Please see highlighted sections to determine street sweeping, resident notification, aggregate, field testing responsibilities, and basis of payment.

Emulsified Maltene-Based Rejuvenator:

A. **General Scope:** This work shall consist of furnishing all labor, material and equipment necessary to perform the operations for the application an Emulsified Maltene-Based Asphalt Rejuvenating Agent to bituminous asphaltic surface courses. The rejuvenation of surface courses shall be by spray application of a cationic **Maltene-Based** Rejuvenating Agent composed of petroleum oils and resins emulsified with water. The base used for the emulsion shall be a naphthenic base stock. The asphalt binder rejuvenation shall be affected through maltene replacement technology. All work shall be in accordance with the specifications, any applicable drawings, and subject to the terms and conditions of this contract.

B. **Pre-Construction:** The CONTRACTOR shall present samples of materials, laboratory reports, calibration reports, and proof of work experience as required by these specifications to the Resident Engineer at the pre-construction meeting.

C. **Material Specifications:** The emulsion will be a naphthenic petroleum maltene-based rejuvenating agent composed of four petroleum maltene components (listed below) uniformly emulsified with water. Each bidder must submit with his bid a certified statement from the asphalt rejuvenator manufacturer showing that the asphalt rejuvenating emulsion conforms to the required physical and chemical requirements.

SPECIFICATIONS

Tests	Test Method ASTM	AASHTO	Requirements Min.	Max.	
Tests on Emulsion:					
Viscosity @ 25°C, SFS	D-244	T-59	15	40	
Residue, % W[1]		D-244(Mod.)	T-59(Mod)	60	65
Miscibility Test[2]		D-244(Mod.)	T-59(Mod)	No Coagulation	
Sieve Test, %W[3]		D-244(Mod.)	T-59(Mod)	-	0.1
Particle Charge Test	D-244	T-59	Positive		
Percent Light Transmittance[4]	GB	GB	-	30	
Tests on Residue from Distillation:					
Flash Point, COC, °C	D-92	T-48	196	-	
Viscosity @ 60°C, cSt	D-445	-	100	200	
Asphaltenes, %w		D-2006-70	-	-	1.00
Maltene Dist. Ratio		D-2006-70	-	0.3	0.6
$\frac{PC + A_1}{S + A_2}$[5]					
PC/S Ratio[5]		D-2006-70	-	0.5	-
Saturated Hydrocarbons,S[5]		D-2006-70	-	21	28

[1] 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.
[2] Test procedure identical with ASTM D-244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.
[3] Test procedures identical with ASTM D-244-60 except that distilled water shall be used in place of two percent sodium oleate solution.
[4] Test procedure is attached.
[5] Chemical composition by ASTM Method D-2006-70:
PC = Polar Compounds, A_1 = First Acidaffins
A_2 = Second Acidaffins, S = Saturated Hydrocarbons

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D. Material Performance: The asphalt rejuvenating agent shall have the capability to penetrate the asphalt pavement surface and performing as follows. The asphalt rejuvenating agent shall be absorbed and incorporated into the asphalt binder. Verification that said incorporation of the asphalt rejuvenating agent into the asphalt binder has been effected shall be by analysis of the chemical properties of said asphalt binder i.e. viscosity shall be reduced by petroleum maltene fraction replacement method to the following extent. For pavements receiving the first or original application of rejuvenating agent the viscosity shall be reduced by an AVERAGE of thirty-five, (35%) percent as determined by dynamic shear rheometer (DSR) method for asphalt testing in accord with AASHTO T315-05. For retreated pavements after an initial treatment with the asphalt rejuvenator the viscosity shall be reduced by petroleum maltene replacement method a minimum of twenty percent(20%)as determined by dynamic shear rheometer (DSR) method for testing in accord with AASHTO T315-05. In addition the phase angle shall be increased. This analysis shall apply to extracted asphalt binder, taken from cores extracted fifteen to thirty days following application, in the upper three eights inch (3/8") of pavement. In addition the treated areas shall be sealed in-depth to the intrusion of air and water.

When directed by the Engineer, the Contractor shall have the following additional testing performed . The extracted asphalt binder taken from the treated and untreated cores as heretofore outlined shall be further tested per ASTM D-2006-70 Rostler Analysis. The results of this testing shall indicate a decrease in the percent asphaltene content for the treated samples as compared to the untreated samples.

The bidder must submit with their bid:

1. Asphalt Rejuvenator product name and descriptive literature. Literature shall be descriptive and detailed information and shall show it at least meets the material specifications.

2. A current Material Safety Data Sheet (SDS) for the material showing Current CAS#'s

3. The manufacturer's certification that the material proposed for use is in compliance with these specification requirements.

4. Previous use documentation and test data conclusively demonstrating that the rejuvenating agent has been used successfully for a period of 5 years by government agencies such as Cities, Counties, or DOT's.

5. Testing data from a minimum of five projects showing that the asphalt rejuvenating agent has been proven to perform, as heretofore required, through field testing by an independent testing laboratory as to the required change in the asphalt binder viscosity and percent asphaltene content.

6. Minimum of 2 physical test spots throughout state showing the products physical performance. Treatment shall be a minimum of 2 years in age showing significant surface mending, healing, and preservation qualities as compared to the adjacent control section constructed from the same asphalt mat. Detailed pictures shall be submitted with bid outlining age, location, and clear delineation between the treated and untreated section

7. Written Experience outline of the project superintendent

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E. **Product Standards**: The product "Reclamite"® produced by Tricor Refining, LLC is the standard for the naphthenic emulsified petroleum maltene-based asphalt rejuvenating agent requirements and the prices quoted on the Bid Sheet Base Bid shall be for one of these standards. Bidders may offer an ALTERNATE.to the standard specification. ALTERNATE products are subject to a 2 year testing pilot free of charge to the agency. Testing of the product must be completed before ALTERNATE can be considered.

F. **Rejuvenator Acceptance**: (Product sampling) The Engineer will take samples of the rejuvenation product proposed for use upon delivery of each shipment in accordance with ASTM D140 and store in accordance with the MSDS, Section VII for a period of at least six months after payment. Testing, as necessary, will be accomplished by the Engineer to verify information provided by the MSDS information

G. **Applicator Experience:** The asphalt rejuvenating agent shall be applied by an experienced applicator of such material. The bidder shall have a minimum of 5 years experience in applying the product proposed for use on municipal streets. The Contractor must submit with his bid a list of five (5) projects on which he applied said rejuvenator. He shall indicate the project dates, number of square yards treated in each and the name and phone number of the manager in charge of each project.

A project superintendent knowledgeable and experienced in application of the asphalt rejuvenating agent must be present and in control of each day's work.

H. **Application Temperature and Weather Limitations:** The temperature of the asphalt rejuvenation emulsion, at the time of application shall be as recommended by the manufacturer. The asphalt rejuvenating agent shall be applied only when the existing surface to be treated is thoroughly dry. The asphalt rejuvenating agent shall not be applied when the ambient temperature is below 40 degrees Fahrenheit or when temperatures are forecasted to fall below 35 degrees Fahrenheit within twenty-four (24) hours of application. It shall be the discretion of the Resident Engineer to determine when weather conditions are not appropriate for the application to occur. Contractor shall halt the application process when so ordered by the Resident Engineer.

I. **Handling of Asphalt Rejuvenating Agent:** Contents in tank cars or storage tanks shall be circulated at least forty-five minutes before withdrawing any material for application. When loading the distributor, the asphalt rejuvenating agent concentrate shall be loaded first and then the required amount of water shall be added. The water shall be added into the distributor with enough force to cause agitation and thorough mixing of the two (2) materials. To prevent foaming, the discharge end of the water hose or pipe shall be kept below the surface of the material in the distributor which shall be used as a spreader. The distributor truck will be cleaned of all of its asphalt materials, and washed out to the extent that no discoloration of the emulsion may be perceptible. Cleanliness of the spreading

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equipment shall be subject to inspection and the Contractor shall halt the application process when so ordered by the Project Engineer

J. **Application Equipment:** The distributor for spreading the emulsion shall be self- propelled, and shall have pneumatic tires. The distributor shall be designed and equipped to distribute the asphalt rejuvenating agent uniformly on variable widths of surface at readily determined and controlled rates from 0.05 to 0.5 gallons per square yard of surface, and with an

allowable variation from any specified rate not to exceed five (5) percent of the specified rate. Distributor equipment shall include full circulation spray bars, pump tachometer, volume measuring device and a hand hose attachment suitable for application of the emulsion manually to cover areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the emulsion within the tank. A check of distributor equipment as well as application rate accuracy and uniformity of distribution shall be made when directed by the Resident Engineer. The truck used for sanding shall be equipped with a spreader that allows the sand to be uniformly distributed onto the pavement. The spreader shall be able to apply 1 to 4 pounds of sand per square yard in a single pass. The spreader shall be adjustable so as to not broadcast sand onto driveways or tree lawns. Any equipment which is not maintained in full working order, or is proven inadequate to obtain the results prescribed, shall be repaired or replaced at the direction of the Resident Engineer.

K. **Application of Rejuvenating Agent:** The asphalt rejuvenating agent shall be applied by a distributor truck at the temperature recommended by the manufacturer and at the pressure required for the proper distribution. The emulsion shall be so applied that uniform distribution is obtained at all points of the areas to be treated. Distribution shall be commenced with a running start to insure full rate of spread over the entire area to be treated. Areas inadvertently missed shall receive additional treatment as may be required by a hand sprayer application. Application of the asphalt rejuvenating agent shall be on one-half width of the pavement at a time. When the second half of the surface is treated, the nozzle nearest the center of the road shall overlap the previous by at least one-half the width of the nozzle spray. In any event the construction joint of the pavement shall be treated in both passes of the distributor truck. Before spreading, the asphalt rejuvenating agent shall be blended with water at the rate of 60% rejuvenating agent and 40% water, by volume or as specified by the manufacturer. The combined mixture of asphalt rejuvenating agent and water shall be spread at the rate of 0.05 to 0.10 gallons per square yard, or as approved by the Resident Engineer following field testing. Where more than one application is to be made, succeeding applications shall be made as soon as penetration of the preceding application has been completed and approval is granted for additional applications by the Resident Engineer. Grades or super elevations of surfaces that may cause excessive runoff in the opinion of the Resident Engineer shall have the required amounts applied in two (2) or more applications as directed. Said treatment shall be uniformly applied by a method acceptable to the Resident Engineer. Care should be taken during all rejuvenator applications to not get excessive material on the curb and gutter. Additional cleaning may be required if this occurs at the contractor's expense. After the rejuvenating emulsion has penetrated, a

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coating of sand shall be applied to the surface in sufficient amount to protect the traveling public as required by the Resident Engineer. The Contractor shall furnish a quality inspection report showing the source and manufacturer of asphalt rejuvenating agent. When directed by the Resident Engineer, the Contractor shall take representative samples of material for testing.

L. **Field Testing:** Viscosity and penetration testing shall be done on three different streets during the application process. Four (4) cores shall be taken at each location prior to and approximately 15-60 days following the application of the maltene-based asphalt rejuvenator. Core locations will be determined by the Project Manager and core holes shall be filled with approved mix. The top three-eighths (3/8) inch of each core shall be removed and the asphalt extracted and recovered using California Test Method 365 (CTM 365). Viscosities of the recovered asphalt binder shall be determined using the Dynamic Shear Rheometer (DSR) in accordance with AASHTO T315-05. The results from the pre-treatment and the post-treatment cores from each street shall be compared and the present change in each calculated. The average value of the pre- treatment results and the post treatment results will be used to determine the final Viscosity and phase angle. No compensation will be made for material not meeting specifications. Test indicating failure to meet the specifications may result in additional tests being required on other streets. No additional compensation will be made for additional testing. Testing shall be performed by an independent third party testing laboratory that has experience with the specified test methods and equipment. Testing shall be coordinated with owner's materials testing laboratory and in their presence when cores are extracted or when required by the Project Engineer. The owner reserves the right to extract treated cores 2 years after rejuvenator application. Viscosity values shall be determined using AASHTO T315-05 and compared to the original untreated values.

M. **Street Sweeping:** The Contractor shall be responsible for sweeping and cleaning of the streets prior to and after treatment. Prior to treatment, the street will be cleaned of all standing water, dirt, leaves, foreign materials, etc. This work shall be accomplished by hand brooming, power blowing or other methods approved by the Resident Engineer. If hand cleaning is not sufficient, then a self-propelled street sweeper shall be used. All sand used during the treatment must be removed no later than forty-eight (48) hours after treatment of the street. This shall be accomplished by a combination of hand and mechanical sweeping. All turnouts, cul-de-sacs, etc. must be cleaned and free of any material that would interfere with the treatment. All debris generated by sweeping shall be picked up and disposed of by the contractor. Street sweeping shall be included in the price bid per square yard for asphalt rejuvenating agent. If after sand is swept and it is determined that a hazardous condition exists on the roadway, the Contractor must apply additional sand and sweep no later than twenty-four (24) hours following reapplication. No additional compensation will be allowed for reapplications and removal of sand.

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N. **Traffic Control and Safety:** The Contractor shall schedule his operations and carry out the work in a manner to cause the least disturbance and/or interference with the normal flow of traffic over the areas to be treated. Treated portions of the pavement surfaces shall be kept closed and free from traffic until penetration has become complete and the area is suitable for traffic. Cure time shall be no longer than 90 minutes. When traffic must be maintained at all times on a particular street, then the Contractor shall apply asphalt rejuvenating agent to one (1) lane at a time. Traffic shall be maintained in the untreated lane until the traffic may be switched to the completed lane. Access to adjacent properties shall be maintained during the application. The Contractor shall be responsible for all traffic control and signing required to permit safe travel. All signing and barricading of the work zone shall comply with MUTCD guidelines and State standards. The Contractor shall notify the Resident Engineer as to the streets that are to be treated each day. All support vehicles used shall also have flashing beacons that can be seen from all sides of the vehicle, for safety considerations for all work on major arterials. If the Contractor fails to provide the required signing, the Contractor shall stop all operations until safe signing and barricading is achieved.

O. **Spreading/Ordering of Sand or Screenings:** The Contractor will furnish and apply sand or lime screenings. The contractor shall furnish all equipment, tools, labor and incidentals necessary to perform the sanding operation in accordance with this contract. Spreading shall consist of applying free flowing sharp sand, FA2 or limestone screenings to insure even distribution of the sand or screenings to be worked into any voids in the payment surface as directed by customer representative. The aggregate distributor shall apply sand or screenings at a rate of 1-4 pounds per square yard.

Aggregate distributor must be able to carry enough aggregate to cover an applied load of the rejuvenating agent, at least (9) nine tons. Repeated sanding may be required on some areas of pavement and contractor must be available on an as needed basis to provide the required sanding.

P. **Resident Notification:** The Contractor shall distribute by hand, a typed notice to all residences and businesses on the street to be treated. The notice will be delivered no more than 24 hours prior to the treatment of the road or as required by each individual agency. The notice will have a local phone number that residents may call to ask questions. The contractor shall also place the notice on the windshield of any parked cars on the street

Q**. Basis of Payment:**

Pay Item	Pay Unit
● Asphalt Rejuvenating Agent	Per Square Yard
● Field Core Removal	Each
● Field Core Laboratory Analysis – DSR (Viscosity)	Each
● Field Core Laboratory Analysis – D-2006	Each

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[4] Procedure for Determining Percent Light Transmittance on Asphalt Rejuvenating Agent:

a. Scope: This procedure covers the determination of percent light transmittance of the asphalt rejuvenating agent.

b. Apparatus:

1. Container may be glass, plastic or metal having a capacity of 6,000 ml.
2. Graduated cylinder, 1,000 ml, or greater
3. Light transmittance measuring apparatus, such as Bausch and Lomb or Lumberton spectrophotometer
4. Graduated pipette having 1 ml capacity to 0.01 ml accuracy
5. Suction bulb for use with pipette
6. Test tubes compatible with spectrophotometer, 3/4" X 6, Bausch and Lomb, Catalog No. 33-17- 81, (B&L)

c. Calibration of spectrophotometer:

1. Calibrate spectrophotometer as follows:
   a. Set wavelength at 580 mu,
   b. Allow spectrophotometer to warm-up thirty minutes,
   c. Zero percent light transmittance (%LT) scale,
   d. Rinse test tube three times with tap water and fill to top of circle marking on B&L test tube or approximately 2/3 full,
   e. Place tube in spectrophotometer and set %LT scale at 100, and,

f. Repeat steps (c) (e) two times or until no further adjustments necessary.

d. Procedure:

1. Shake, stir or otherwise thoroughly mix emulsion to be tested. Place sample of emulsion in beaker and allow to stand one minute.
2. Place 2,000 ml tap water in container.
3. Suck 1.00 ml emulsion into pipette using suction bulb. Wipe off outside of pipette.
4. Using suction bulb, blow emulsion into container.
5. Rinse pipette by sucking in diluted emulsion solution and blowing out.
6. Clean pipette with soap or solvent and water. Rinse with acetone.
7. Stir diluted emulsion thoroughly.
8. Rinse out tube to be used with the diluted emulsion three times and fill to top of circle.
9. Calibrate spectrophotometer.
10. Place diluted emulsion sample tube in spectrophotometer, cover and read %LT to nearest tenth.
11. Repeat steps 9 and 10 until three identical consecutive readings are achieved.
12. The elapsed time between addition of emulsion to dilution of water and final %LT reading should not exceed 5 minutes.