Department of Transportation

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June 3, 2013

ADDENDUM NO. 1

RE: June 6, 2013 Rapid City Region Office Informal Letting

TO WHOM IT MAY CONCERN:

The following addenda to the plans shall be inserted and made part of your proposal for the referenced project.

PROPOSAL:

- Please add the attached Special Provision for Polymer-Modified Microsurfacing, dated 2/13/13.

PLANS:

- No change

Sincerely,

_____
John Rehorst
Region Design Engineer

STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
POLYMER-MODIFIED MICROSURFACING

FEBRUARY 13, 2013

I. DESCRIPTION

This work consists of applying a mixture of latex-based polymer-modified emulsified asphalt, mineral aggregate, mineral filler, water, and necessary additives proportioned, mixed and uniformly spread on the existing roadway surface.

II. MATERIALS

A. Polymer-Modified Emulsified Asphalt: The polymer-modified emulsified asphalt shall be a blend of CQS-1h and a latex-based polymer. The polymer-modified emulsified asphalt shall conform to the requirements of Section 890, with the following modifications and additions:

Quality (on emulsion)	Test	Requirement:
Residue after Distillation[1]	AASHTO T59	62%, min

Quality (on residue)	Test	Requirement:
Softening Point	AASHTO T53	135°F (57°C), min
Penetration at 77°F (25°C)	AASHTO T49	40 – 90

[1] The standard distillation procedure shall be modified as follows: The temperature on the lower thermometer shall be brought slowly to 350 ± 10°F (177 ± 5°C) and maintained at this level for 20 minutes. The total distillation shall be completed in 60 minutes ± 5 minutes from the first application of heat.

The latex-based polymer material shall be milled or blended into the asphalt or emulsifier solution during the manufacture of the emulsified asphalt to produce a homogeneous mixture. The latex-based polymer shall be added in the necessary proportions to result in a minimum of 3% latex by weight of residual asphalt cement in the emulsion. The undisturbed latex polymer modified emulsion shall stand for a period of 24 hours and not show separation of the emulsion and latex modifier. The sample shall show uniform color throughout with no color striations.

The storage stability and cement mixing test is not required for the emulsion.

The Contractor shall provide certification to the Engineer for each load of polymer modified emulsion delivered to the project to ensure that the emulsion meets the requirements.

B. Aggregate: Compatibility of the aggregate and polymer modified asphalt emulsion shall be certified by the emulsion manufacturer. All materials used in the job mix formula shall be representative of the materials proposed by the Contractor for use in the project. The average gradation of each stockpile shall be furnished to the mix designer.

The mineral aggregate shall be composed of a combination of crushed stone and mineral filler meeting the requirements of Section 881 with the following modifications and additions:

The job mix formula (target) gradation shall be within the gradation band specified. After the job mix formula (target) gradation is established and accepted, the percent passing each sieve shall not vary by more than the job mix formula tolerance. The percent passing shall not go from the high end to the low end of the range for any two consecutive sieves.

Composite Mineral Aggregate Requirements

Gradation:

Sieve Size	SDDOT Type II (Percent Passing)	SDDOT Type III (Percent Passing)	Job Mix Formula Tolerance
3/8" (9.5mm)	100	100	
#4 (4.75mm)	90-100	79-90	± 5%
#8 (2.36mm)	65-90	45-70	± 5%
#16 (1.18mm)	45-70	28-50	± 5%
#30 (600 μm)	30-50	19-34	± 5%
#50 (300 μm)	18-30	12-25	± 4%
#100 (150 μm)	10-21	7-18	± 3%
#200 (75 μm)	5.0-15.0	5.0-15.0	± 2.0%

Aggregate Tests

Test	Method	Specification
Sand Equivalent[1]	SD221	60% Min
LA Abrasion Loss	AASHTO T 96	40% Max
Sodium Sulfate Soundness Loss (five cycles)	SD220	12% Max
+#4 (4.75 mm) sieve Fractured Faces Two or more faces[2]	SD211	95% Min
-#4 (4.75 mm) sieve Manufactured Fines[3]		70% Min
+#4 (4.75 mm) sieve Light Weight Particles[2,4]	SD214	1.0% Max
-#4 (4.75 mm) sieve Light Weight Particles	SD214	1.0% Max
Plastic Index (PI)	SD207	Non Plastic

[1]Evaluated for specification at mix design only.
[2]Not required if aggregate material is produced from a ledge rock source.
[3]Manufactured fines shall be manufactured solely from material retained on the ¾" (19 mm) sieve, unless the aggregate is produced from a ledge rock source.
[4]If the amount of material retained on the #4 (4.75 mm) sieve is 10% or less, the minimum sample size required will be 200 grams of +#4 (4.75 mm) material.

C. Mineral Filler: Mineral filler shall meet the requirements for Type I non air-entrained Portland Cement in accordance with Section 750 and shall be free of lumps.

D. Water: Water shall conform to Section 790.

E. Additives: Additives may be added to the emulsion mix or any of the component materials to provide control of the quick-set properties and increase adhesion. Additives must be included as part of the mix design and be certified as compatible with other components of the mix.

F. Composition and Quality of Mixture: The Contractor shall be responsible for the design and proportioning of the microsurfacing mixture. The mix design shall be prepared by a laboratory that has experience in designing microsurfacing and shall be approved by the Bituminous Engineer. The microsurfacing mixture shall be designed in accordance with the International Slurry Surfacing Association (ISSA) guidelines. The proposed mix design shall be submitted to the Bituminous Engineer for review and approval. The proposed mix design shall include all test results, the proportions of all ingredients of the mixture, and the gradation of the aggregate proposed for use.

The microsurfacing mixture shall meet the following requirements:

Test	Method	Specification
Wet Stripping	ISSA TB-114	90% min
Wet Track Abrasion Loss - One Hour Soak - Six Day Soak	ISSA TB-100	 50 g/ft^2 (538 g/m^2) max 75 g/ft^2 (807 g/m^2) max
Saturated Abrasion Compatibility	ISSA TB-144	3 g loss, max
Mix Time at 77°F (25°C)	ISSA TB-113	Controllable to 120 sec., min
Mix Time at 100°F (37.4°C)	ISSA TB-113	Controllable to 35 sec., min
WET COHESION	ISSA TB-139	

@ 30 minutes min. (set) @ 60 minutes min. (traffic)		10 lb-in min. (12 kg-cm min.) 17 lb-in min. (20 kg-cm min.)
Excess Asphalt by LWT Sand Adhesion	ISSA TB-109	50 g/ft² max. (538g/m² max.)
Lateral Displacement Specific Gravity after 1,000 cycles of 125 lbs (57 kg)	ISSA TB-147	5% max 2.10 max
Classification Compatibility	ISSA TB-144	11 grade points min (AAA, BAA)

G. Proportioning: The mix design shall designate the proportions to be used within the following limits:

Component Materials	Limits
Residual Polymer-Modified Emulsified Asphalt	5.5% to 10.5% by dry weight of aggregate.
Latex-Based Polymer Modifier	Minimum of 3% solids based on asphalt weight content
Mineral Filler	0.25% to 3.0% by dry weight of aggregate.
Additives	As needed
Water	As needed to provide proper consistency.

H. Mix Design Format: The designer shall submit the final mix design in the following format.

1. Source of each individual material.

2. Aggregate:
- **a.** Gradation
- **b.** Sand Equivalent
- **c.** Abrasion Resistance
- **d.** Soundness

3. Field Simulation Tests:
- **a.** Wet Stripping Test
- **b.** Wet Track Abrasion Loss
- **c.** Saturated Abrasion Compatibility
- **d.** Trial Mix Time at 77°F (25°C) and 100°F (37.4°C)

4. Interpretation of Results and the Determination of a Job Mix Formula:
- **a.** Percentage of Mineral Filler (minimum and maximum)
- **b.** Percentage of Water, including aggregate moisture (minimum and maximum)
- **c.** Percentage of Mix Set Additive (if required)
- **d.** Percentage of Modified Emulsion
- **e.** Residual Asphalt Content of Modified Emulsion
- **f.** Percentage of Residual Asphalt

5. Signature and Date

I. Storage of Emulsion: The Contractor shall provide suitable storage facilities for the polymer-modified asphalt emulsion. The facilities shall be equipped to prevent water from entering the emulsion and shall be adequately heated to prevent freezing of the polymer-modified emulsified asphalt.

III. CONSTRUCTION REQUIREMENTS

A. Weather and Seasonal Limitations: The microsurfacing material shall be spread only when the surface temperature on a shaded portion of the existing surface is above 50°F (10°C) and rising. Placement is not permitted when the weather is rainy or foggy. Microsurfacing material shall not be placed when there is a danger the finished product will freeze within 48 hours.

Microsurfacing material shall be placed only between June 1 and September 15 (inclusive).

B. Equipment

1. Mixing Machine: The Contractor shall provide a continuous micro-surfacing lay down machine with a positive connection conveyer belt aggregate delivery system, inter-connected positive displacement, water-jacketed gear pump to accurately proportion aggregate, and asphalt emulsion. The mineral filler feed shall be located so the proper amount of mineral filler is dropped on the aggregate before discharging into the pugmill. The pugmill must be a continuous flow twin shaft multi-blade type and a minimum of 4 ft (1.2 m) long. The blade size and side clearance must meet the equipment manufacturer's recommendations. The asphalt emulsion shall be introduced within the first one-third of the mixer length to ensure proper mixing of all materials prior to exit from the pugmill.

The Contractor shall use a self propelled, front feed, and continuous loading machine with duel driving stations. A remote forward speed control shall be provided at the back mixing platform so that the back operator can control forward speed and the level of mixture in the spreader box. Sufficient transport units shall be used to ensure a continuous operation during mix production and application.

Individual volume or weight controls for proportioning each material shall be provided. The controls shall be positioned to be accessible at any time. Using the controls the Contractor shall calibrate the operation prior to production and shall determine the amount of each material to be used at any time.

The Contractor shall provide a water pressure system and nozzle-type spray bar to spray water ahead of and outside the spreader box when required. Water shall be applied at a rate to dampen the surface, but not to create free flowing water, ahead of the spreader box.

The Contractor shall provide nurse trucks to ensure that legal axle loads are not exceeded and a steady rate of progress in the laying of the microsurfacing is made.

2. **Spreader Box:** The Contractor shall spread the mix uniformly using a mechanical type spreader box attached to the mixer and equipped with spiral augers mounted on adjustable shafts. The mixture shall be continually agitated and distributed. Sufficient agitation shall be provided to prevent stagnation, excessive build-up, or lumps. The spreader box shall be equipped with front and rear flexible seals to achieve direct contact with the road. Use a secondary strike-off plate attached to the spreader box to provide a smooth finished surface texture. The use of burlap drags is not allowed.

   The spreader shall be maintained to prevent the loss of the microsurfacing mixture during the surfacing of superelevated curves. The mixture shall be spread to fill all cracks and minor surface irregularities and leave a neat appearing, uniform, non-skid application of the aggregate and asphalt on the surface.

   The mixture shall be homogeneous during and following mixing and spreading. It shall be free of segregation and excess water or emulsion. Under no circumstance shall water be sprayed directly into the laydown box while laying microsurfacing material.

   All excess material that overruns the gutters shall be removed or squeegeed back onto the surface. All excess material shall immediately be removed from the end of each day's run.

   Areas which cannot be reached with the mixing machine shall be surfaced using hand tools to provide a complete and uniform coverage. Care shall be exercised to leave no unsightly appearance from the handwork. The same type of finishing as applied by the spreader box shall be required.

3. **Rut Filling Box**: The Contractor shall provide a rut box specifically designed and manufactured to fill ruts. A rut box shall be provided for each designated wheel track. The rut box shall be 5 ft to 6 ft (1.5 m to 2.0 m) in width and have a dual chamber with an inner V configuration of augers to channel the large aggregate to the center of the rut and the fines to the edges of the rut fill pass. The box shall be equipped with dual strike-off plate to control both the width and depth of the rut fill.

4. **Miscellaneous Equipment:** The Contractor shall provide hand squeegees, shovels and other equipment necessary to perform the work. Cleaning equipment such as power brooms, air compressors, water flushing equipment, and hand brooms shall be adequate for surface preparation.

C. Stockpiling of Aggregate: Precautions shall be taken to ensure that stockpiles do not become contaminated. Excess moisture which would interfere with the amount of asphalt required in producing the desired homogeneous mixture will not be permitted. The stockpile shall be kept in areas that drain readily. Segregation of the aggregate will not be permitted.

D. Preparation of Surface: The area to be microsurfaced shall be thoroughly cleaned of all vegetation, loose aggregate, soil tracked onto the roadway and other objectionable material immediately prior to placing microsurfacing. Water used in prewetting the surface shall be applied at a rate to dampen the entire surface without any free-flowing water ahead of the spreader box.

E. Calibration: The Contractor shall calibrate the mixing unit in the presence of the Engineer prior to the start of construction. The mixing unit shall be recalibrated if the material source changes

F. Operations:

1. Microsurfacing Types:

a. Surface Course .....SDDOT Type 2
Apply full lane width in one course at the rate specified in the plans. There shall be no excess buildup or uncovered areas.

b. Scratch Course.....SDDOT Type 2 or 3
(Type to be selected by the designer)
Apply full lane width in one course at the rate specified in the plans. The spreader box shall be equipped with a metal strike-off plate. There shall be no excess buildup or uncovered areas.

c. Rut Filling .....SDDOT Type 3
Ruts greater than 1/2 in. (12.5 mm) shall be filled with a rut box at the rate specified in the plans. The box shall be equipped with dual strike-off plate to control both the width and depth of the rut fill. The rut filling surface shall be crowned between 1/8 in. and 1/4 in. per inch depth to allow for traffic to compact to approximately a level surface. Each pass of rut filling shall be limited to a maximum depth of 1 in. (25mm). A clean overlap and straight edges will be required between wheel tracks. The Contractor shall provide and use a 10 ft (3m) straight edge to control the depth and crown. Rut filling shall be compacted by traffic following one hour of cure. Filled ruts shall cure under traffic for a 24 hour period, prior to the surface course being applied.

2. Application Rates: The design application rate shall be the total amount of micro-surfacing material placed to meet the requirements for cross

section and surfacing. This amount will be the combination of all courses placed.

3. **Test Strip:** A minimum 300 foot (100 m) long, one lane wide test section, for each machine used on the project to determine surface characteristics and set time must be constructed and approved by the Engineer prior to commencing paving operations. A portion of the test section shall be at least 3/4 in. (19mm) thick. The Contractor shall construct the test section at least one (1) day prior to beginning work.

   A new test strip shall be constructed when the system used in job mix changes or there is field evidence that the system is out of specification. The system includes the following: emulsion, aggregate supplier, type of mineral filler, and the lay down machine.

   Normal traffic shall be carried on the test strip within one hour after application without any damage occurring to the strip. The Engineer will inspect the completed test strip after a minimum of 12 hours of traffic to determine if the mix design is acceptable. Full production may begin after the Engineer accepts a test strip. The Engineer will approve the location of the test strip.

4. **Finished Surface:** The Engineer will make inspections of the finished surface at any time and on any 30 yd^2 (25 m^2) of surface. The inspected area shall comply with the following:

   a. No more than four tear marks greater than 1/2 in. (12 mm) wide and/or 4 in. (100 mm) long.

   b. No tear marks greater than 1 in. (25 mm) wide and 3 in. (75 mm) long.

   c. No transverse ripples or longitudinal streaks of 1/4 in. (6 mm) or more in depth when measured by placing a 10 ft (3 m) straight edge over the surface.

5. **Joints:** The longitudinal and transverse joints shall be constructed without any buildups, uncovered areas, or unsightly appearance and shall comply with the following requirements:

   a. Longitudinal joint lines shall be placed with less than 2 in. (50 mm) of overlap on adjacent passes and no more than 1/4 in. (6 mm) difference in elevation between the adjacent passes. The longitudinal joints shall be placed at the lane lines.

   b. Transverse joints shall be constructed with no more than 1/8 in. (3 mm) difference in elevation across the joint when measured with a 10 ft (3 m) straight edge.

6. **Edges:** Edges shall be placed neatly and uniformly along the roadway lane, shoulders and curb lines. Edges shall be placed flush with curbs. Edges shall be placed to no more than ±2 in. (50 mm) horizontal variance in any 100 ft (30m) along roadway lane and shoulder. At locations where feathered microsurfacing is specified or shown on the plans, the ±2 in. (50 mm) edge variance shall be eliminated.

G. Documentation: The Contractor shall provide a daily report to the Engineer. The daily report shall be submitted within one working day and shall contain the following information:

- Date and Air Temperature at start up.
- Beginning and Ending locations for the days work.
- Length, Width, Total Area (square yard) covered for the day.
- Application Rate (pounds per square yard), pounds of aggregate.
- Daily asphalt spot check reports, gallons of emulsion, weight of emulsion ([pounds per gallon).
- Asphalt Emulsion Bill(s) of Lading.
- Counter Readings (and Beginning, and Ending, and Total).
- Control Settings, Calibration Values, Percent Residue in Emulsion.
- Percent of Each Material, Percent of Asphalt Cement.
- Calibration Forms
- Aggregate Certification or Shipment of Tested Stock Report
- Contractor's Authorized Signature

H. Curing: The microsurfacing shall be cured sufficiently so that it will not deform or be picked up by vehicle tires. The Contractor shall provide signs, barricades, and flaggers necessary to control traffic around the areas under construction. Damages to the microsurfacing due to premature opening to traffic shall be repaired by the Contractor at no additional cost to the Department.

I. Opening to Traffic: Place microsurfacing treatment to sustain traffic within 1 hour after placement. The Contractor shall schedule microsurfacing placement to ensure that the traffic lanes are opened to traffic 30 minutes before sundown of the same working day. When traffic is maintained, the entire roadbed shall be free of construction equipment during non-working hours.

IV. METHOD OF MEASUREMENT

The microsurfacing will be measured by the Engineer as follows:

A. Aggregate for Microsurfacing: The aggregate used in accepted portions of work will be measured to the nearest 0.1 ton (0.1 metric ton). No deductions

will be made for moisture naturally occurring in the aggregate. The quantity of mineral filler, water, and additives will be incidental to the aggregate quantity.

B. Asphalt Emulsion for Microsurfacing: Asphalt emulsion including polymer latex modifier used in accepted portions of work will be measured to the nearest gallon (liter). No deductions will be made for water in approved emulsion. The volume shall be corrected for temperature to 60°F (15°C).

C. Preparation of Surface for Microsurfacing: Preparation of the surface will not be measured for payment.

Materials wasted, after use in the calibration process, will be included in the quantities measured for payment; but the amount shall not exceed 5 ton (5 metric ton) of aggregate and 100 gallons (380 liters) of asphalt emulsion.

V. BASIS OF PAYMENT

The microsurfacing will be paid for as follows:

A. Aggregate for Microsurfacing: Aggregate will be paid at the contract unit price per ton (metric ton). This payment shall be full compensation for equipment, labor, and furnishing all materials except asphalt emulsion necessary to complete the work and construction of the test strip.

B. Asphalt Emulsion for Microsurfacing: Asphalt emulsion used will be paid at the contract unit price per gallon (liter). This payment shall be full compensation for furnishing the asphalt emulsion.

C. Preparation of Surface for Microsurfacing: The cost for preparation of the surface shall be incidental to the microsurfacing items.

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