SECTION 2600 ASPHALT CRACK SEALING, IMPROVED STREET CHIP SEAL, SLURRY SEAL, MICRO-SURFACING AND UNIMPROVED STREET SEAL

2601 SCOPE. This section governs the furnishing of all labor, equipment, tools and material, and the performance of all work necessary for minor pavement patching and crack cleaning and sealing, construction of asphalt seal-coat, slurry seal and micro-surfacing, complete, in place, at the locations specified in the Special Provisions and as directed by the Engineer.

2602 CRACK SEALING.

A. Crack Sealing Material. Asphalt Material used for crack sealing shall be AC-20 with fiber as specified in the contract or as directed by the Engineer. The material temperature range shall be 240-290 deg F when applied.

B. Weather Limitations. Crack sealing shall be performed only on days when the ambient temperature is greater than 32 deg F and rising at the time work is to begin. Crack sealing shall not be done on days when ice or other conditions prevent proper cleaning of the cracks.

C. Distributor. A distributor as listed in Section 1305 is required for handling the liquid asphalt for crack sealing.

D. Aggregate for Blotting. "Buckshot Aggregate" shall be clean and dry and conform to the following gradation:

Sieve Size	Percent Passing
No. 4	90-100
No. 10	0-15

E. Cleaning. All cracks less than ½" in width shall be routed. All cracks shall be thoroughly cleaned of undesirable material by the use of an 85 to 90 C.F.M. compressor with air hoses and attachments.

F. Filling Procedure. After all cracks have been thoroughly cleaned, the operator of the hand hose shall apply hot liquid asphalt to the cleaned cracks. Application of the liquid asphalt shall be done in such a manner to avoid an accumulation of excess material on areas adjacent to the cracks. Excess material on the cracked areas shall be redistributed by means of a U-shaped squeegee.

2603 IMPROVED STREET CHIP SEAL.

A. Description. This work shall consist of the application of asphaltic cements and cover aggregate to an existing improved street surface.

B. Requirements for Materials to be used for Improved Street Sealing.

1. Asphalt Cement.

a. The asphalt cement for sealing shall be 85-100 penetration grade, complying with ASTM D-946.

The material shall be sampled and tested as set forth by Section 4 of ASTM D-946.

b. A sample of the liquid bituminous materials may be taken from each distributor or relay on the job site. If the liquid bituminous materials do not meet the specifications as set out in the contract after applying, the Contractor shall correct, at his own expense, all unsatisfactory areas. No additional areas shall be sealed until corrections have been accomplished.

2. Cover Aggregates.

a. Pre-coated Limestone.

(1) Aggregate. This material shall be pre-coated limestone chips of the Bethany Falls Ledge, or other materials approved by the Engineer. Stone chips for seal coating shall be pre-coated with 3/4 to 1 percent by weight of MC-70, as specified in Paragraph 4. All material shall be free of moisture, dust and lumps and shall be approved by the Engineer prior to use.

The chips shall be uniformly heated in a dryer until surface dry. The asphaltic material and hot aggregate shall be measured separately and accurately immediately before introduction into the mixer. Mixing shall be at a suitable temperature and sufficient to produce a thoroughly and uniformly coated aggregate. Pre-coated seal coat chips shall be stockpiled at least 3 days before using.

(2) Gradation. Limestone chips to be used for sealing shall, when graded through sieves with square openings, conform to the following percentages:

Sieve Size	Percent Passing
2"	100
3/8"	95-100
No. 4	18 Max.

(3) Physical Properties. The chips, when tested by Los Angeles Abrasion test shall have a percentage of wear not to exceed 35 percent after 500 revolutions as determined by ASTM C-131. The shale content of the material shall not exceed 0.5 percent by weight. The materials shall be free of acid or other deleterious substances.

(4) Asphalt Coating. Asphalt for the coating of limestone cover aggregate shall be MC-70 conforming to ASTM D-2027, Liquid Asphalt, Medium Cure.

b. Lightweight Cover Aggregate.

(1) Aggregate. Lightweight cover aggregate consists of expanded shale produced by the rotary kiln method and shall comply with the quality and gradation requirements as set forth in these specifications.

(2) Unit Weight. The dry loose weight of Lightweight Cover Aggregate shall not be less than 39 nor more than 48 lbs per cubic foot.

(3) Quality Requirements.

(a) Soundness. The loss ration for Lightweight Cover Aggregate shall not be less than 0.90 when subjected to 25 cycles of the freezing and thawing test as set forth in Section 4, MCIB Specification.

(b) Wear. The percent loss shall not exceed 25 percent when tested by the Los Angeles Abrasion Test Method (ASTM C-131).

(c) Deleterious Substances. The deleterious substances in each individual aggregate shall not exceed the following percentages by weight:

Sticks (wet weight)	0.5
Coal	0.5
Soft Friable Materials	2.5
Unburned or Underburned Shale	0.5

The above percentages are when taken separately. In

addition, any combination of the above shall not exceed 3.0 percent.

(d) Absorption. The water absorption of the expanded shale aggregate shall not exceed 18 percent when soaked for 24 hours.

(4) Gradation. Lightweight cover aggregate shall conform to the grading requirements as follows:

Sieve Size	Percent Passing
1/2	100
3/8	95-100
No. 4	0-25
No. 200	0-2.5

c. Weighing of Cover Aggregate.

The Contractor shall furnish scales for weighing cover aggregate as required in Section 1407 entitled "Scales and Weighing of Vehicles." All loads of cover aggregate will be weighed and evidenced by approved delivery tickets showing the net weight in pounds for each load. Two copies of each ticket shall accompany the load to the work site. Upon the load being incorporated in the work, both copies will be signed by the inspector and one of these copies will be returned to the Contractor.

C. Spot Patching.

Holes, where the surface is broken out, shall be cleaned of any loose material. Holes shall be tacked with a light coating of emulsified asphalt. The tack coat shall extend beyond the limits of the patch.

The emulsified asphalt used for the tack coat shall be either CRS-1, RS-1, MS-1 or SS-1h conforming to ASTM D-977. Patches shall be made in holes or depressions where the surface is in good condition. The Engineer will indicate the extent to which patches shall be made.

The prepared hole shall be patched with hot-mix asphaltic patching material by placing in layers not to exceed 2 inches; each layer being thoroughly compacted before the next layer is placed. After the patching material is placed and raked to a uniform surface, it shall be thoroughly compacted by rolling with a tandem or three-wheeled roller with a minimum weight of 180 pounds per lineal inch or a vibrating shoe compactor. An appropriate number of passes shall be made to insure that the patch is firmly consolidated. The edges shall be well bonded with the old surface. The completed patch shall be in the same plane as the existing pavement.

The asphaltic concrete used for patching at the different locations shall be as directed by the Engineer and shall conform to one of the mixes as set out in Section 1404, for Types 3 and 4 Asphaltic Concrete Surface. Generally the Type 4 mix shall be used for patching.

D. Sealing.

1. Cleaning. After all holes and cracks have been repaired to the satisfaction of the Engineer, and immediately before sealing the Contractor shall thoroughly clean the area to be sealed. The street shall be dry before applying the seal coat.

2. Sealing. After the street has been prepared as set forth above the Contractor shall apply the liquid asphalt by means of an approved distributor meeting the requirements of Section 1305. Provisions shall be made by the Contractor to properly protect the curbs and gutters from the asphaltic spray. Liquid bituminous material shall be applied at a rate between 0.16 and 0.22 gallons per square yard. The specific rate for each job will be determined by the Engineer in the field.

To insure uniform application of the bituminous material to the street surface at the beginning of each distributor load or portion thereof, the Contractor will be required to cover a portion of the street surface with building paper. The area covered by the building paper shall be used as the starting point for each distributor load or each part of a distributor load after a temporary delay, and the spray bars shall be discharged on this paper until all nozzles are working properly. After use, the building paper shall be removed and disposed of by the Contractor.

Immediately after the application of the asphalt, the Contractor shall by means of a self-propelled mechanical spreader, apply a uniform layer of cover aggregate. This material shall be spread at the rate specified by the Engineer. This rate shall be between 10 and 20 pounds per square yard for pre-coated limestone chips and between 8 and 10 pounds per square yard for lightweight aggregate. If material is spread on any area in excess of the amount specified by the Engineer, the surplus shall be immediately removed and placed elsewhere as directed. No payments will be made to the Contractor for the picking up and redistribution of each excess. Hand spreading will be permitted only in those areas not accessible to the mechanical spreader.

Immediately after spreading the cover aggregate, the entire surface shall be rolled with multiple wheel, pneumatic-type rollers. Rolling shall be continued until a thoroughly compacted surface with a uniform aggregate

coverage has been obtained. The Engineer may require additional rollers if one roller cannot keep up with the operations. The first pass of the rollers over the cover aggregate shall not exceed 5 miles per hour. The rollers shall not exceed 10 miles per hour during any rolling operation.

Where double sealing is specified or directed by the Engineer, the area shall be treated with two coats. The top seal coat shall be applied the same day as the first seal coat. Double sealing will be performed as set out for sealing.

The Contractor shall seal all roadway areas within the street right-of-way, except private driveways, including sealing of intersections, alleys, etc, to the property line.

During the sealing operation as described above, the Contractor shall cooperate with the Engineer in arranging a program and schedule of work so traffic may be handled or routed around or thorough the section being sealed. Whenever possible, the street will be closed; but when this is not possible, the sealing will be done in strips while traffic is diverted to the balance of the street. No traffic will be permitted on the sealed portion of the roadway until rolling is completed.
When bleeding occurs or more material is required, additional cover aggregate shall be spread as directed. As soon as the cover material has adhered to the surface, all excess cover aggregate shall be immediately removed.

2604 SLURRY SEAL.

A. Description. This work shall consist of the application of Slurry Seal Material to an existing surface. The Slurry Seal shall consist of a mixture of emulsified asphalt, mineral aggregate and water, properly proportioned, mixed and spread on the surface in accordance with this specification and as directed by the Engineer.

B. Materials.

1. Emulsified Asphalt. The Emulsified Asphalt to be used for this work shall be CRS-1h unless otherwise specified.

2. Aggregate for Slurry Seal. The mineral aggregate used for this work shall be chat aggregate which is a by-product of the milling of lead and zinc ores and shall conform to the following grading requirements:

Sieve Size	Percent Passing
3/8"	100
No. 4	82-94
No. 8	45-65

No. 16	25-46
No. 30	15-35
No. 50	10-25
No. 200 *	5-15

* The percent passing the No. 200 Sieve shall be determined by ASTM C-117.

3. Mineral Filler. Mineral Filler shall be any recognized brand of Portland Cement that is free from lumps.

4. Water. Water shall be potable and shall be free of harmful soluble salts.

C. Equipment.

1. Slurry Mixing Equipment. The slurry mixing machine shall be self-propelled. Sufficient storage capacity for aggregate, emulsified asphalt, cement and water shall be provided to properly mix and apply a minimum of 8 tons of aggregate without the use of auxiliary tracks and tanks. The mixed unit shall be capable of delivering to the spreader unit aproperly proportioned and thoroughly mixed slurry on a continuous flow basis.

   The mixing machine shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler at the same time and location that the aggregate is fed.

2. Slurry Spreading Equipment. Attached to the slurry mixing machine shall be a squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor box. The rear flexible seal shall act as a strike off and be adjustable in width. It shall be maintained to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. A burlap drag will be required to obtain the desired texture. The box shall be equipped with a steering device and shall be kept clean and free of any build up of asphalt and aggregate.

D. Proportioning. The Engineer shall approve all Slurry Seal Materials and methods prior to mixing and application. The proportions of the mixture to be used shall be as follows unless variations are approved by the Engineer:

Aggregate for Slurry Seal	13.5 to 16.5 lbs per sq. yd. (dry basis)
Emulsified Asphalt	9.5 to 10.5 percent by weight of dry aggregate.
Mineral Filler (added)	1.5 to 3.0 percent by weight of dry

	aggregate.
Water	Quantity to produce proper consistency.

Once the proper consistency is obtained changes in proportioning of the various components of the mixture shall be held to a minimum.

E. Construction Requirements.

1. Surface Preparation. Immediately prior to applying the Slurry Seal the surface shall be thoroughly cleaned of all objectionable materials and pre-wetted, leaving no standing water.

2. Application. The mixture shall be spread to leave a uniform non-skid film of fine aggregate and asphalt on the surface. Squeegees shall be used to spread the Slurry Seal mixture in areas inaccessible to the spreader box and other areas where hand spreading may be required. A hand drag shall be used at these locations to give the same texture as the machine-layed surface.

   A sufficient amount of slurry shall be carried in all parts of the spreader box at all time so that complete coverage is obtained. No lumping, balling, or unmixed aggregate shall be permitted. Any oversized aggregates or foreign materials shall be removed from the aggregate prior to delivery to the mixing machine. No streaks or slick spots shall be left in the unfinished surface.

3. Weather Limitations. Slurry Seal shall be placed only when the surface temperature is 60 deg. F or above, the relative humidity is below 80 percent and no precipitation.

F. Property Owner Notification. The City will supply the Contractor door tags which the Contractor shall place on the doors of all involved property owners. The door tag shall comply with the included sample or an approved equal.

2605 MICRO-SURFACING

A. Description. Micro-Surfacing is a mixture of polymer-modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives, properly proportioned, mixed and spread on a paved surface in accordance with a specification and as directed by the Engineer. The mix should be capable of being spread in variable thick cross-sections (wedges, ruts, scratch courses and surfaces) which, after curing and initial traffic consolidation, resists compaction throughout the entire design tolerance range of bitumen content and variable thickness to be encountered. The end product should maintain a skid-resistant surface (high wet friction co-efficient) in variable thick sections throughout the service life of the Micro-Surfacing. The mix is to be a

quick-traffic system, meaning that it will be able to accept traffic after a short period of time. The amount of time will vary from job to job and must be evaluated on an individual job basis. Normally, these systems have been required to accept rolling traffic on a one-half (1/2) inch (12.7 mm) thick surface within one hour after placement in +75°F (24°C) temperature and 50 percent or less humidity.

B. Applicable Specifications**.**

1. General.

There are agencies and testing methods listed in the appendix (see Appendix A) which form a part of this guideline. It is normally not required to run all referenced tests on every project. Some of the tests are expensive and take a substantial amount of time to conduct. If the materials to be used on the project have a past record of good performance, the requirements for testing may be decreased. Local paving authorities are often familiar with the materials and should be able to furnish information which would minimize the amount of testing required.

C. Materials

1 Emulsified Asphalt – General.

The emulsified asphalt shall be a quick-traffic, polymer-modified asphalt emulsion conforming to the requirements specified in AASHTO M208 or ASTM D2397 for CSS-1h. The cement mixing test shall be waived for this emulsion.

The polymer material shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

The minimum amount and type of polymer modifier shall be determined by the Laboratory performing the mix design. The minimum amount required will be based on asphalt weight content and will be certified by the emulsion supplier. In general, a three percent (3%) polymer solids, based on asphalt weight, is considered minimum.

The five-day (5) settlement test may be waived, provided job stored emulsion is used within thirty-six (36) hours from the time of the shipment, or the stored material has had additional emulsion blended into it prior to use.

Quality Tests

When tested according to the following tests, the emulsion shall meet the following requirements of AASHTO M208 or ASTM D2397 for CSS-1h, plus the following:

AASHTO TEST NO	ASTM TEST NO.	QUALITY	SPECIFICATION
AASHTO T59	ASTM D244	Residue after Distillation	62% Minimum

The temperature for this test should be held below 280ºF (138ºC). Higher temperatures may cause the polymers to break down.

AASHTO TEST NO	ASTM TEST NO.	QUALITY	SPECIFICATION
AASHTO T53	ASTM D38	Softening Point	62% Minimum
AASHTO T49	ASTM 2397	Penetration at 77˚F (25˚C)	40-90*
	ASTM 2170	Kinematic Viscosity @275˚ F (135˚C)	650 cST/sec Minimum ˚F

* Climate conditions should be considered when establishing this band.

Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to assure that it is the same as that used in the mix design.

2. Aggregate

General

The mineral aggregate used shall be of the type and grade specified for the particular use of the Micro-Surfacing. The aggregate shall be a manufactured crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or combination thereof. To assure the material is totally crushed, 100 percent of the parent aggregate will be larger than the largest stone in the gradation to be used.

Quality Tests

When tested according to the following tests, the aggregate should meet these minimum requirements:

AASHTO TEST NO	ASTM TEST NO.	QUALITY	SPECIFICATION
AASHTO T176	ASTM D2419	Sand Equivalent	65 Minimum
AASHTO T104	ASTM C88	Soundness	15% Maximum using NA_2SO_4 or 25% Maximum

			using $MgSO_4$
AASHTO T96	ASTM C131	Abrasion Resistance	30% Maximum

The abrasion test is to be run on the parent aggregate. The aggregate should meet state-approved polishing values. Proven performance may justify the use of aggregates that may not pass all of the above tests.

3. Grading

When tested in accordance with AASHTO T27 (ASTM Cl36) and AASHTO T11 (ASTM C117), the target (mix design) aggregate gradation (including the mineral filler) shall be within one of the following bands (or one currently recognized by your local paving authority).

SIEVE SIZE	TYPE II PERCENT PASSING	TYPE III PERCENT PASSING	STOCKPILE TOLERANCE
3/8 (9.5 mm)	100	100	
# 4 (4.75 mm)	90-100	70-90	±5%
# 8 (2.36 mm)	65-90	45-70	±5%
# 16 (1.18 mm)	45 – 70	28 – 50	±5%
# 30 (600 um)	30-50	19-34	±5%
# 50 (330 um)	18-30	12-25	±4%
#100 (150 um)	5-15	5-15	±3%
#200 (75 um)	5-15	5-15	±2%

The job mix (target) gradation shall be within the gradation band for the desired type. After the target gradation has been submitted (this should be the gradation that the mix design is based on), then the percent passing each sieve shall not vary by more than the stockpile tolerance shown in the above table for each individual sieve, and still remain within the gradation band. It is recommended that the percent passing shall not go from the high end to the low end of the range for any two consecutive screens.

The aggregate will be accepted at the job location stockpile or when loading into the support units for delivery to the lay-down machine. The stockpile shall be accepted based on five gradation tests according to AASHTO T2 (ASTM D75). If the average of the five tests are within the gradation tolerances, then the materials will be accepted. If the tests show the material to be out, the contractor will be given the choice to either remove the material or blend other aggregate with the stockpiled material to bring it into

specification. Materials used in blending must meet the quality tests before blending and must be blended in a manner to produce a consistent gradation. If blending is used, it will require that a new mix design be performed.

Screening shall be required at the stockpile prior to delivery to the paving machine if there are any problems created by having oversize material in the mix.

4. Mineral Filler

Mineral filler, if required, shall be any recognized brand of non-air entrained Portland cement or hydrated lime that is free from lumps. It may be accepted upon visual inspection. The type and amount of mineral filler needed shall be determined by a laboratory mix design and will be considered as part of the aggregate gradation. An increase or decrease of less than one percent (1%) may be permitted when the Micro-Surfacing is being placed if it is found to be necessary for better consistency or set times.

5. Water

The water shall be potable and free of harmful soluble salts or reactive chemicals and any other contaminants.

6. Additives

Additives may be added to the emulsion mix or any of the component materials to provide the control of the quick-traffic properties. They must be included as part of the mix design and be compatible with the other components of the mix.

D. Laboratory Evaluation

1 General

Before the work commences, the contractor shall submit a signed mix design covering the specific materials to be used on the project. This design will be performed by a laboratory which has experience in designing Micro-Surfacing. After the mix design has been approved, no substitution will be permitted, unless approved by the Engineer.

ISSA can provide a list of laboratories experienced in Micro-Surfacing design.

2. Mix Design

The contractor shall submit to the Engineer for approval a complete mix design prepared and certified by a laboratory. Compatibility of the aggregate, polymer-modified emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate gradation that the contractor will provide on the project. Recommended tests and values are as follows:

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-139	Wet Cohesion @ 30 Minutes Minimum (set) @ 60 Minutes Minimum (Traffic)	 12 kg-cm Minimum 2- kg-cm Minimum or Near Spin
ISSA TB-139	Excess Asphalt by LWT Sand Adhesion	50 g/ft^2 Maximum (538 g/m^2 Maximum
ISSA TB-114	Wet Stripping	Pass (90% Minimum)
ISSA TB-100	Wet0Track Abrasion Loss One hour Soak 6 Day Soak	 50 g/ft^2 (538 g/m^2) Maximum 75 g/ft^2 (807 g/m^2) Maximum

The Wet Track abrasion test is performed under laboratory conditions as a component of the mix design process. The purpose of this test is to determine the minimum asphalt content of a slurry system. The Wet Track Abrasion Test is not recommended as a field quality control or acceptance test. Some systems require longer times for the asphalt to adhere to the stone. In these systems, a modified Marshall Stability Test (ISSA TB-148) or Hveem Cohesiometer Test (ASTM D 1560) has been used to confirm asphalt content.

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-147	Lateral Displacement Specific Gravity after 1,000 Cycles of 125 Pounds (56.71 kg)	5% Maximum 2.10 Maximum
ISSA TB-144	Classification Compatibility	11 Grade Points Minimum (AAA, BAA)
ISSA TB-113	Mix Time @77˚F (25˚ C)	Controllable to 120 Seconds Minimum

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he mixing test is used to predict how long the material can be mixed in the machines before it begins to break. It is more for information to be used by the contractor than for quality of the end product.

The mixing test and set-time test should be checked at the highest temperatures expected during construction.

The mix design should report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive usage, and polymer-modified asphalt emulsion based on the dry weight of the aggregate.

All the component materials used in the mix design shall be representative of the materials proposed by the contractor to be used on the project.

The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during construction, based on field conditions. The Engineer will give final approval for all such adjustments.

AGGREGATE	LIMITS
Residual Asphalt	5.5 to 10.5% (5) by dry weight of aggregate
Mineral Filler	0.0 to 3% by Dry weight of aggregate
Polymer-Based Modifier	Minimum of 3% solids based on bitumen weight content
Additives	As needed
Water	As required to produce proper mix consistency

3. Rate of Application

The Micro-Surfacing mixture shall be of the proper consistency at all times, so as to provide the application rate required by the surface condition. The average Single application rate, as measured by the Engineer, shall be in accordance with the following table:

AGGREGATE TYPE	**LOCATION**	**SUGGESTED APPLICATION RATE**
Type II	Urban and Residential Streets	10 – 20 lb/yd^2 (5.4 – 10.8 KG/m^2)
Type III	Primary and interstate Route Wheel Ruts	10-30 lb/yd^2 (8.1 -16.3 KG/m^2) As Required (See Appendix B)

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uggested application rates are based upon the weight of dry aggregate in the mixture. Application rates are affected by the unit weight of the aggregate.

Micro-Surfacing is often put down in two full-width passes in place of rut-filling when the rutting or deformation is not severe. When two passes are used, the first pass (scratch course) is made using a metal or stiff rubber strike-off and applying only what the surface demands for leveling. The second course is applied at 15 - 30 lb/yd^2 (8.1 - 16.3 kg/m^2).

E. EQUIPMENT

1 General

All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working condition at all times to ensure a high-quality product.

2 Mixing Equipment

The machine shall be specifically designed and manufactured to lay Micro-Surfacing. The material shall be mixed by an automatic-sequenced, self-propelled Micro-Surfacing mixing machine, which shall be a continuous-flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving multi-blade, double-shafted mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls. On major highways, the machine may be required to be a self-loading machine capable of loading materials while continuing to lay micro-surfacing, thereby minimizing construction joints. If used, the self-loading machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during applications of the Micro-Surfacing material and be equipped with opposite-side driver stations to assist in alignment. The self-loading device, opposite-side driver stations, with forward and reverse speed controls shall be original equipment manufacturer design.

3 Proportioning Devices

Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt, additive, and water) shall be provided and properly marked. These proportioning devices are used in material calibration and determining the material output at any time.

4 Spreading Equipment

The mixture shall be agitated and spread uniformly in the surfacing box by means of twinshafted paddles or spiral augers fixed in the spreader box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as a final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry.

a. Secondary Strike-off

A secondary strike-off shall be provided to improve surface texture. The secondary strike-off shall have the same adjustments as the spreader box.

b. Rut-Filling Box

When required on the plans, before the final surface course is placed, preliminary micro-surfacing material may be required to fill ruts, utility cuts, depressions in the existing surface, etc. Ruts of one-half (1/2) inch (12.7 mm) or greater in depth shall be filled independently with a rut-filling spreader box, either five foot (5) (1.5 m) or six foot (6) (1.8 m) in width. For irregular or shallow rutting of less than one-half (1/2) inch (12.7 mm) in depth, a full-width scratch-coat pass may be used as directed by the B.A.R. Ruts that are in excess of one and one-half (1-1/2) inches (38.1 mm) in depth may require multiple placements with the rut-filling spreader box to restore the cross-section. All rut-filling level-up material should cure under traffic for at least a twenty-four (24) hour period before additional material is placed on top of the level up.

5 Auxiliary Equipment

Suitable surface preparation equipment, traffic control equipment, hand tools, and any other support and safety equipment shall be provided by the contractor as necessary to perform the work.

6. Calibration

Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be acceptable, provided that no more than 60 days have lapsed. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

7. Weather Limitations

Micro-Surfacing shall not be applied if either the pavement or air temperature is below 50°F (10°C) and falling, but may be applied when both pavement and air temperatures are above 45°F (7°C) and rising. No Micro-Surfacing shall be applied when there is the possibility that the finished product will freeze within 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

8. Notification and Traffic control

a. Notification

All homeowners and businesses affected by the construction shall be notified one day in advance of the surfacing. Suitable signs may be posted prior to the surfacing. Should work not occur on the specified day, a new notification will be distributed. The notification shall be in a form of a written posting, stating the time and date that the surfacing will take place.

b. Traffic Control

All traffic control devices shall be in accordance with State and Federal requirements and, further, shall conform to the requirements of the Manual on Uniform Traffic Control Devices. Suitable methods shall be used by the contractor to protect the Micro-Surfacing from damage from all types of vehicular traffic. Opening to traffic does not constitute acceptance of the work. The B.A.R. shall be notified of the methods to be used.

9. Surface Preparation

a. General

Immediately prior to applying the Micro-Surfacing, the surface shall be cleared of all loose material, silt spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before applying Micro-Surfacing. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the Micro-Surfacing by a suitable method. The B.A.R. shall approve the surface preparation prior to surfacing. No dry aggregate either spilled from the lay-down machine or existing on the road, will be permitted.

b. Tack Coat

Normally, tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt/three parts water and should be applied with a standard distributor. The emulsified asphalt should be SS or CSS grade. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gal/yd^2 (0.23 to 0.45 l/m^2). The tack coat shall be allowed to cure sufficiently before the application of Micro-Surfacing. If a tack coat is to be required, it must be noted in the project plans.

c. Cracks

It is advisable to pre-treat the cracks in the surface with an acceptable crack sealer prior to the application of the Micro-Surfacing.

10. Application

a. General

If required, it is recommended that a test strip be placed in conditions similar to those expected to be encountered during the project.
When required by local conditions, the surface shall be pre-wetted by fogging ahead of the spreader box. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement. The Micro-Surfacing shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided. No lumping, balling, or unmixed aggregate shall be permitted. No streaks, such as those caused by oversized aggregate, shall be left in the finished surface. If excess streaking develops, the job will be stopped until the contractor proves to the B.A.R. that the situation has been corrected. Excessive streaking is defined as more than four drag marks greater than one-half (1/2) inch wide (12.7 mm) and four inches (4) long (101 mm), or one inch (1) wide (25.4 mm) and three (3) inches long (76.2 mm), in any 29.9 yd^2 (25 m^2) area. No transverse ripples or longitudinal streaks of one-fourth (1/4) inch in depth (6.4mm) will be permitted, when measured by placing a ten (10) foot (3 m) straight edge over the surface.

b. Joints

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall

provide suitable-width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd-width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of three (3) inches (76.2 mm) shall be allowed for overlap of longitudinal lane line joints. Also, the joint shall have no more than a one-fourth (1/4) inch (6.4 mm) difference in elevation when measured by placing a ten (10) foot (3 m) straight edge over the joint and measuring the elevation drop-off.

c. Mix Stability

The Micro-Surfacing shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water or emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate. Under no circumstances shall water be sprayed directly into the lay-down box while laying micro-surfacing material.

d. Handwork

Areas which cannot be reached with the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. If necessary, the area to be handworked shall be lightly dampened prior to mix placement. Care shall be exercised to leave no unsightly appearance from handwork. The same type of finish as applied by the spreader box shall be required.

e. Lines

Care shall be taken to ensure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance. If necessary, a suitable material will be used to mask off the end of streets to provide straight lines. Edge lines shall not vary by more than ± 2 inches (± 50 mm) horizontal variance in any 96 feet (30 m) of length.

f. Clean-Up

All areas, such as man-ways, gutters, and intersections, shall have the Micro-Surfacing mix removed as specified by the Owner. The contractor shall, on a daily basis, remove any debris associated with the performance of the work.

11. Method of Measurement

a. Area

On smaller projects, the method of measurement and payment is usually based on the area covered, measured in square feet, square yards, or square meters.

b. Ton and Gallon

On larger projects of over 50,000 yd^2 (41,806 m^2), measurement and payment are based on the ton of aggregate and the gallons (liters) of emulsified asphalt used. The aggregate is measured by the actual weight delivered to the job lay-down site or is weighed on the job site with certified scales. Delivery tickets or printed weights shall be used for measurement. The emulsified asphalt used on the project will be measured by the certified tickets for each load delivered to the job site. Any emulsified asphalt not used or returned to the supplier shall be deducted from this quantity.

12. Payment

The Micro-Surfacing shall be paid for by the unit area or the weight of the aggregate and the weight or gallons (liters) of emulsified asphalt used on the work and accepted by the Owner. The price shall be full compensation for furnishing all preparation; missing and applying these materials; and for all labor, equipment, tools, test design, cleaning, and incidentals necessary to complete the job as specified herein.

2606 UNIMPROVED STREET SEALING.

A. Description. This work shall consist of applying a single liquid asphaltic coat with limestone cover aggregate to unimproved streets.

B. Requirements for Liquid Asphalt Materials.

The particular grade of liquid asphalt required on different streets will be an R-C or M-C liquid asphalt, as determined by the Engineer, conforming to the requirements of ASTM D-2027 entitled "Specifications for Liquid Asphalt Type M-C or R-C".

C. Cover Aggregate.

This material shall be limestone chips of the Bethany Falls Ledge or an approved equal, and the shale content shall not be greater than 0.5 percent maximum by weight.

The chips when tested by Los Angeles Abrasion Test shall have a percentage of wear not to exceed 35 percent after 500 revolutions as determined by ASTM C-131.

All chips shall have less than 1 percent moisture, adhere immediately to the liquid asphalt, and not strip from the surface.

Gradation for limestone chips to be used for sealing shall conform to the following:

Square Sieve Size	Percent Passing
1/2"	100
3/8"	80-100
No.4	0-26
No.10	0-2

The Contractor shall furnish scales for weighing cover aggregate as required in Section 1407 entitled "Scales and Weighing of Vehicles." All loads of cover aggregate will be weighed as required, and evidenced by approved delivery tickets showing the net weight in pounds for each load. Two copies of each ticket shall accompany the load to the work site. Upon the load being incorporated in the work, both copies will be signed by the inspector and one of these copies will be returned to the Contractor.

D. Sealing.

The rate of application shall be 0.15 to 0.25 gallons per square yard and shall contain 1 per cent of an anti-stripping agent (single strength), thoroughly mixed with the cutback asphalt. The specific rate of application will be determined for each street by the Engineer. The distributor used shall meet the requirements of Section 1305.

Immediately after the application of the liquid asphalt the Contractor shall, by means of a mechanical spreader, apply a uniform layer of cover aggregate. This material shall be spread at the rate specified by the Engineer within the range of 16 and 24 pounds per square yard. If material is spread on any area in excess of the amount specified by the Engineer, the surplus shall be immediately removed and placed elsewhere as directed. No payment will be made to the Contractor for the picking up and redistribution of such excess. The same applies for spillage. Hand spreading will be permitted only in those areas not accessible to the mechanical spreader.

Immediately after spreading the seal coat aggregate, the entire surface shall be rolled with a multiple wheel, pneumatic-type rollers. Rolling shall be continued until a thoroughly compacted surface with uniform aggregate coverage has been obtained. These rollers shall weigh between 8 and 10 tons.

Where double sealing is called for, or required by the Engineer, the area shall be treated with two seal coats, the top coat to be applied in the same manner as set out for sealing.

During the sealing operation as described above, the Contractor shall cooperate with the Engineer in arranging a program and schedule of work so traffic may be routed around or through the section being sealed. Whenever possible, the street will be closed; but when this is not possible, the sealing shall be done in strips while traffic is diverted to the balance of the street. No traffic will be permitted on the sealed portion of the roadway until the rolling is completed.

The Contractor will be required to maintain a uniform aggregate coverage over the entire surface until such time as no more aggregate will be needed on any part of the surface to make a completed and finished job. When bleeding occurs or more material is required, additional cover aggregate shall be spread as directed.

2607 PROVISIONS FOR PUBLIC CONVENIENCE DURING SEALING OPERATION. The Contractor shall provide and maintain sufficient signs, barricades, warning lights, flag persons and watch persons to protect the work and public in a manner satisfactory to the Engineer. Any areas damaged prior to acceptance by the City shall be repaired at the Contractor's expense.

Signs for "No Parking" to be used will be furnished by the Contractor. These signs shall comply with the standards established by the MUTCD with regard to size, color, wording, height and placement. When "No Parking" signs are posted on the streets with parking meters, the Contractor shall cover the parking meter heads with bags.

The Contractor shall take all necessary precautions to protect the public (pedestrian and vehicular) from flying debris. The Contractor shall use warning signs and devices to warn motorists of work ahead and shall use traffic cones where necessary to guide traffic.