral Aggregate.** *Use mineral aggregate 100% crushed limestone, slag, trap rock, or gravel, meeting gradation specified in Table A at the quarry stockpile or after blending. It must be compatible with the latex modified emulsion, this shall be confirmed by the emulsion manufacturer.*

3. **Mineral Filler.** Use mineral filler of any recognized brand of non-air entrained Portland cement Type 1 (701.04), that is free of lumps. Accepted by visual inspection.
4. **Water.** Shall be potable and free from harmful soluble salts.
5. **Latex Modifier.** A latex based modifier with other emulsifiers, all milled into the asphalt emulsion by an approved emulsion manufacturer. Provide modifier capable of making emulsion mix cure sufficiently so normal traffic can be placed on the material in 1 hour without damaging the surface.
6. **Other Additives.** Supplied by emulsion manufacturer to control mix set time.

414.03 Mix Design.

1. *The manufacturer of the polymer modified emulsion shall submit a job mix formula (JMF) for the specific materials to be used on the project with certified test results for the Engineer's approval. The JMF shall state the following (all percentages are based on the dry weight of the aggregate):*
 - A. *Source of each individual material*
 - B. *Aggregate gradation*
 - C. *Percentage of aggregate*
 - D. *Percentage of mineral filler (minimum and maximum)*
 - E. *Percentage of water (minimum and maximum)*
 - F. *Percentage of mix set additives (if required)*
 - G. *Percentage of polymer modified CSS-1h emulsified asphalt*
 - H. *State the quantitative effects of moisture content on the unit weight of the aggregate*
 - I. *Results for the tests in the following table:*

Characteristic	Requirement	ISSA Test Method
<i>Wet Cohesion</i>		<i>TB-139</i>
<i>30 minutes Min. (set time)</i>	<i>12kg-cm</i>	
<i>60 minutes Min. (traffic)</i>	<i>20 kg-cm or near spin</i>	
<i>Wet Stripping, Min.</i>	<i>90%</i>	<i>TB-114</i>
<i>Wet Track Abrasion Loss</i>		<i>TB-100</i>
<i>One Hour Soak, Max.</i>	<i>538 g/m²</i>	
<i>Saturated Abrasion</i>		<i>TB-144</i>
<i>Compatibility, Max.</i>	<i>3g loss (.106 ounces)</i>	
<i>Mix Time @ 77°F (25°C)</i>	<i>Controllable to 120 seconds</i>	<i>TB-113</i>

Mix Time @ 104°F (40°C) Controllable to TB-113
35 seconds

The TB-139 (set time) and TB-113 (mix time) tests shall be checked at the highest temperature during construction. For the TB-113 test at 104°F (40°), all ingredients and containers shall be preheated.

Use aggregate in job mix formula that represent material to be used on the project.

Mix Types

- Type I** Used to seal cracks and fill voids or provide rich elastomer inner layer and tack prior to overlay.
- Type II** Used to seal cracks, fill voids and shallow ruts and provide wearing surface where ADT is less than 20,000.
- Type III** Used to fill moderate ruts and give a heavier wearing surface where ADT is 20,000 or greater.
- Type IV** Used to fill deep ruts up to 2 inches (50 mm) in single pass.

2. **Proportioning.** The Engineer will approve the design mix and all surfacing materials and methods prior to use and designate the proportions to be used within the following limits:

Surface	Type I	Type II	Type III	Type IV
Minimum Thickness inches (mm)	N/A	1/4 (6.4)	-	-
Mineral Aggregate lbs/sy (kg/m ²) dry wt.	<i>16+/-2 (9-1) 28+/-2 (15+1) Per Plan Note Per Plan Note</i>			

** Plan or proposal Note may be used to specify number of courses or application rates.*

Latex Emulsified Asphalt Residue By	7.0-8.5%	7.0-8.5%	6.0-8.5%	5.5-8.0%
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Wt. Of Aggregates
Mineral Filler 2% +/- 1.5 by weight of dry aggregate depending on weather conditions.

Latex Based Modifier	As Required	As Required	As Required	As Required
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Mis Set Additive	"	"	"	"
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It is permissible to increase binder content for slags and other absorptive aggregates.

3. **Composition of Mixture.** Provide aggregate and mineral filler within limits of Table A, asphalt emulsion, additive and water.

TABLE A
Composition by Weight Percentages
of Aggregate Gradations and Mineral Filler
Percentages by Weight

Passing Sieve	Type I	Type II	Type III	Type IV
1/2" (13 mm)	100	100	100	100
3/8," (9.5 mm)	100	100	95-100	90-100
#4 (4.75 mm)	85-100	85-100	65-85	50-70
#8 (2.36 mm)	50-80	50-80	45-65	40-55
#16 (1.18 mm)	40-65	40-65	28-45	25-40
#30 (600 μm)	25-45	25-45	19-34	19-34
#50 (300μm)	13-25	13-25	10-20	10-20
#200 (75μm)	5-15	5-15	4-10	4-10

4. **Sampling and Testing.** *The Contractor shall produce a mixture that will be in compliance with the JMF and the quality control tolerances. The methods described in this section shall be used by the Contractor to measure compliance. The Contractor shall maintain all compliance with specifications and quality control documentation and submit certified results to the Engineer.*
- A. **Asphalt Content.** The Contractor shall calculate the percent asphalt content of the mixture from the equipment counter readings randomly, a minimum of three times a day. The quality control single test tolerance is +/- 0.5% and the average daily asphalt content is +/- 0.2% from the JMF.
- B. **Application Rate.** The Contractor shall calculate the yield of the course being placed from the equipment counter readings randomly, a minimum of three times a day. The quality control tolerance from the specified application rate is +/- 21b/sy (1 kg/m².)
- C. **Documentation.** The Contractor shall maintain a daily report, providing control section, job number, route, date, air temperature, control settings (Calibration Values, Unit Weight of Emulsion, Percent Residue of Emulsion), beginning and ending intervals, counter readings (Beginning, Ending, and Total), length, width, total area, aggregate quantity, emulsion quantity,

percent of each material, percent of asphalt cement, application rate, combined application rate, and Contractor's signature.

414.04 Placement.

1. **Weather Limitations.** Place when the atmospheric temperature is 40° F (4° C) and rising or above, it is not raining and there is no forecast of temperature below 32° F (0° C) within 24 hours from the time the mixture is applied.
2. **Mixing Equipment.** Produce the mixture in a self-propelled front feed continuous loading mixing machine equipped with chain dragged conveyer belt aggregate delivery system and an inter-connected positive displacement water jacketed gear pump to accurately proportion ingredients. Provide a spray bar to completely wet the aggregate dropping down to pugmill with additive and water. Pugmill must be a continuous flow, twin shafted multi blade and at least 50 inches (1,270 mm) long. The emulsion shall be introduced beyond at least the 1/3 point up the mixer to insure proper mixing of aggregate, cement, additive and water before emulsion is added. Blade size and side clearances shall meet manufacturer's recommendations. Equipment mixer with remote speed control at the back mixing platform so the back operator can control forward speed and level of mixture in paving or rutbox. Provide material control devices, readily accessible and so placed that the inspector may determine the amount of each material used at any time. Calibrate each material control device prior to each mix type application.

Equipment machine with a water pressure system and nozzle type spray bar to provide a water spray ahead of and outside the spreader box when required.

Locate mineral filler feed so the proper amount of cement is dropped on the aggregate before discharge into mixer.

Truck mounted machine with positive, non-slipping aggregate delivery system may be used on small projects of less than 15,000 s.y. (12,541 m²).

3. **Spreading Equipment.** Spread the mixture uniformly by means of a mechanical type squeegee box attached to the mixer, equipped with paddles mounted on adjustable shafts to continually agitate and distribute the materials throughout the box or causing excessive side build-up and lumps. Attach flexible seals, front and rear, in contact with the road, to prevent loss of mixture from the box. Rut filling equipment requires movable steel strike-off. Operate spreading equipment to prevent the loss of mixture on super-elevated curves. Spread the mixture to fill cracks and minor surface irregularities and leave a uniform high-skid resistant application of aggregate and asphalt on the surface. Operate spreader box so a uniform consistency is achieved without causing skips, lumps or tears in the finished surface.

4. **Surface Preparation.** Prior to applying mixture, clean the surface of vegetation, loose materials, dirt, mud and other objectionable items. *A tack coat shall be applied to the existing pavement surface prior to application of the Micro-surfacing. The tack coat shall consist of a diluted CSS-1h emulsified asphalt. Dilution will be 1 part water to 1 part CSS-1h emulsion. The rate of application of the diluted material will be 0.05 gal/sy (.2L/M²). Application of the tack coat will be made to the existing pavement prior to the leveling course. No tack coat will be required between the leveling and surface courses if applied within 5 days of leveling. Cost of this shall be included in Item 414, Micro-surfacing.*

5. **Application.** Spread the mixture to fill minor cracks and shallow potholes and leave a uniform surface. Take care when rut filling to restore the designed profile of the pavement cross section. Avoid excess crowning (over filling) of rut areas. Use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading.

Carry a sufficient amount of material, at all times, in all parts of the spreader box so complete coverage is obtained. Water may be sprayed into spreader box to facilitate spreading without harming the mix. No lumping, balling or unmixed aggregate is permitted in the finished surface.

Adjustments to the additive may be required for slow setting when hand spreading is needed. When hand spreading, pour the mixture in small window along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute.

In areas with adjacent concrete curb or curb and gutter which are not to be treated, the Contractor shall use special care to avoid covering the concrete. If the Engineer determines that insufficient care is being taken to protect the concrete, masking with suitable material may be ordered by the Engineer at no additional cost to the City.

Make a neat appearing seam when 2 passes join. Remove excess material from ends of each run immediately.

6. **Compaction.** Rolling may be required. Roll with pneumatic-tired roller equipped with tread tires with tire pressure of 40-60 psi (275-413 kPa).

414.05 Method of Measurement. The *micro-surfacing* shall be measured and paid for by the square yardage (square meters) of work completed and accepted as designated by the engineer for each type applied. A payment reduction will be applied for any *micro-surfacing* found to be deficient.

414.06 Basis of Payment. Payment for accepted quantities complete in place will be paid for at the contract unit price per square yard (square meter) which price and payment shall be full compensation for furnishing and placing all materials; provided, however, that the micro-surfacing meets the weight requirements.

Payment will be reduced for streets that fall below the specified rate of application. The rate of pay will be reduced by 15 percent of pay quantity for each pound (kilogram) below the plan rate.

No additional payment over the unit contract bid price will be made *for micro-surfacing* which has an average weight in excess of that shown in the plans.

Payment for accepted quantities, complete in place, will be made at the contact price for:

Item	Unit	Description
414	Square Yard (Square Meter)	<i>Micro-surfacing, Type _____</i>

