

SPECIFICATIONS FOR SINGLE PASS ASPHALT RECYCLING

Scope of Work

This work shall consist of recycling the existing pavement as specified to the depth indicated on the plans or in the specifications and/or in close conformity to the existing line, grade, and width, virtually eliminating conventional grading and rolling behind the recycling machine. This method of recycling shall be “Single Pass Asphalt Recycling.”

General Description

Through a Single Pass Asphalt Recycling machine, the pavement’s existing asphalt shall be milled to a designated depth, mixed with an asphalt emulsion additive, passed through a grid system, and finally augered through a vibrating compaction screed. Grading and rolling of inaccessible areas shall follow to insure proper drainage and compaction.

The recycled material shall be such that 95-100% meet a gradation of one and one half (1 1/2) inches or smaller. Although the specified pavement thickness will be designated in the proposal, the contractor may be required to vary the depth to insure that the underlying subgrade is not disturbed.

Asphalt Recycling Machine

1. Milling Drum: The milling drum shall operate in an upmilling direction and be equipped with 140 teeth plus end of drum 23 teeth segments to insure a square cut. The machine shall be equipped with a fully automatic performance regulator that automatically regulates the working speed with the milling drum pressure. The milling width shall be a minimum of eighty (80) inches.
2. Milling Depth and Slope Controls: The “Single Pass Asphalt Recycler” shall be equipped with an automatic grade control. The nominal milling depth shall be set on both sides of the machine. The grade control shall maintain depth by constantly monitoring both of the rear positioning cylinders to insure uniform depth from the crown of the road to the road’s edge. The recycling machine shall be equipped with a slope control device that permits the milling to be sloped from 0” to 5/8” per foot in either direction.
3. Crawler Tracks: All four crawler tracks shall be equipped with rubber pads to eliminate damage to existing pavement not included in the project. Rubber-tired machines will not be permitted.
4. Liquid Asphaltic Emulsion Metering System: The additive system shall have an electronic control unit for selecting and measuring the required amount of asphaltic emulsion. The control unit shall also monitor the amount of emulsion that the volumetrically controllable pump sends to the injection nozzles. It shall also have a programmable microprocessor that compensates for variables such as forward speed of the machine, the milling depth, milling width, and material density to always provide the correct percentage of emulsion additive. The recycling width shall vary by opening and closing valves to the individual injection nozzles.
5. Variable Paving and Compaction Screed: The recycling machine shall be equipped with a vibrating paving screed capable of shaping to grade and profile, including precompaction in a “Single Pass”.

Preparation

If applicable, prior to the “Single Pass Asphalt Recycling” procedure, the contractor shall remove existing pavement adjacent to the existing vertical curb, curb and gutter, or pavement edge to a depth as determined by the thickness of the new pavement or as directed by the Engineer. The width of the pavement removal shall be at least four (4) feet or as determined by the Engineer in the field.

Excess grindings as a result of this operation shall be removed from the site.

Materials and Application Rates

The asphalt emulsion shall be Cationic Cyclogen ME-CSS1, and be mixed at the rate of .50 gallons per inch depth per square yard. This rate can vary due to field conditions, test results, and the Engineer (or his field representative’s decision).

Grading and Compaction

Fine grading and compaction shall follow the “In-Place Asphalt Recycling” operation, specifically areas which may not be accessible. Grading shall meet requirements for bituminous base material for ODOT #301. Compaction shall meet the requirements of ODOT #401.

Cationic Cyclogen ME -CSS-1

The Recycling Agent Cyclogen ME shall be composed of petroleum resin oil base emulsion with water. The recycling agent Cyclogen ME shall be blended with Emulsified Asphalt CSS-1 at a ratio varying between 15% and 25% by volume as required by a job mix formula prepared by the contractor and approved by the Engineer.

Specification for CSS-1

Viscosity, Saybolt Furol at 77 degrees F

min	max
20	100

Storage Stability Test 24h% 1

Particle Charge Test	(Positive)
Sieve Test	0.10 Max
Cement Mixing Test	2.0 Max

Distillation

Oil Distillate by Volume of Emulsions, % Residue 57 min

Test Residue

Penetration	100 min	250 max
Ductility	40 min	
Solubility in trichlorethylene		97.5%

Specification for Cyclogen ME

The Emulsified Recycling Agent shall be composed of a petroleum resin oil base uniformly emulsified with water. The contractor shall submit a certified statement from the recycling agent manufacturer showing that the emulsion conforms to the following physical and chemical requirements.

Test-Emulsion	ASTM Test Method	Requirements	
		Min	Max
Viscosity @ 25°C, SFS	D-244	15	40
Residue, %wt	D-244 (Mod)	60	65
Miscibility Test	D-244 (Mod)	No coagulation	
Sieve Test, %wt	D-244 (Mod)	-0.1	
Particle Charge Test	D-244	Positive or Neutral	

ASTM D-244 Modified Evaporation Test for percent of residue is made by heating 50 gram sample to 149°C (300° F) until foaming ceases, then cool immediately and calculate results.

Test procedure identical with ASTM D-244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.

TEST ON EMULSION RESIDUE FROM DISTILLATION

Property	Function & Purpose	ASTM Test Method	Required
Viscosity @ 60°C cSt	Asphalt Viscosity Adjustment in recycled mix	D-2170	200-500
Flash Point, COC, °C	Handling Precaution	D-92	204 min.
Volatility, IBP, °C 2% v, °C 5% v, °C	Avoidance of air pollution and hardening by evaporation	D-1160 10mm	149 min. 191 min. 210 min.
RFT-C Weight Change, %wt.	Durability of the Recycling Agent	D-2872	4.0 max.
Compatibility, PC/S	Avoidance of Syneresis	D-2006-70	0.5 min.
Saturates %wt.	Compatibility with aged asphalt	D-2007	28 max.
Asphaltenes, %w	Compatibility with aged asphalt	D-2006-70	1.0 max.
Chemical Composition (PC+A/S+A)	Durability of asphalt in recycled mix	D-2006-70	0.4-0.8
RTF-C Ratio*	Durability of asphalt in recycled mix	D-2872	2.5 max.

*Viscosity, RTF-C residue @ 60 degrees C cSt/ viscosity, original materials @ 60 degrees cSt.

The materials shall be a naphthanic base cationic emulsion and shall have the capability of rejuvenating by increasing the ductility and penetration value of the asphalt binder in the material to be recycled. This will be verified by the Pre & Post Test Comparisons.

The contractor shall furnish a notarized manufacturer's certification attesting to conformance to the above physical and chemical requirements. Previous use documentation will be required for similar type applications.

Preliminary Testing

Test core samples have been extracted from random locations by the Engineer to determine the depth of asphalt on each pavement to be recycled. In addition, preliminary data as to aggregate gradation and quantity of residual asphalt binder in each pavement has been determined. This data is attached and is made a part of these specifications, and is for use by prospective bidders in preparing their bid.

Mix Design

It shall be the Contractor's responsibility to remove samples of pavement and perform the hereinafter described testing to establish an approved mix design. The proposed mix design shall be submitted to the Engineer at least 2 days prior to the start of work on any pavement section.

A representative sample shall be taken for 8,000 square yards of pavement to be recycled, or at each visible change in the mix type. The aggregate and asphalt binder shall be separated and analysis of the aggregate gradation and amount, penetration value and viscosity of the residual asphalt shall be performed. The basic properties of the pavement to be recycled shall be determined as follows: A representative sample of pavement to be recycled, about 5 kg, for each test area shall be heated at 140 F for approximately one half hour and then crumbled, taking care not to crush the aggregate. The residual asphalt shall be extracted from a 4 kg. sample of the crumbled pavement by absom recovery method. The recovered asphalt shall be evaluated for percent of total pavement sample by weight, penetration value at 77 F and viscosity of 140 F. The sample aggregate shall be dried and a sieve analysis performed to determine: percent retained on No. 8 sieve, percent retained on No. 200 sieve, percent passing No. 200 sieve. From the gradation data, the asphalt demand of the aggregate sample shall be determined by the following formula.

$$P = \frac{(4R + 7S + 12F) \times C}{100}$$

$$\text{Asphalt Recycling Agent Required} = P \times A$$

Where:

P= weight percent of asphalt in the mix

R= weight percent of rock in the aggregate, retained on No. 8 sieve

S= weight percent of "sand" defined as the portion in the aggregate passing No. 8 sieve, retained on No. 200 sieve

F= weight percent of fines in the aggregate, passing No. 200 sieve, and

A= Asphalt Content, sample extraction

C= a factor to adjust from new aggregate (c= 1.0) to recycled aggregate. Therefore if:

Penetration value of recovered AC is 15 or less C = 1.2

Penetration value of recovered AC is greater than 15 C = 1.1

Fines (F) passing No. 200 sieve exceed 7.5% C=1.2

A check of moisture content in the pavement to be recycled shall be performed. It is required that a Minimum moisture content of 4% be maintained throughout the blending and compaction operation.

Should additional moisture above the designed percentage of recycling agent be necessary then water shall be added to said agent to satisfy the requirement.

Recycling Agent

The asphalt recycling agent shall be composed of a petroleum resin oil base uniformly emulsified with water. The Contractor shall submit a certified statement from the recycling agent manufacturer showing that the asphalt recycling emulsion conforms to the following physical and chemical requirements.

SPECIFICATIONS FOR RECYCLING AGENT

<u>TESTS- EMULSION</u>	<u>ASTM TEST METHOD</u>	<u>REQUIREMENTS</u>
Viscosity @ 25 C, SFS	ASTM D-244	15- Pumping
stability	GB Method**	Pass
Emulsion coarseness	Sieve test	0.1 max.
%w	ASTM D-244***	
Sensitivity to fines,	Cement mixing,	2.0 max.
%w	ASTM D-244	
Particle charge	ASTM D-244	Positive
Concentration of oil phase, %w	(MOD)****	60 min.

Meets all requirements of Pacific Coast User Producer specs for Asphalt Recycling Agents dated 5-15-79.

- ** The following suitable pumping temperatures, M-88 C (190F).
- *** Viscosity, ATF-C residue @ 60 C cSt/viscosity, original materials @ 60 cSt.
- **** For conversion to Tons use 242 gal/ton.

SPECIFICATIONS FOR RECYCLING AGENT RESIDUE

TESTS-EMULSION	ASTM TEST METHOD	REQUIREMENTS
Viscosity @ 60 C, cST	D-2170	1000-4000
Flash Point, COC, C	D-92	232 min.
Volatility,		
IBP, C	D-1160, 10mm	163 min.
2% v, C	D-1160, 10mm	204 min.
5% v, C	D-1160, 10mm	221 min.
RTF-C Weight Change, %w	D-2872	2.0 max.
Compatibility, PC/S	D-2006-70	7.0 max.
Saturates, %w	D-2007	28 max.
Asphaltenes, %w	D-2006-70	7.0 max.
Chemical Composition, (N + A1)/ (P + A2)	D-2006-70	0.6 - 1.0 max.
RTF-C Ratio**	D2872	2.5 max.
Specific Gravity***	D-70	0.98 - 1.02

Suitable pumping temp: 88 C (190F)

- ** Viscosity, RTF-C residue @ 60 C cSt/viscosity, original materials @ 60 C cSt.
- *** For gal./ton conversion use 242 gal./ton

Additional Additives

To provide additional stability and obtain optimum moisture content during curing a 35% calcium Chloride solution shall be injected into recycled mat. Based on preliminary mix design where the asphalt content is less than 6% .30 to .35 gallons per square yards calcium chloride solution is required. Where asphalt content exceeds 6% .60 to .70 gallons per square yard calcium chloride solution is required.

For gallon/ton conversion, use 242 gallons/ton

Field Conditions

The equation system is used for estimating purposes only and may change as field conditions vary. Final decisions and field adjustments for amount of Cyclogen ME and additional water additive shall be made in concert by both the Contractor and the Engineer or the Field Inspector.

Basis of Payment

- (1) Square Yards of Single Pass Recycling included testing and mix design.
- (2) Gallons of CSS-1 or undiluted Recycling Agent Cyclogen M.E. or a blend of all.