

A-2 Microsurfacing Specification Section 10-2.13, TYPE II Microsurfacing (Bid Item 8)
(CITY OF LOMPOC, DEPARTMENT OF PUBLIC WORKS CALIFORNIA, PROJECT
MANUAL, PART A, NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS FOR
2018 CAPE SEAL PROJECT CITY PROJECT NO. FY-18-S-3)

GENERAL

Type II Microsurfacing shall be placed after, and on top of the finished and prepared asphalt rubber chip seal in certain areas called out for "Cape Seal," and shall be placed in certain other prepared roadway areas, including Central Avenue from D Street to O Street, and within the intersection of Central Avenue and V Street, as called out in the Street & Facility Location List and/or on the Plan Exhibits in the appendices of these Special Provisions. Type II Microsurfacing consists of a mixture of microsurfacing emulsion, Type II aggregate, water, mineral filler, and additives. Microsurfacing shall conform to the provisions of Section 37 "Seal Coats" of the 2015 Caltrans Revised Standard Specifications, including the provisions in Section 37-3, "Slurry Seals and Microsurfacing;" these Special Provisions, including but not limited to Section 10-2.1 General Requirements/Site Preparation; and the direction of the Engineer. The mix shall be capable of being spread in variably thick cross sections (wedges, wheel path depressions, scratch courses and surfaces), which, after curing and initial traffic consolidation, resists deformation throughout the entire design tolerance range of bitumen content and variable thickness to be encountered. Type II Microsurfacing shall be placed in conformance with the contract documents, and such that it may be opened to traffic within no more than 1 hour from the time of placement, without causing traffic damage to the microsurfacing, including but not limited to excessive raveling or shedding of microsurfacing materials.

SUBMITTALS

At least 21 working days before microsurfacing placement is proposed, the Contractor shall submit to the Engineer for approval a laboratory report of tests and a proposed mix design covering the specific materials to be used on the project, and the Contractor shall not begin placement until after the City's written approval of the submittal. The laboratory which develops the mix design must sign and date the original laboratory report and mix design for submittal to the City, and the report shall show the results of the tests on individual materials, comparing their values to those required by the specifications. Acceptance of the mix design by the City shall be subject to verification testing and review by a laboratory retained by the City.

The laboratory report must clearly show the following:

1. Test results used in the mix design
2. Proportion of the following material based on the aggregate's dry weight:
 - Aggregate
 - Filler determined from tests, target, minimum, and maximum
 - Water content, target, minimum, and maximum
 - Microsurfacing emulsion
 - Asphalt solids content, target, minimum, and maximum
 - Additives
 - Polymer content (in % by weight of residual asphalt)

The tests and mix design shall be performed by a laboratory which is AMRL certified or as approved by the Engineer, and is capable of performing the applicable International Slurry Surfacing Association (ISSA) tests.

The microsurfacing mixture shall conform to the requirements specified when tested in accordance with the following tests: Test	ISSA Test Methods	Requirement
Wet Cohesion (set)	TB* 139 @ 30 min. (set)	12 kg-cm minimum
Wet Cohesion (Traffic)	@ 60 min.	20 kg-cm minimum (or near spin)
Excess Asphalt using Loaded Wheel Test	TB 109	540 g/m ² maximum
Wet Stripping	TB 114	Pass (90% minimum)
Wet Track Abrasion	TB 100 Six day soak	540 g/m ² loss
Displacement	TB 147A	
	Lateral, maximum %	5
	Specific Gravity after 1000 cycles of 56.8 kg	2.10
Classification Compatibility	TB 144*	(AAA, BAA) 11 grade points minimum
Mix Time @ 25°C	TB 113	Controllable to 120 seconds minimum

* TB = Technical Bulletin from ISSA

The laboratory shall also report the quantitative effects of moisture content on the unit mass of the aggregate (bulking effect). Previous laboratory reports covering the same materials may be accepted provided they are made within the previous 6 months. The mix design shall further show recommended changes in cement, water and additive proportions for high temperature weather conditions by reporting proportions of materials required for 60 seconds of mix time with materials heated to 100°F (38°C). This 100°F mixing report will not be required for projects requiring nighttime application or application in cool weather conditions.

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.

Once the proportions of materials to be used are approved by the Engineer, no substitution of other materials will be permitted unless the materials proposed for substitution are first tested and a laboratory report is submitted for the substituted design as specified above. Substituted materials shall not be used until the mix design for those materials is approved by the Engineer.

MATERIALS

The material for microsurfacing immediately prior to mixing shall conform to the following requirements:

Microsurfacing Emulsion

Microsurfacing emulsion shall be homogenous and shall be a polymer modified quick-setting, quick-traffic cationic asphalt emulsion conforming to the requirements of Section 94 "Asphaltic Emulsions" of the 2015 Caltrans Revised Standard Specifications and these Special Provisions. The polymer material shall be milled or blended into the asphalt or blended into the emulsifier solution prior to the emulsification process. The asphalt emulsion manufacturer shall certify that the emulsion contains a minimum of 3% polymer solids based on the mass of asphalt (asphalt residual) within the emulsion. The emulsion, upon standing undisturbed for a period of twenty-four (24) hours, shall show no white or milky colored substance on its surface, and shall be a homogeneous brown color throughout.

The polymer modified quick-setting quick-traffic asphalt emulsion shall conform to the following requirements when tested in accordance with the specified test method.

Tests on Emulsion

Test on Emulsion	Test Method	Requirement
Viscosity SSF @ 25° C	AASHTO T 59	15 - 90 sec
Sieve	AASHTO T 59	0.30 % max
Settlement, 5 days	ASTM D244	5 % max
Storage Stability, 1 day	AASHTO T 59	1 % max
Residue by evaporation	California Test 331	62 % min

Test on Residue	Test Method	Requirement
Penetration @ 25°C 100 gm, 5 sec.	AASHTO T 49	40-90 mm
Ductility at 25 C (min in mm)	AASHTO T 51	400
Softening Point	AASHTO T 53	57°C min
Polymer Content (min, %)	Caltrans Test 401	3.0

Water and Additives

Water shall be of such quality that the asphalt will not separate from the emulsion before the microsurfacing is in place on the pavement. If necessary for workability, a set-control agent that will not adversely affect the microsurfacing may be used.

Mineral Filler

Mineral filler shall be any recognized brand of non-air entrained portland cement or hydrated lime that is free of lumps. The type and amount of mineral filler needed shall be determined by the laboratory mix design and will be considered as part of the mineral gradation requirement. A tolerance of $\pm 0.5\%$ from the value prescribed in the approved mix design is permitted when the microsurfacing is being placed if it is found to be necessary for better consistency or set times; however, the maximum cement content shall not exceed 2.0% including any such tolerance.

Aggregate

The mineral aggregate used shall be of the type and grade specified for the particular use of the microsurfacing. The aggregate shall be high quality manufactured crushed stone. The material shall be free from vegetative matter and other deleterious substances. All aggregate shall be free of caked lumps and oversize particles.

The aggregate, prior to the addition of emulsion, shall conform to the requirements of this section. If aggregates are blended each component aggregate shall meet the sand equivalency and abrasion resistance and shall be 100% crushed as tested in accordance with California Test 205. The definition of a crushed particle in California Test 205 Section D is amended to read: "Any particle having 2 or more fresh mechanically fractured faces shall be considered a crushed particle."

The percentage composition by mass of the aggregate shall meet the following grading requirements when tested in conformance with California Test 202:

Type II Gradation

Sieve Size	Percentage Passing
3/8"	100
No. 4	94-100
No. 8	65-90
No. 16	40-70
No. 30	25-50
No. 200	5 - 15

The Type II aggregate shall conform to the following additional quality requirements:

Test	Method	Requirement
Sand Equivalent, min	Caltrans Test 217	65
Durability Index, min	California Test 229	65
% of crushed particles, Min %	Caltrans Test 205	100
Abrasion Resistance, loss at 500 revolutions, Max %	Caltrans Test 211	35%

* Crushed particles must have 2 fractured faces

**Abrasion Resistance shall be performed on the parent aggregate before crushing.

If the results of the aggregate grading do not meet the gradation specified, the microsurfacing represented by the test shall be removed. However, if requested in writing by the Contractor and approved by the Engineer, the microsurfacing may remain in place and the Contractor shall pay to the City \$10 per ton for the microsurfacing represented by the test and left in place.

If the results of the Sand Equivalent test for aggregate do not meet the requirement specified, the microsurfacing represented by the test shall be removed. However, if requested in writing by the Contractor and approved by the Engineer, the microsurfacing may remain in place and the Contractor shall pay to the City \$10 per ton for the microsurfacing represented by the test and left in place. When the results of both the aggregate grading and the Sand Equivalent test do not conform to the requirements specified, said payments to the City for both non-conforming tests shall apply. The City may deduct these amounts from any moneys due, or that may become due to the Contractor under the contract. No single aggregate grading or Sand Equivalent test shall represent more than 300 tons or one day's production; whichever is smaller.

APPLICATION OF MICROSURFACING

Proportioning

Aggregate, mineral filler, microsurfacing emulsion, water, and additives, including set-control agent if used, shall be proportioned by volume utilizing the mix design approved by the Engineer. The component materials and the proposed microsurfacing mixture shall conform to the requirements specified under Submittals, Materials, and other applicable content of this Type II Microsurfacing section of the Special Provisions, and to the 2015 Caltrans Revised Standard Specifications. If more than one kind of aggregate is used, the correct amount of each kind of aggregate to produce the required grading shall be proportioned separately, prior to adding the other materials of the mixture, in a manner that will result in a uniform and homogeneous aggregate blend.

The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during the construction, based on field conditions. The following component materials shall be within the following limits:

Residual Asphalt	7.5% to 10.5% by dry mass of aggregate
Mineral Filler	0% to 2% by dry mass of aggregate
Additive	As needed
Water	As required to produce proper mix consistency. Contactor shall set target, min, and max water contents in their mix designs and ensure construction conforms to approved mix designs.

The completed mixture, after addition of water and any set-control agent, shall be such that the microsurfacing mixture has proper workability and (a) will permit a traffic flow without pilot-car-assisted traffic control on the microsurfacing within one hour after placement without causing damage to the microsurfacing, and (b) will prevent development of bleeding, raveling, separation or other distress within 15 days after placing the microsurfacing. Traffic shall not be permitted on the microsurfacing until it has sufficiently cured. See Curing subsection below for additional requirements and discussion of curing. The Contractor shall also furnish an aggregate moisture determination from the stockpile prior to placing the microsurfacing, and said moisture shall be retested if weather conditions have changed the aggregate moisture content appreciably. Aggregate moisture will be accounted for in determining the aggregate/bitumen ratio to be used during placement. Portable acetylene moisture determination kits will be allowed for determining moisture contents.

The aggregate shall be proportioned using a belt feeder operated with an adjustable cutoff gate. The height of the gate opening shall be readily determinable. The emulsion shall be proportioned by a positive displacement pump. Any variable rate emulsion pump, if used, shall be calibrated and sealed in its calibrated condition in accordance with Caltrans current Material Plant Quality Program (MPQP) prior to usage.

Uniformity of distribution of asphalt will be determined by extraction test in accordance with California Test 310. The bitumen ratio (kg of asphalt per 100 kg of dry aggregates) shall not vary by more than ± 0.4 percent based on the dry aggregate mass approved by the Engineer.

The delivery rate of aggregate and emulsion per revolution of the aggregate feeder shall be calibrated at the appropriate gate settings for each mixer-spreader truck used on the project in accordance with Caltrans current Material Plant Quality Program (MPQP) and the requirements of these Special Provisions.

The aggregate belt feeder shall deliver aggregate to the pugmill with such volumetric consistency that the deviation for any individual aggregate delivery rate check-run shall not exceed 2.0 percent of the mathematical average of three runs of at least 3 tons in duration each. The emulsion pump shall deliver emulsion to the pugmill with such volumetric consistency that the deviation for any individual delivery rate check-run shall be within 2.0 percent of the mathematical average of three runs of at least 1135 liters (300 gallons) each in duration. The water pump shall deliver water to the pugmill with such volumetric consistency that the deviation for any individual delivery rate check-run shall be within 2.0 percent of the mathematical average of three runs of at least 1135 liters (300 gallons) each in duration.

The emulsion storage located immediately before the emulsion pump shall be equipped with a device which will automatically shut down the power to the emulsion pump and aggregate belt feeder when the emulsion level is lowered sufficiently to expose the pump suction line.

A temperature-indicating device shall be installed in the emulsion storage tank at the pump suction level. The device shall indicate temperature of the emulsion and shall be accurate to within 10°F (5°C).

The belt delivering the aggregate to the pugmill shall be equipped with a device to monitor the depth of aggregate being delivered to the pugmill. Said device for monitoring depth of aggregate shall automatically shut down the power to the aggregate belt feeder whenever the depth of aggregate is less than the target depth of flow. A second device shall be located where it will monitor movement of the aggregate belt by detecting revolutions of the belt feeder. The device for monitoring belt movement or no flow, as the case may be, shall automatically shut down the power to the aggregate belt when aggregate belt movement is interrupted. This second device will not be required where the aggregate delivery belt is an integral part of its drive chain. To avoid erroneous shutdown by normal fluctuation, a delay of 3 seconds between sensing and shutdown of the operation will be permitted.

Equipment

The first sentence of Section 37-3.01C(3) "Mixing And Spreading Equipment," of the 2015 Caltrans Revised Standard Specifications is amended to read:

Mixing and spreading equipment for slurry seals and microsurfacing must be self-propelled and must accurately deliver and automatically proportion the asphaltic emulsions, water, aggregate, and any mineral filler and additives by volume; and mix them in continuous flow double shaft, multi-blade pugmill mixers of adequate size and power for the type of mixture to be placed, capable of minimum speeds of 200 revolutions per minute. Single shaft pugmills will not be allowed.

A minimum of two operational mixing machines of 12 cubic yard capacity, or larger, shall be maintained on the project. The mixed material retention time in the pug mill shall be less than three seconds. No retention of mixed material shall be allowed within the pug mill by gate shut-off or other mechanical means. Any machines with pugmill retention or shut-off gates shall have them removed prior to being used on this project. The mixing machine shall have sufficient storage capacity of aggregate, emulsified asphalt, and water to maintain an adequate supply to the proportioning controls. All indicators required in the section entitled "Proportioning" shall be in working order prior to commencing mixing and spreading operations.

All rotating and reciprocating equipment on mixer-spreader trucks shall be covered with metal guards. The mixer-spreader truck shall not be operated unless all low-flow and no-flow devices and revolution counters are in good working condition and functioning and all metal guards are in place. All indicators required by these special provisions shall be visible while walking alongside the mixer-spreader truck.

Aggregate feeders shall be connected directly to the drive on the emulsion pump. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to the nearest one-tenth of a revolution.

In addition to the requirements of Section 5-1.33, "Equipment," of the 2015 Caltrans Revised Standard Specifications, the identifying number of mixer-spreader trucks shall be at least 2 inches in height, located on the front and rear of the vehicle.

The microsurfacing mixture shall be spread by means of a spreader box conforming to the following requirements:

- The spreader box shall be capable of spreading a minimum of 12 feet wide, corresponding to a traffic lane width, and shall have strips of flexible rubber belting or similar material on each side of the spreader box and in contact with the pavement to positively prevent loss of microsurfacing from the ends of the box. All spreader boxes over 7.8 feet in application width shall have baffles,

reversible motor driven augers, or other suitable means, to ensure uniform application. Spreader box skids shall be maintained in such manner as to prevent chatter (wash boarding) in the finished mat.

- The spreader box shall have a double strike-off blade design at the rear of the box. The first strike-off blade shall be made of steel or stiff rubber and the second strike-off blade (attached to the first blade) shall be made of a flexible material. Rear flexible strike-off blades shall make close contact with the pavement, and shall be capable of being adjusted to the various crown shapes so as to apply a uniform microsurfacing coat. A secondary strike-off blade attached to the rear of the spreader box (located behind the double strike-off blades at the rear of the spreader box) shall be provided and shall be adjustable. It shall be designed and operated such that a uniform texture is achieved in the finished surface of the microsurfacing.
- Flexible fabric drags attached to the rear of the spreader box shall not be allowed. Strike-off blades (rubber) shall be cleaned or changed daily if problems with cleanliness and longitudinal scouring occur.

Mix Paver Calibration

Prior to beginning work on the project, perform calibration and submit calibration data for all microsurfacing trucks in accordance with Section 37-3.01C(3)(f) Equipment Calibration of the 2015 Caltrans Revised Standard Specifications.

Calibrate the mix paver to be used for the placement of microsurfacing in the presence of the Engineer according to the method recommended by the mix paver manufacturer. ISSA also provides a procedure for calibration.

Each unit shall be calibrated prior to the beginning of each project for each aggregate type, or as required by the City. The calibration procedure shall include a metered verification for each material used. No machine will be permitted to work until the calibration has been completed or accepted. The units from the meters need to be calibrated to gals of emulsion, tons of aggregate, pounds of filler and gallons of additives.

Surface preparation

Fulfill the provisions of Section 10-2.1 General Requirements/Site Preparation, 10-2.10 Roadway Preparation, and other applicable content of the Contract Documents. Before placing microsurfacing, remove all loose paving particles, all dirt, organics and all other extraneous material. Sweep the streets and areas for application from curb face to curb face or edge of pavement to edge of pavement (when there is no curb), using vacuum type street sweepers or rotary street sweepers with a rear broom as approved by the Engineer. In rural areas, other methods may be used with the written permission of the Engineer.

Allow crack sealant material to cure for a minimum of 30 days on pavement surfaces that have been crack sealed before application of the microsurfacing. Waive this requirement if a compatible crack sealant is used that does not require a cure time.

If required by the City, then apply a tack coat using an emulsified asphalt meeting the requirements of AASHTO M 140, M 208, or M 316. Dilute the emulsified asphalt one-part emulsion to one-part water at the plant or the project site as approved by the Engineer. Apply the diluted tack coat at the rate of 0.05 to 0.10 gallons/yd². Allow the tack to cure sufficiently before the application of the microsurfacing.

Application Rates

The target microsurfacing application rate over existing asphalt concrete, existing slurry seal or microsurfacing, or other dense or smooth fine grained paving surface shall be 13.5 lb of dry aggregate per

square yard of application surface. The target microsurfacing application rate over the ½" chip seal shall be 18 lbs of dry aggregate per square yard of application surface. Prior to beginning work, the Contractor shall obtain approval from the Engineer for each application rate proposed for use over each different underlying pavement surface.

Application Conditions

Microsurfacing shall only be placed when the ambient and pavement surface temperature is 50°F (10°C) minimum and rising. The forecasted high temperature must be at least 65 degrees F within 24 hours after placement. Microsurfacing shall not be placed if rain is falling or is imminent or if there is the possibility that the finished product will freeze within 24 hours.

Test Strip

Prior to commencing large quantities of microsurfacing application, the Contractor shall complete a 500' long test strip per Section 10-2.1 General Requirements/Site Preparation of these Special Provisions, and shall obtain approval from the Engineer to proceed with additional paving upon review of test strip construction and curing.

Workmanship

The contractor shall apply the microsurfacing to meet the following workmanship requirements:

- Spread the microsurfacing uniformly, as much as possible using the spreading machine, with as little handwork as possible, and as approved by the Engineer. Evidence of a wash boarding effect in the finished microsurfacing will be cause for removal and/or repair of the microsurfacing. Spread the microsurfacing such that no ridges remain.
- Longitudinal joints shall correspond with the edges of traffic lanes. The Engineer may permit other patterns of longitudinal joints, if such patterns shall not adversely affect the quality of the finished product, as determined by the Engineer. Longitudinal joints common to two driving lanes, shall be butt joints with overlaps not to exceed 3 inches.
- Make smooth transitions at the ends of each segment of paving to match the existing paving. Building paper shall be placed at transverse joints over previously placed microsurfacing to avoid double placement of microsurfacing, or other suitable methods approved by the Engineer shall be used. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface shall not be permitted.
- The mixture shall be uniform and homogeneous after spreading on the surfacing and shall not show separation of the emulsion and aggregate after setting.
- The finished surface shall be free of irregularities such as scratch or drag marks.
- Evidence of solidification of the asphalt, balling or lumping of the aggregates, or the presence of uncoated aggregates will be cause for rejection of the microsurfacing.
- Where the completed microsurfacing is not uniform in color, the street or road shall be treated to eliminate the color variation at the Contractor's expense. The method of treatment must be approved by the Engineer.
- Exercise care to prevent the slurry from being deposited on surfaces not designated to be sealed, i.e., more than 2-inches onto concrete gutters, cross gutters, driveways, etc. The Contractor shall remove slurry from those surfaces not designated to be sealed. The method used to remove the slurry must be approved by the Engineer.

Protect and cure the microsurfacing in accordance with the Curing subsection below. The cost to repair and/or cleanup damage caused by pedestrians, bicycles or vehicles tracking through the microsurfacing shall be borne solely by the Contractor. If bleeding, raveling, delamination, rutting, washboarding, or other defects occur for which the Engineer requires repairs, then the Contractor shall promptly make such repairs in accordance with the contract documents and the direction of the Engineer. The Contractor shall quantify and submit to the Engineer with its daily quantity submittals the amounts of all materials rejected, wasted, or otherwise removed and disposed from the work, and shall note and deduct such quantities from its pay quantity totals.

Documentation

Submit to the Engineer complete documentation of the quantities and qualities of materials delivered and placed for the Project. Such documentation shall include, but not be limited to:

- A. Calibration: Calibration data for all slurry seal and microsurfacing spreader trucks shall be submitted in accordance with Section 37-3.01C(3)(f) Equipment Calibration of the 2015 Caltrans Revised Standard Specifications sufficiently prior to the start of those items of work for the Engineer to review and approve such submittals before that work begins.
- B. Delivered Quantities: Weigh tickets and delivery tickets for all materials delivered to the jobsite shall be given to the Engineer by the morning of the day following the date of delivery. All Tickets shall clearly show the date of delivery. Tickets not received by the Engineer by 12:00 noon the day after delivery will not be paid for.
- C. Daily reports of all amounts of each mix component actually used in all slurry seal and microsurfacing placed, for each spreader truck, for each day of project work shall be submitted to the Engineer prior to beginning work the next day, and shall include the following:
 - Aggregate used in tons
 - Microsurfacing emulsion used in tons
 - Mineral filler used in pounds
 - Water used in gallons
 - Additives used in mixture in gallons
 - Surface area completed in square yards
 - Surface area application rate, dry pounds of aggregate per square yard
 - Percentage of emulsified asphalt based on mass of dry aggregate
 - Moisture data for the aggregate collected every 2 hours when you are unable to maintain the moisture content to within a maximum daily variation of ± 0.5 percent.
- D. Quality Control Data: All quality control data, including test results, shall be submitted to the Engineer as soon as such data is available. Any portion of that data which is required in daily reports in item C above shall be submitted in accordance with that item.
- E. Aggregate: A chronological list of all delivery tickets by gradation type and stockpile, listing delivery date, ticket number and tonnage. A list of current stockpiles and the amounts left from the weigh tickets listed and the waste amount in each stockpile.
- F. Asphalt Emulsion: A chronological list of all delivery tickets, listing delivery date, ticket number and amount. Also list the amount of emulsion currently at stockpile, from delivery tickets.
- G. Quantity of Material Lost: Each weight measurement taken and a running total of Quantity of Material Lost shall be submitted to the Engineer before beginning work the next day, or if all such materials are retained at the staging area in a manner approved by the Engineer for measurement at a later time, such as at the completion of the placement and sweeping work, then provide such documentation to the Engineer by the morning of the day after such measurements are taken.

No payment will be made for the quantity of dry aggregate which exceeds the theoretical amount of dry aggregate which should have been utilized based upon the approved application rate, the approved mix design, and the weight of emulsion used for the project.

FIELD SAMPLING

During the placement of the microsurfacing, the City may take a number of field samples of the mixed microsurfacing per mixer per day. As a minimum, this would include samples taken from the chute while the microsurfacing mixer is operating for each street and in each direction, and may also include samples from the mat placed by the mixer/spreader truck. Three Wet Track Abrasion Test specimens may be fabricated from each sample taken from the chute. A laboratory retained by the Engineer may test specimens from each sample. If a specimen fails to pass the Wet track Abrasion Test (WTAT) criteria in the following "Microsurfacing Test Values" table, then the other specimens from that sample will be tested at the Contractor's expense. The average of the test results from the three specimens will be used with results from other samples taken from the same truck to determine pay reduction as provided below, if the Engineer allows the material to remain without replacement. The samples shall also be tested for residual asphalt content and water content to make sure they meet specifications and conform to the approved mix design.

Microsurfacing Test Values

Test Requirements	ASTM Test Method	MIN.	Max.
Wet Track Abrasion Test (Weight loss, gm/m ²)	D3910	0	540
Extraction Test (Emulsion Content, %)	D2172	± 1.0% of approved mix design	
Water Content, % of Dry Aggregate Weight	D2172	Per approved mix design	

If the average of all Wet Track Abrasion Tests made per microsurfacing mixer per day by the Engineer fail to conform to the requirements in the Microsurfacing Test Values table above, and the Engineer allows the material to remain in place rather than be replaced at the Contractor's sole expense, then the Contractor agrees that payment for the work represented by the failed tests shall be reduced as specified in the following table.

WTAT Pay Reduction Factors

WTAT LOSS (gm/m ²)	Payment Reduction (Percent)
0 - 540	0
540.1 - 650	5
650.1 - 750	15
750.1 - 860	30
860.1 - 1070	70
1070.1 or Greater	100

Microsurfacing with WTAT loss greater than 1070.1 gm/m², and microsurfacing otherwise rejected by the Engineer due to non-conformance with the contract documents, shall be removed and replaced to the satisfaction of the Engineer at the Contractor's sole expense.

CURING

Ensure all microsurfacing is scheduled, constructed, and protected to comply with the contract documents both for the quality and coverage required, as well as for public convenience and access.

Streets, roads, and other areas of application shall only be closed from the hours of 7:00 A.M. to 5:00 P.M., to allow vehicles access to the street, road, or area by 5:00 P.M without any damage to the microsurfacing.

The application of any materials to the roadway or area shall be completed as early as necessary to allow sufficient cure time, cooling, finishing, delineation, and cleanup in order to allow public traffic full access to the roadway or area no later than 5:00 P.M., or earlier if so directed by the Engineer. The application of microsurfacing, shall be completed by 2:45 P.M. at the latest, or as early as necessary to allow sufficient cure time in order to allow public traffic full access to the street or road no later than 5:00 P.M.

Provide adequate cure time while protecting the microsurfacing from any damage until the microsurfacing can be opened to public traffic without any damage resulting to the microsurfacing from such traffic. Ensure the microsurfacing mixture continually conforms to the contract documents, conforms to the approved mix design, and maintains appropriate quantities of mix additives in order to perform as specified in the contract, and not result in excessive raveling or other performance problems.

Separate microsurfacing placement into multiple application days for both street and facility locations as is necessary to maintain public, owner and tenant access and convenience, and as required by the City. Two-way traffic shall be maintained on all streets and anywhere else required by the City, unless otherwise approved by the City in writing. Intersections and school, commercial, government, and multi-unit residential driveways shall be completed in a minimum of two (2) parts to allow continual ingress and egress of traffic, where required by the Engineer.

When ambient temperatures are below 75°F (25°C), Contractor shall use extra care in confirming sufficient curing of microsurfacing prior to opening it to traffic.

The time required and/or conditions evidencing sufficient curing shall be approved by the Engineer upon confirmation in the field. The microsurfacing must build sufficient cohesion to resist abrasion due to traffic. Shedding, raveling, or loss of microsurfacing material should be less than 3% when it is properly mixed, placed, and protected. If the mixture is opened to traffic too early, it will ravel off quickly, particularly in high stress areas. A general rule recommended by ISSA is that a microsurfacing can carry early traffic when it is expelling clear water.

The microsurfacing shall be placed in conformance with the contract documents, and such that it shall cure so as to change in color from brown to black within 20 minutes after placement, and shall be able to be opened to vehicle traffic within 1 hour from the time of placement, without causing traffic damage to the microsurfacing, including but not limited to excessive raveling or shedding of microsurfacing materials. Traffic shall not be allowed on the microsurfacing until it has adequately cured. Approval shall be obtained from the Engineer of the microsurfacing curing, prior to allowing traffic.

Sand blotter (dry kiln sand) shall not be used unless approved in writing by the Engineer. All measures specified above shall be implemented, and if the Engineer determines that the use of sand blotter is necessary, then after the Engineer's written approval, sand blotter may be placed in a manner that prevents any damage to the microsurfacing from its use. Sand blotter shall be placed and maintained in a manner and quantity sufficient to protect the microsurfacing from damage, and to ensure the safety of all modes of traffic passing over it. The Contractor shall sweep and remove sand blotter once the microsurfacing has cured sufficiently to prevent damage to the microsurfacing by vehicle traffic, and at least within 2 working days. Full compensation for supplying, placing, maintaining, and removing sand blotter shall be considered as included in the contract price paid for microsurfacing, and no separate payment will be made therefor.

Any damage to the microsurfacing resulting in whole or in part from the Contractor failing to fully comply with the provisions of this section shall be promptly corrected to the satisfaction of the Engineer at the Contractor's sole expense. Such correction shall include but not be limited to removal of microsurfacing where determined necessary by the Engineer, and/or re-application of the specified microsurfacing in accordance with the contract documents to rectangular limits not less than full lane width, and as approved by the Engineer. Such repairs shall be accomplished as soon as the problems are noted.

ROLLING

The microsurfacing shall be rolled after placement and initial curing with three (3) passes of a minimum 8-ton pneumatic tire roller equipped with a water spray system, which has all tires inflated per the manufacturers specifications, and which meets the requirements of Caltrans 2015 Revised Standard Specifications, Section 37. Full compensation for supplying and operating a pneumatic tire roller shall be included in the price paid for microsurfacing and no separate payment will be made therefore.

SWEEPING

Protect and cure microsurfacing in accordance with the contract documents, and prevent damage and loss of significant or excessive microsurfacing materials. Promptly remove and dispose of spilled, failed, and rejected materials and perform necessary repairs or replacement as directed by the Engineer and in accordance with the contract documents.

Sweep the microsurfacing 24 hours after placement without damaging the microsurfacing. For 4 days afterwards, sweep the microsurfacing daily unless determined otherwise by the Engineer. Two weeks after the microsurfacing has been placed and streets, or other microsurfacing areas have been opened to traffic, the Contractor shall sweep the surface to remove any loose aggregate. The contractor shall sweep the microsurfacing streets or areas from curb face to curb face or edge of pavement to edge of pavement (when there is no curb), using vacuum type street sweepers. In rural areas other methods may be used with the written permission of the Engineer. The Contractor shall also promptly sweep any other areas required by the Engineer, where loose or out of place project materials exist.

The Contractor shall quantify and document all sweepings of microsurfacing materials placed, for City review. If the amount of sweepings is excessive, the City will apply pay reductions for the pay quantities represented by the excessive sweepings, or require the Contractor to make the necessary repairs, including but not limited to reapplication of the microsurfacing in accordance with the contract documents. All materials collected (by sweeping or otherwise) from the microsurfacing placed shall be transferred to a location approved by the Engineer and weighed to determine the Quantity of Material Lost from the roadway or application surface. Quantities of materials collected from areas which the Contractor repaired or re-applied microsurfacing at its own expense in accordance with the contract documents and as approved by the Engineer, should be deducted or excluded from the Quantity of Material Lost documentation which the Contractor shall provide to the Engineer. The Contractor shall provide to the Engineer each weight measurement taken and a running total of Quantity of Material Lost of placed microsurfacing before beginning work the next day, or shall retain all such materials at the staging area in a manner approved by the Engineer for measurement at a later time, such as at the completion of the placement and sweeping work. The Contractor shall separately store and accurately measure and document the Quantity of Material Lost from each application area which appears to ravel, shed, or lose greater than 5% of the weight of dry aggregate of the microsurfacing placed in that application area, in order to avoid payment reductions applying to a larger area.

Pay reductions for excessive loss of placed microsurfacing material shall be imposed as follows:

Quantity of Material Lost Pay Reduction Factors

Quantity of Material Lost (% by weight of dry aggregate placed)	Payment Reduction (Percent)
0 - 5	0
5 - 10	10
10 - 15	25
15 - 20	40
20 - 30	70
30 or Greater	100

The Engineer may require repair or replacement of microsurfacing which has raveled, shed, or lost excessive amounts of material, or which otherwise does not conform to the contract documents, as determined by the Engineer. Once the Engineer has reviewed and confirmed the Quantities of Material Lost and has authorized disposal of such materials, the Contractor shall properly dispose of all such materials.

QUALITY CONTROL

General

The Contractor is responsible for quality control (QC) sampling, testing, and documentation, and shall submit a QC plan including materials and procedures for verifying the quality of the aggregates and emulsified asphalt(s); measures to ensure placement of materials conforms to the contract documents; and measures and documentation to ensure the in-place end product conforms to the contract documents. The Contractor's QC plan shall include but is not limited to sampling, testing, inspection, monitoring, documentation, and corrective action procedures during transport, stockpiling, proportioning, placement, and sweeping/cleanup operations. The plan shall include, as a minimum, the following:

- Sampling and testing procedures in accordance with AASHTO MP 28.
- Sampling and testing procedures for asphalt emulsion.
- Sampling and testing procedures for residual binder content.
- Actions the contractor will take to correct any deficiencies and who will be responsible to the make corrections.
- Regular submittals of all QC data, and who will be responsible for those submittals.

A written Quality Control Plan (QCP) shall be developed which details the Contractor's QC program that meets the requirements of these specifications. The QCP shall be contract specific and signed by the Contractor's representative. Slurry seal and microsurfacing construction shall not begin or proceed without the Engineer's approval of the QCP and QC personnel present on the project. Failure to comply with these provisions will result in shutdown of the operations until such time as the Contractor's operations are in compliance.

Unless the Engineer accepts other documentation of the qualifications and/or responsibilities of the Contractor's QC staff, the QC staff shall include the following as a minimum:

- QCP Administrator – The person with overall responsibility of the QCP.
- QCP Manager – The person responsible for the execution of the QCP and liaison with the Agency. This person shall be on the project, and have the authority to stop or suspend construction operations.
- QC Technicians – The person(s) responsible for conducting QC tests and inspection to implement the QCP. QC technicians shall have Level 2 Aggregate Testing Certification from the American Concrete Institute (ACI) or other accrediting body approved by the Agency.
- Certified Crew Members – Two crew members (job foreman and mixer/spreader operator), at a minimum, shall possess a valid microsurfacing certification and be on the project at all times the microsurfacing is being constructed. The microsurfacing certification is administered by the National Center for Pavement Preservation (NCP) on behalf of AASHTO TSP² (Transportation System Preservation Program).

MEASUREMENT AND PAYMENT

Bid Item 8 "Type II Microsurfacing" will be measured by the Ton of microsurfacing placed in conformance with the contract documents, as approved by the Engineer, by combining the weight of the aggregate and microsurfacing emulsion. The weights of added water, set control additive, and water used to pre-wet the pavement shall not be included in the measurement for payment.

If test results for aggregate grading or sand equivalent do not comply with the specifications, you may remove the installed microsurfacing represented by the test results or request it remain in place, as approved by the Engineer, with a payment deduction of \$10 per ton. If test results for both aggregate grading and sand equivalent do not comply with the specifications, both deductions are made. An aggregate grading or cleanness value test represents 300 tons or 1 day's production, whichever is less.

No payment will be made for tonnage of microsurfacing in excess of 110% of the calculated quantities required to cover the application areas at the application rates approved by the Engineer, in conformance with these Special Provisions and the approved submittals.

The contract price paid per Ton for Type II Microsurfacing shall be considered to include full compensation for furnishing all labor, materials, tools, equipment, mix designs, submittals, preparatory work, documentation, quality control, guarantees, warranties, incidentals, clean-up, and for doing all the work involved in constructing the microsurfacing, complete in place, and protecting the microsurfacing until it has cured, all as shown on the plan exhibits, and as specified in these Special Provisions and in the 2015 Caltrans Revised Standard Specifications, and as directed by the Engineer.

The contractor must furnish the following warranty after completion of the work and prior to final payment:

The Contractor hereby warrants that all workmanship and all materials furnished under the contract comply fully with requirements of these Type II Microsurfacing specifications. If at any time within two years from the date of filing of the Notice of Completion, any unfaithful or defective work should appear, which in the opinion of the City is due to inferior materials or workmanship, the Contractor warrants to do whatever is necessary to remedy the defects immediately without cost to the City. The City will notify the Contractor in writing of the defects and the repairs to be made, and the Contractor will begin repairs within a mutually agreed time frame. Such repairs shall include but not be limited to re-application of the specified Type II Microsurfacing in accordance with the contract documents to rectangular limits not less than full lane width and as approved by the Engineer, over any areas where greater than 10% of the underlying pavement material, including but not limited to chip seal material, is visible.