

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 872
LIGHT EMITTING DIODE
TRAFFIC AND PEDESTRIAN SIGNAL LAMP UNITS**

APRIL 21, 2006

872.01 Description

872.02 Material Requirements

872.03 Documentation Requirements

872.04 Warranty

872.01 Description. This Supplemental Specification describes the minimum acceptable design and performance requirements for 12"(300 mm) Light Emitting Diode (LED) traffic and pedestrian signal lamp units.

872.02 Material Requirements. Furnish LED signal lamp units that meet or exceed all the requirements of the current Institute of Transportation Engineers (ITE) publications- Vehicle Traffic Control Signal Heads (VTCSH) - Light Emitting Diode (LED) Circular Signal Supplement 2005; Pedestrian Traffic Control Signal Indications (PTCSI) - Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules and Vehicle Traffic Control Signal Heads - Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules, unless otherwise stated in the specifications herein.

All LED signal lamp units shall be the latest model currently in production and new. Equipment no longer being manufactured shall not be accepted, even if it meets the following specifications.

LED signal lamp units shall conform to the following criteria:

A. Physical and Mechanical Requirements

1. The LED traffic signal lamp unit shall be designed as a retrofit replacement for existing incandescent signal lamps and shall not require any special tools for installation. The 12"(300 mm) retrofit replacement LED traffic signal lamp unit shall fit into existing traffic signal housings built to ITE VTCSH standards without modifications.
2. Installation of a retrofit replacement LED traffic signal lamp unit into an existing signal housing shall only require removal of the existing lens and incandescent lamp. The new unit shall fit securely in the housing door and connect to existing electrical wiring or terminal block by means of simple connectors. Removal of the reflector is optional.
3. Each LED signal lamp unit shall be identified on the back side with the following:
Manufacturer's name and trademark

- a. Part number
 - b. Serial number
 - c. Voltage rating
 - d. Power consumption (watts and volt-ampere)
 - e. Vertical indexing indicator (i.e., “up arrow”, or the word “UP” or “TOP”) if specific orientation of the module is required.
 - f. Date of manufacture (minimum information required - month & year)
 - g. Single units shall have identification markings as to the type and color of the module. Bi-Modals shall be marked with module type.
 - h. Each LED signal lamp unit shall have a label placed on the unit certifying compliance to ITE standards for color and luminance.
4. The LED traffic signal lamp unit shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing.
 5. The assembly and manufacturing process for the LED traffic signal lamp unit assembly shall be such as to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
 6. The lens of the LED signal lamp unit shall be capable of withstanding ultraviolet light (direct sunlight) exposure for a minimum time period of five years without exhibiting evidence of deterioration.
 7. Ensure that lenses will withstand a 3.5 foot (1.0 meter) drop test, are a minimum of 1/8 inch (3 mm) thick, and are free of bubbles and imperfections. The lenses shall be smooth on the outside with no external facets to prevent dirt and debris build up.
 8. Each LED traffic signal lamp unit shall comprise a UV stabilized polymeric outer shell, multiple LED light sources, and a regulated power supply.
 9. If lenses are tinted, they shall match the wavelength (chromaticity) of the LED.
 10. An optical assembly shall diffuse the light output and provide uniform illumination across the entire surface of the lens and eliminate the visibility of the individual LEDs to the observer. The optical assembly shall be used for all ball modules and shall be optional on arrow and pedestrian modules.
 11. The LED traffic signal lamp unit shall be designed for universal installation in both span wire and standard/stationary pole mount applications.
 12. The “Arrow” pattern produced by the Arrow LED traffic signal lamp units shall conform to the VTCSH standard for color, size and shape. The Arrow LED traffic signal lamp units shall not require a specific orientation or have a variance in light output, pattern or visibility for any mounting orientation.

13. LED pedestrian signal lamp units shall be designed as a retrofit replacement, modular or screw in unit for the message bearing surface of a 12" (300 mm) pedestrian traffic signal, type A-2, housing built to the PTCSI - part 2 Standard.

14. The LED pedestrian signal lamp unit shall fit into existing pedestrian signal housings without the need to modify the housing. Installation of the retrofit replacement LED pedestrian signal lamp unit into an existing 12"(300 mm) pedestrian signal housing shall only require the removal of the existing message bearing surface, existing lamp components (i.e. lens, lamp module, gaskets, and reflector) and insertion of the retrofit replacement into the area once occupied by the removed assembly.

15. The single pedestrian module shall be designed to display a full "HAND" icon and a full" Walking "Person icon that complies with PTCSI standards for this (icon) symbol for the size specified.

16. LED traffic signal lamp units shall be visible at 450 feet (137 meters) during sway conditions (extended view) until obscured by the visor.

17. The module shall be designed to detect catastrophic loss of the LED load. Upon sensing the loss of the LED load, the module shall present a resistance of at least 250K Ohms across the input power leads within 300 msec.

18. Turn-On and Turn-off time is less than 75 msec. Also, low voltage Turn-Off is less than 35 Volts.

B. Photometric Requirements

1. The red, yellow and orange lamps shall be manufactured using AlInGaP (Aluminum-Indium-Gallium-Phosphide) technology or other LEDs with lower susceptibility to temperature degradation than AlGaS (Aluminum-Gallium-Arsenic). AlGaS LEDs will not be permitted. Green lamps shall be manufactured using Indium Gallium Nitride.

2. Each LED traffic signal lamp unit shall meet minimum laboratory light intensity values, color (chromaticity), and light output distribution as described in ITE VTCSH – LED Circular Signal Supplement of the specifications 4.1, and 4.2 as a minimum. Table A-1 provides the minimum maintained luminous intensity values for the VTCSH LED Circular Signal. Environmental test shall include an expanded view for the red and green ball indications with the following minimums for a period of 60 months.

Table A-1				
Minimum Luminous Intensity Values (In Candelas)				
Vertical Angle	Horizontal Angle (Left/Right)	RED	YELLOW	GREEN
-17.5	2.5	51	127	67
	17.5	15	36	19
-12.5	2.5	110	273	143
	17.5	37	91	48
-7.5	2.5	281	701	366
	17.5	91	228	119
-2.5	2.5	358	892	466
	17.5	117	291	152
+2.5	2.5	150	373	195
	7.5	124	309	162
	12.5	84	209	109
	17.5	47	118	62
+7.5	2.5	69	173	90
	7.5	55	137	71
	12.5	40	100	52
+12.5	2.5	37	91	48
	7.5	29	73	38
-22.5	2.5	37	91	48
	7.5	29	73	38
	12.5	22	55	29
	17.5	11	27	14
-27.5	2.5	26	64	33
	17.5	18	46	24

Notes:

Luminous intensity values for equivalent left and right horizontal angles are the same.

Tabulated values of luminous intensity are rounded to the nearest whole value.

Arrow Indications (in candelas/m²)

Yellow	Green
11,000	11,000

3. LEDs for arrow indications shall be spread evenly across the illuminated portion of the arrow area. Arrow LED traffic signal lamp units shall meet VTCSH – Part 3: LED Vehicle Arrow Traffic Signal Modules, March 2004. Arrow LED traffic signal lamp units shall be designed so that when operated over the specified ambient temperature and voltage ranges, the signal is clearly visible and attracts attention for a distance of at least 1300 feet (400 meters) under normal atmospheric conditions. Arrow LED traffic signal lamp units shall have 3 rows of LEDs only.

4. Measured chromaticity coordinates of LED traffic signal lamp units shall conform to the chromaticity requirements of the following table, for a minimum period of 60 months, over an operating temperature range specified in section “D”. Each LED traffic signal lamp unit shall meet the minimum requirements for light output for the entire range from 80 to 135 volts.

Chromaticity Standards	
Red	Y: not greater than 0.308 or less than 0.998
Yellow	Y: not less than $0.411 \frac{x}{x}$ nor less than $0.995 - x$ nor less than 0.452
Green	Y: not less than $0.506 - 0.519x$ nor less than $0.150 + 1.068x$ nor more than 0.730

5. LED pedestrian signal lamp units shall be designed so that when operated over the specified ambient temperature and voltage ranges, the signal shall attract the attention of, and be readable to, a viewer (both day and night) at all distances from 10 feet (3 meters) to the full width of the area to be crossed.

6. The measured chromaticity coordinates of LED pedestrian signal lamp units shall conform to the chromaticity requirements of Section 5.3, Color and the associated Figure C of the PTCSI standard, for a minimum period of 60 months, over an operating temperature range specified in section “D”. Each LED traffic signal lamp unit shall meet the minimum requirements for light output for the entire range from 80 to 135 volts.

C. Electrical

1. Each unit shall incorporate a regulated power supply engineered to electrically protect the LEDs and maintain a safe and reliable operation. The power supply shall provide capacitor filtered DC regulated current to the LEDs per the LED manufacturer’s specification. Design of the power supply shall be such that the failure of an individual component or any combination of components cannot cause the signal to be illuminated after AC power is removed.

2. The LED traffic signal lamp unit shall operate on a 60 Hz AC line voltage ranging from 80 volts RMS to 135 volts RMS. The circuitry shall prevent flickering over this voltage range. Nominal rated voltage for all measurements shall be 120 ± 3 volts RMS.
3. All unit types shall be operationally compatible with the traffic signal equipment that each type is designed and intended to interface with. This equipment includes all controllers, conflict monitors, current monitors, switch pack and flashers currently in use by the Ohio Department of Transportation. The LED traffic signal lamp unit shall be operationally compatible with all TS-1, TS-2, 170 and 2070 controllers, NEMA TS-1 conflict monitors (including so-called NEMA plus features such as dual indication detection and short yellow time detection); NEMA TS-2 Malfunction Management Units; and 170 cabinet Type 210ECL and 2010ECL conflict monitors (including red monitoring and so-called plus features such as dual indication detection and short yellow time detection) currently used by the Department. In the case of conflicts between specifications, the latest ODOT specifications will control.
4. The individual LED light sources shall be wired so that a catastrophic failure of one LED light source will not result in the loss of more than 1 LED light source in the LED signal lamp unit.
5. Two, captive, color coded, 600 V, 20 AWG minimum jacketed wires, 3 feet (0.9 m) long, conforming to the National Electric Code, rated for service at 221 degrees F (105 degrees C), are to be provided for an electrical connection.
6. The LED signal shall operate with a minimum 0.90 power factor.
7. Total harmonic distortion (current and voltage) induced into an AC power line by a signal lamp unit shall not exceed 20 percent.
8. LED signal lamp units and associated on-board circuitry shall conform to the requirements in Federal Communications Commission (FCC) Title 47, Sub Part B, Section 15 regulations concerning the emission of electronic noise.
9. The LED signal lamp units shall incorporate circuitry to ensure that they show no evidence of illumination for input voltages below 35 volts. LED signal lamp units shall be illuminated (unregulated illumination) for all input voltages higher than 45 volts AC but less than 80 volts AC. They shall have fully regulated illumination for applied voltages of 80 volts through 135 volts AC. Proof of the intended function of this circuitry shall be accomplished by connecting the lamps to a variable voltage source and slowly raising the applied voltage from zero volts up to 135 volts, and then slowly lowering the applied voltage from 135 volts to zero volts.
10. Proposed LED signal lamp units shall be less than or equal to the base wattage shown below at 77 degrees F (25 degrees C).

Retrofit	Wattage
12" R 12" Red Ball	12 or less
12" Y 12" Yellow Ball	22 or less
12" G 12" Green Ball	15 or less
12" Y 12" Yellow Arrow	10 or less
12" G 12" Green Arrow	19 or less

D. Environmental Requirements

1. Green and red LED traffic signal lamp units shall be rated for use in the ambient operating temperature range of -40 degrees F to +166 degrees F (-40 degrees C to +74 degrees C). Yellow signal lamps shall be rated at a range of -13 degrees F to +166 degrees F (-25 degrees C to +74 degrees C).

2. The unit shall consist of a housing that is a sealed watertight enclosure that eliminates dirt contamination and allows for safe handling in all weather conditions. The LED signal lamp unit shall be sealed against dust and moisture intrusion per the requirements of NEMA Standard 250-1991 for Type 4 enclosures to protect all internal LED and electrical components.

Furnish materials according to the Department's Qualified Products List (QPL).

872.03 Documentation Requirements

A. Each LED traffic signal lamp unit shall be provided with the following documentation:

1. Installation instructions.
2. The manufacturer name, brand and model number of all LEDs used shall be provided, along with the LED manufacturer's recommended drive current and degradation curves.

872.04 Warranty.

- A. The LED signal lamp unit shall be repaired or replaced by the manufacturer if it exhibits a failure due to workmanship or material defects within the first 60 months of field operation.
- B. The LED signal lamp unit shall be repaired or replaced by the manufacturer if, when operating over the specified operating ambient temperature and voltage ranges, the unit does not meet or exceed all minimum luminous intensity requirements as defined in the ITE (Institute of Transportation Engineers) LED Purchase Specification - Vehicle Traffic Control Signal Heads (VTCSH), Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules dated June 2005 during the first 60 months of field operation.

- C. The measured chromaticity coordinates of LED signal lamp units shall conform to the requirements for chromaticity in Section 4.2 and Figure 1 of the ITE VTCSH and the PTCSI over the temperature range provided in the Specifications for the duration of the warranty period.
- D. The manufacturer shall provide a written warranty against defects in materials, workmanship and luminous intensity for LED signal lamp units for a period of 60 months after installation of LED signal lamp units. Replacement LED signal lamp units shall be provided within 10 days after receipt of failed LED signal lamp units at no cost to the State, except the cost of shipping the failed units.
- E. An LED pedestrian signal lamp unit shall be repaired or replaced by the manufacturer if the signal lamp unit does not attract the attention of, or is not readable to, a viewer (both day and night) at all distances from 10 feet (3 meters) to the full width of the area to be crossed when operated over the specified operating ambient temperature and voltage ranges.

Designer Note:

This Supplemental Specification will be provided on all projects where LED signal heads are specified for State maintained traffic signals. It may be provided on other projects at the maintaining agency's discretion

CITY OF MARYSVILLE

PUBLIC SERVICE DEPARTMENT

STREET AND STORM DIVISION

SUPPLEMENTAL SPECIFICATION 872-H

Polycarbonate Signal Head

Without Indications

1/10/2008

872-H.01 Description

872-H.02 Materials

872-H.03 Requirements

872-H.04 Hardware

872-H.05 Housing

872-H.06 Door

872-H.07 Field Proven

872-H.08 Stability

872-H.09 Exclusions

872-H.01 Description.

This Supplemental Specification describes the minimum design and performance requirements for Polycarbonate Signal Heads.

872-H.02 Material

1. Shall be injection molded from ultraviolet and heat stabilized, flame retardant opaque polycarbonate.
2. Shall be yellow in color, matching Federal Standard 595-13655, unless directed otherwise by the City Engineer.

872-H.03 Requirements

1. Shall meet or exceed ITE specifications for Vehicle Traffic Control Signal Heads.
2. Shall be a 12 inch housing

872-H.04 Hardware

1. Shall be stainless steel. This requirement does not apply to mounting plates that are designed to reinforce the signal mounting points or the terminal blocks provided for indication wire termination.
2. Shall have stainless steel or brass threaded inserts when utilizing door thumb screws.

872-H.05 Housing

1. Shall be a one piece unit.
2. Shall have serrations in 5 degree increments at each end.
3. Shall have top and bottom openings that accept standard 1.5 inch mounting hardware.
4. Shall have provisions for mounting two 6 position 2 terminal wire termination blocks.
5. The termination blocks shall be UL Listed.
6. Shall be constructed such that multiple units can be fastened together to make multiple section signals.
7. Shall have reinforcement ribbing integrally molded on both the top and bottom of the unit surrounding the 1 ½ inch mounting holes.
8. Shall have provisions for easily adding a backplate.

872-H.06 Door

1. Shall be a one piece molded ultraviolet and heat stabilized polycarbonate.
2. Shall be yellow in color, matching Federal Standard 595-13655, unless directed otherwise by the City Engineer.
3. Shall have provisions for visor mounting.
4. Shall provide that visors be at least 9.5 inches long, and be attached with four screws.
5. Interior surfaces of the visor shall be flat black.
6. Shall have a gasket groove inside the door which shall accommodate a weather and mildew resistant resilient gasket which, when the door is closed seals flat against the housing, makes a positive seal.

872-H.07 Field Proven

Shall have been field tested in actual traffic signal application for a period of at least one year.

872-H.08 Stability

Shall be stable enough for single point mounting.

872-H.09 Exclusions

This specification is not intended to cover the lens, reflector or lamp socket. City of Marysville uses LED light sources exclusively in traffic signals.

CITY OF MARYSVILLE
PUBLIC SERVICE DEPARTMENT
STREET AND STORM DIVISION
SUPPLEMENTAL SPECIFICATION 1503
SOIL STABILIZATION
DECEMBER 17, 2007

- 1503.01 Description**
- 1503.02 Materials**
- 1503.03 Laboratory Mixture Design**
- 1503.04 Equipment**
- 1503.05 Storage and Handling**
- 1503.06 Construction Methods**
- 1503.07 Curing and Protection**
- 1503.08 Maintenance/Defective Areas**
- 1503.09 Basis of Payment**

SOIL STABILIZATION

1503.01 Description. This supplemental specification outlines the requirements for constructing a stabilized soil structure by uniformly mixing an approved chemical stabilizer, such as Lime, Quicklime, Fly-Ash and/or Cement with the soil and compacting the resulting mixture.

The intended purpose is to permanently strengthen and weather-proof the subgrade soil. Credit may be accorded for this process in pavement design, if all parameters of this specification are complied with.

1503.02 Materials. The materials used shall meet the following requirements:

Lime. Hydrated lime and Quicklime shall meet the requirements of section 712.04 (b) of the ODOT CMS.

Cement. Cement shall meet the requirements of section 701 of the ODOT Construction and Material Specifications.

Fly Ash. Fly Ash, Class C or F, shall meet the requirements of ODOT CMS section 701.13 and ASTM C 618. Fly Ash not conforming to these requirements may be considered, provided performance requirements of this specification can be proven.

Water. Water shall be clean and clear. If the water is of questionable quality, it shall be tested in accordance with the requirements of AASHTO T 26.

Other Materials. It is not the intent of this document to limit the use of other materials, however, it is beyond the scope of this document to focus on materials for which AASHTO and ASTM standards have not been developed. Materials not conforming to the above, may be considered, provided performance requirements of this specification can be proven.

1503.03 Laboratory Mixture Design. Proposed mix design proportions and recommended depth of application shall be submitted to the City by an approved geotechnical firm, selected by the Contractor, sufficiently in advance of the work for review and approval. If pavement design options are to be considered, submittals must be received no less than 45 days in advance of stabilization operations. A sufficient number of samples shall be taken to insure control data, {moisture-density relationship curve(s)}, developed in the laboratory, represents field conditions, and to account for any changes in soil type. A mix design shall be submitted for each anticipated soil type.

The proposed mix design shall yield a minimum CBR value of 20 and a minimum average unconfined compressive strength of at least 100 psi at 7 days, and at least 150 psi at 28 days.

1503.04 Equipment. The Contractor shall use equipment that will produce results meeting the requirements for application of materials, compaction, and finishing as controlled by these Specifications. Mixing shall be performed using an approved power driven rotary type mixer. Prior to construction, all equipment shall be in satisfactory working condition, and available for inspection by the Project Engineer or his designee.

1503.05 Storage and Handling. Admixtures shall be properly stored and handled in closed weatherproof containers until immediately before distribution. Hydrated lime, Quicklime, or Cement in bags shall be properly stored in weather-protected conditions with adequate protection from ground dampness. The storage facilities shall be approved by the City.

1503.06 Construction Methods.

Temperature and Weather Limitations. Stabilization shall be performed only when ambient air temperature is above 40° F, and when the soil is not frozen. Do not perform this work during wet or unsuitable weather, or when freezing weather is anticipated within 24 hours of mixing/compaction.

Preparation of Existing Roadway. Prior to starting the stabilization process all unsuitable materials, such as stumps, roots, and organic material shall be removed. Construct the area to be stabilized to an elevation such that, upon completion of the operations, the subgrade will conform to the lines, grades, and cross-section shown on the plans.

Spreading of Material. The admixture shall be spread using equipment that will provide uniform distribution over the entire repaired area and in such a manner as to limit scattering and loss by wind.

Tailgate spreading of material will not be permitted.

The material may be spread in either a slurry or dry form at the option of the Contractor.

Mixing. Mixing operations shall be such that all ingredients are distributed evenly throughout the required depth, and provide a uniform mixture, free of segregation, that is satisfactory to the Engineer. The moisture content of the mixture shall be maintained at \pm 2% of the optimum moisture content.

The material shall be pulverized so that 100% passes the 1 inch sieve and 60% passes the #4 sieve.

Compaction. Immediately upon completion of the spreading/mixing operations, the mixture shall be thoroughly compacted to 98% of the maximum dry density established during the preparation of the laboratory mix design. All soil subgrade shall be compacted to 100%. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

If depressions, defective areas or soft spots develop during the compaction operation, they shall be corrected immediately.

After each section is completed, field density tests shall be made. If the compacted mixture fails to meet the specified density requirements, further evaluation by means of a test roll per ODOT CMS section 204.06, may be performed at the discretion of the Project Engineer to evaluate subgrade stability for acceptance. The City may require the area to be reworked as necessary to meet these requirements and may require the Contractor to change compaction equipment and/or methods to obtain the required density.

Finishing. When compaction of the stabilized soil is nearing completion, the surface shall be shaped to the required lines, grades and cross section within the tolerances of ODOT CMS item 203.08. Compaction should continue until the required density is obtained.

1503.07 Curing and Protection. After the subgrade has been finished as specified, it shall be cured for a period of at least 5 days above 40°F, or until core samples extracted from the subgrade meet the requirements of 1503.03.

During the curing period, the subgrade shall be protected against drying by applying an approved prime coat or polymer solution to prevent moisture loss.

All traffic or equipment other than curing equipment shall not be allowed on the finished subgrade until completion of curing, unless permitted by the Engineer.

1503.08 Maintenance/Defective Areas. The contractor shall maintain, at his expense the entire stabilized area in a manner satisfactory to the City. Maintenance shall include immediate repairs of any defective or damaged portions of the treated subgrade.

1503.09 Basis of Payment. The accepted quantities of stabilized soil will be paid for at the contract unit price per square yard or cubic yard, (*square meter or cubic meter*), which price and payment shall be full compensation for furnishing and placing all materials.

Item	Unit	Description
1503	Square Yard (<i>Square Meter</i>) Cubic Yard (<i>Cubic Meter</i>)	Soil Stabilization

**CITY OF MARYSVILLE
PUBLIC SERVICE DEPARTMENT
STREET AND STORM DIVISION**

**SUPPLEMENTAL SPECIFICATION 1510
STRESS ABSORBING MEMBRANE INTERLAYER (SAMI)
DECEMBER 17, 2007**

- 1510.01 Description**
- 1510.02 Specifications and Materials**
- 1510.03 Equipment**
- 1510.04 Pre-paving on site meeting**
- 1510.05 Weather Limitations**
- 1510.06 Construction**
- 1510.07 Application of Bituminous Binder**
- 1510.08 Quality Control**
- 1510.09 Documentation**
- 1510.10 Acceptance**
- 1510.11 Placement of Asphalt Overlay**
- 1510.12 Method of Measurement**
- 1510.13 Basis of Payment**

STRESS ABSORBOING MEMBRANE INTERLAYER (SAMI)

1510.01 Description

This work shall consist of furnishing all materials, equipment, labor and preparation necessary for the application of Stress Absorbing Membrane Interlayer. The applied material shall completely seal the entire pavement surface and provide a uniform textured surface, suitable for placement of hot mixed asphalt, micro-surfacing or as a finished surface.

1510.02 Materials

POLYMER MODIFIED BITUMINOUS BINDER

<u>EMULSION PROPERTY</u>	<u>MIN.</u>	<u>MAX.</u>	<u>TEST METHOD</u>
S.F. VISCOSITY, 50 C (sec)	50	400	ASTM D 244
PERCENT SOLIDS (%)*	70		ASTM D 244
STORAGE STABILITY, 24 hrs. (%)		1.0	ASTM D 244
SIEVE TEST, #20 mesh (%)		0.1	ASTM D 244

<u>RESIDUE PROPERTY</u>	<u>MIN.</u>	<u>MAX.</u>	<u>TEST METHOD</u>
PENETRATION, 100g, 5 sec, 25 C (dmm)	70	100	ASTM D 5
SOFTENING POINT, RING & BALL (C)	65		ASTM D 36
ELASTIC RECOVERY, 4 C, 10 cm (%) **	70		ASTM D 113
FORCE DUCTILITY, 4 C, 40 cm ***	25 lbs./sq. in.		ASTM D 4

* By distillation or evaporation

** The specimen is extended 10 cm. The extended area is severed in the middle using a pair of shears. After 1 hour, at the test temperature the severed ends are returned to contact and the ductilometer reading is made again. The sample must recover at least 70 percent of the original 10 cm distance.

*** ASTM D 113 as modified by the addition of a load cell to the standard ductility apparatus. The load cell is calibrated in pounds per square centimeter. Reading is measured at 40 cm. Reading is multiplied by 6.45 to yield pounds per square inch force required to extend the test specimen.

The asphalt modifier shall be a SBS type polymer, Styrene-Butadiene-Styrene. The modifier shall be added to the asphalt cement prior to the emulsification process.

COURSE AGGREGATE

The course aggregate shall be 100% crushed material from quarried stone, natural gravel or other high quality aggregate and meet the following requirements:

PHYSICAL REQUIREMENTS

TEST DESCRIPTION SPECIFICATION AASHTO T96 L.A. Abrasion Test 40% max. S1029* Deleterious Material 1.0 max. S1021* Crushed Pieces 100% AASHTO T104 Sodium Sulfate Soundness Test, 5 Cycle 15

GRADING REQUIREMENTS – ASTM C-117

SIEVE SIZE	TYPE I	TYPE II
1 inch (25mm)	100	100
¾ inch (19mm)	100	90-100
½ inch (12.5mm)	95-100	20-50
No. 4 (4.75mm)	5-25	0-10
No. 8 (2.36mm)	0-10	0-5
No. 200 (75um)	2	2

1510.03 Equipment

All equipment required for performance of the work shall be approved before construction is to begin, and shall be maintained in satisfactory operating condition. The Contractor shall furnish an accurate thermometer, hand brooms and other small tools and equipment essential for the completion of the work.

PRESSURE DISTRIBUTOR

The pressure distributor shall have a computerized rate control that automatically adjusts the distributor's pump to the ground speed. The pressure distributor shall be capable of heating and re-circulating the bituminous binder to the specified temperature. The proper nozzles shall be used for the material and rate specified.

AGGREGATE SPREADER

The aggregate spreader shall be self-propelled and shall be equipped with hoppers, revolving cylinders and adjustments necessary to produce a uniform distribution of material at the specified rate.

PNEUMATIC TIRE ROLLER

The pneumatic tire rollers shall conform to ODOT CMS 401.12 type P-2.

1510.04 Pre-Paving on Site Meeting

A meeting between the Contractor and Engineer will be held at the project site prior to beginning work. The agenda for this meeting will include:

- Review of Contractors detailed work schedule
- Review of the traffic control plan
- Inspection of equipment
- Calibration and adjustment to equipment

1510.05 Weather Limitations

The stress absorbing membrane interlayer shall be placed when the pavement and atmospheric temperature is 50° F or above. Placement is not permitted if it is raining, when the pavement surface is wet, or when temperatures are forecasted to be below 32° F within 24 hours of placement.

1510.06 Construction

The Contractor shall follow the construction methods as described.

1. The Contractor shall establish stations, at 1,000 foot intervals on the entire project, prior to placing the stress absorbing membrane interlayer. The stations shall be maintained until the project is completed.
2. Preparation of the surface shall be in accordance with ODOT CMS 407.05. The surface shall be cleaned by the Contractor and shall be dry when the bituminous binder is applied. Material cleaned from the surface shall be disposed of in accordance with ODOT CMS 203.01.
3. The specified aggregate shall be spread uniformly onto the bituminous binder within 30 seconds of the bituminous spray and shall be placed in accordance with ODOT CMS 422.08.
4. Projects greater than 12,000 sy² shall use a minimum of two rollers. Rollers shall proceed at maximum speed of 5 mph. The entire surface shall receive a minimum of two roller passes. The first roller pass shall be performed within one minute of aggregate spreading.
5. Brooming of the completed surface shall be accomplished prior to unrestricted use by traffic. The entire surface shall be clean of all loose material prior to placement of surface course material.

6. The Contractor shall protect all utility castings using tarpaper or other approved material. All covers shall be properly fitted to the casting and removed prior to sweeping.

1510.07 Application of Bituminous Binder and Course Aggregate

The bituminous binder shall be heated to specified temperature and uniformly placed to prevent ridges or streaks in the surface and shall be in accordance with ODOT CMS 422.07.

BITUMINOUS BINDER

The bituminous binder shall be applied at a temperature of 150 F to 180 F, and at the rate specified.

COURSE AGGREGATE

Stockpiling and loading methods shall permit ready identification of material and to minimize segregation and contamination of the aggregate. The moisture content of the course aggregate shall be below 4% and maintained throughout the project. Course aggregate shall be spread uniformly without ridges or gaps at the specified rates. Spreading of the aggregate shall be adjusted to produce a minimum of excess loose particles and shall provide complete coverage after rolling.

The spreading operation shall be accomplished in such a manner that the tires of trucks or the spreader at no time comes into contact with the newly applied bituminous material.

MATERIAL APPLICATION RATES

BINDER APPLICATION RATE Gallons per Square Yard

APPLICATION TYPE	TYPE I	TYPE II	TOLERANCE
Finished Surface	0.40 – 0.45	N/A	± 0.2
Prior to Micro-Surfacing	0.45 – 0.50	N/A	± 0.2
Prior to 1 inch min. Overlay	0.50 – 0.55	0.65 – 0.70	± 0.2

Aggregate application rate shall be as determined by the supplier of the SAMI binder and shall produce a completed surface with no exposed binder. The

supplier of the SAMI binder shall determine the application rate for emulsion and aggregate, based on the existing pavement condition and aggregate size. This information shall be reported to the Engineer prior to beginning work and shall include an aggregate gradation on the job specific materials.

1510.08 Quality Control

The Contractor to measure compliance shall use the methods described in this section.

- Aggregate gradation
- Aggregate Moisture Content
- Yield Check on Bituminous Binder
- Temperature Check on Bituminous Binder

If the Contractor's test results exceed any of the identified quality control tolerances, the Engineer shall be immediately notified. The Engineer will review the explanation and the corrective action taken by the Contractor. Another test will be taken and if the results still exceed the quality control tolerance, placement shall stop. The Contractor shall immediately notify the Engineer, and identify the cause of the excessive deviation and detail corrective action necessary to bring the deficiency into compliance. The Engineer will give approval prior to resuming work.

BITUMINOUS BINDER

The application rate shall not exceed a tolerance of 0.02 gallons per square yard from the specified rate, and within the temperature range as specified in 1510.07.

COURSE AGGREGATE

The aggregate shall be clean and uniform, and shall be within the gradation range as specified in 1510.02, Moisture content shall not exceed the tolerance as specified in 1510.07.

1510.09 Documentation

The Contractor shall provide the Engineer a daily report with the following information:

- Control Section/Project Number/County/Route
- Date/Air Temperature/Pavement Temperature

Bituminous Binder Temperature (3 per day)
Station Location per Test
Beginning and Ending Stations
Yield Check on Bituminous Binder (3 per day)
Aggregate Gradation & Moisture (1 per day)
Length/Width/Total Area

Other required documentation shall include:

Bill of lading on aggregate and bituminous binder, to be provided as requested or at project completion.

1510.10 Acceptance

The Contractor shall inspect the completed Stress Absorbing Membrane Interlayer during the application process for any deficiencies. The deficiencies will be limited to flushing, surface patterns and loss of stone retention. Workmanship shall be inspected for the following:

Untreated areas (missed)
No overlap on longitudinal joints
No overlap on construction joints

All corrective work shall be accomplished prior to resurfacing with bituminous materials, or within 24 hours. The Contractor shall furnish materials, equipment and labor to make corrections at no additional cost to the Contract. The Engineer shall give final approval on inspection and corrective work.

1510.11 Placement of Asphalt Overlay

If the SAMI application is used as an intermediate layer for an asphalt overlay, a minimum period of 24 hours shall be observed prior to the placement of the asphalt surface course after placement of the SAMI material. This time limit may be increased or decreased by the Engineer dependent on ambient temperatures and conditions.

1510.12 Method of Measurement

Stress absorbing membrane interlayer will be measured by the square yard as provided for in the Contract Documents. The accepted quantities, measured as provided for above, will be paid for at the contract unit price for stress absorbing membrane interlayer.

1510.13 Basis of Payment

Stress absorbing membrane interlayer shall be paid for per square yard for furnishing all preparation, materials, equipment, labor, clean up, and incidentals necessary to complete the work as specified.

Item	Description	Unit
1510	Stress Absorbing Membrane Interlayer, Type I	Square Yard
1510	Stress Absorbing Membrane Interlayer, Type II	Square Yard

**CITY OF MARYSVILLE
PUBLIC SERVICE DEPARTMENT
STREET AND STORM DIVISION**

**SUPPLEMENTAL SPECIFICATION 1512
FIBER REINFORCED BITUMINOUS MEMBRANE SURFACE TREATMENT
(FIBER-SAMI)**

DECEMBER 17, 2006

- 1512.01 Description**
- 1512.02 Specifications and Materials**
- 1512.03 Equipment**
- 1512.04 Pre-paving on site meeting**
- 1512.05 Weather Limitations**
- 1512.06 Construction**
- 1512.07 Application of Fiber Reinforced Bituminous Binder**
- 1512.08 Quality Control**
- 1512.09 Documentation**
- 1512.10 Acceptance**
- 1512.11 Placement of Asphalt Overlay**
- 1512.12 Method of Measurement**
- 1512.13 Basis of Payment**

FIBER REINFORCED BITUMINOUS MEMBRANE SURFACE TREATMENT (FIBER-SAMI)

1512.01 Description

This work shall consist of furnishing all materials, equipment, labor and preparation necessary for the application of a Fiber Reinforced Bituminous Membrane Surface Treatment used as a stand alone finished surface (Type A) or as a Stress Absorbing Membrane Interlayer (SAMI) (Type B). The applied material shall completely seal the entire pavement surface and provide a uniform textured surface, suitable for placement of hot mixed asphalt, micro-surfacing or as a finished surface.

This is accomplished by using a specific applicator, which can be mounted on an asphalt distributor modified for applying the surface treatment of bituminous binder reinforced with glass fibers. The applicator comprises of an open bottomed spray bar housing fan or blower for producing a down draft in the housing, and at least one spray bar mounted on the housing and adapted to extend transversely in the direction of movement of the asphalt distributor on which the unit can be mounted.

A number of nozzles spaced longitudinally along the spray bar for spraying bituminous material, means of controlling the nozzles, and a number of sources for dispensing the cut glass fibers through the open bottomed housing to the surface of the bituminous material previously sprayed shall also be included.

1512.02 Materials

POLYMER MODIFIED BITUMINOUS BINDER

EMULSION PROPERTY	MIN.	MAX.	TEST METHOD
S.F. VISCOSITY, 50 C (sec)	100	250	ASTM D 244
PERCENT SOLIDS (%)*	65		ASTM D 244
STORAGE STABILITY, 24 hrs. (%)		1.0	ASTM D 244
SIEVE TEST, #20 mesh (%)		0.1	ASTM D 244
RESIDUE PROPERTY	MIN.	MAX.	TEST METHOD
PENETRATION, 100g, 5 sec, 25 C (dmm)	100	200	ASTM D 5
ELASTIC RECOVERY, 10 C, 10 cm (%) **	50		ASTM D 113

* By distillation or evaporation

** The specimen is extended 20 cm. The extended area is severed in the middle using a pair of shears. After 1 hour, at the test temperature the severed ends are returned to contact and the ductilometer reading is made again. The sample must recover at least 50 percent of the original 20 cm distance.

The polymer modifier shall be a SBS or a SBR type polymer. The minimum amount of solid or dry polymer modifier shall 3%, based upon the asphalt weight. The polymer materials shall be milled or blended into the asphalt or blended through the emulsion mill as the emulsion is being produced.

COURSE AGGREGATE

The course aggregate shall be 100% crushed material from quarried stone, natural gravel or other high quality aggregate and meet the following requirements:

PHYSICAL REQUIREMENTS

TEST DESCRIPTION SPECIFICATION AASHTO T96 L.A. Abrasion Test 40% max. S1029* Deleterious Material 1.0 max. S1021* Crushed Pieces 100% AASHTO T104 Sodium Sulfate Soundness Test, 5 Cycle 15

GRADING REQUIREMENTS – ASTM C-117

SIEVE SIZE		TYPE A	TYPE B
1 inch	(25mm)	100	100
¾ inch	(19mm)	100	100
½ inch	(12.5mm)	95-100	95 -100
No. 4	(4.75mm)	5-25	5 - 25
No. 8	(2.36mm)	0-10	0-10
No. 200	(75um)	2	2

FIBER

The glass fiber is E Class from an approved source. The glass fiber spools are supplied internally wound, in coils or cheeses. The spools are cut in-place into 60 mm, (2.38”) lengths which are distributed uniformly across and between the two parallel applications of modified asphalt emulsion. Glass fiber spread rates are up to 120 g/m², (4oz.), with additional asphalt emulsion rates of spread, depending upon the site requirements.

1512.03 Equipment

All equipment required for performance of the work shall be approved before construction is to begin, and shall be maintained in satisfactory operating condition. The Contractor shall furnish an accurate thermometer, hand brooms and other small tools and equipment essential for the completion of the work.

PRESSURE DISTRIBUTOR/FIBER APPLICATOR

The pressure distributor shall have a computerized rate control that automatically adjusts the distributor's pump to the ground speed. The pressure distributor shall be capable of heating and re-circulating the bituminous binder to the specified temperature. The proper nozzles shall be used for the material and rate specified. There shall be two separate spray bars, one in front of the fiber applicator housing and one following it. The fiber cutter and distributor shall be an integrated unit. The integrated applicator shall be comprised of an open bottomed spray bar housing, a fan or blower producing a down draft in the housing, and at least one spray bar mounted on the housing and adapted to extend transversely in the direction of movement of the vehicle on which the applicator is mounted. A number of sources for dispensing cut glass fiber through the open bottomed housing to the surface of the binder material previously sprayed shall also be included.

The integrated applicator shall have been calibrated within the previous 12 months for transverse and longitudinal distribution application rates according to ASTM D2995, Practice for Determining Application Rate of Bituminous Applicator or other suitable method. The bituminous fiber applicator shall be equipped, maintained, and operated so that the bituminous materials can be applied at controlled rates from 0.1 l/m² (0.022 gal/SY) to 2.7 l/m² (0.56 gal/SY). The fiber is applied at controlled rates from nominally 30 to 120 g/m² (approx. 1-4 oz/SY). These applications shall be such that a uniform first layer of asphalt emulsion is applied followed by uniform layer of glass fibers that is chopped in-place and covered with a uniform layer of asphalt emulsion.

AGGREGATE SPREADER

The aggregate spreader shall be self-propelled and shall be equipped with hoppers, revolving cylinders and adjustments necessary to produce a uniform distribution of material at the specified rate.

PNEUMATIC TIRE ROLLER

The pneumatic tire rollers shall conform to ODOT CMS 401.12 type P-2.

1512.04 Pre-Paving on Site Meeting

A meeting between the Contractor and Engineer will be held at the project site prior to beginning work. The agenda for this meeting will include:

- Review of Contractors detailed work schedule
- Review of the traffic control plan
- Inspection of equipment
- Calibration and adjustment to equipment

1512.05 Weather Limitations

The fiber reinforced bituminous membrane surface treatment shall be placed when the pavement and atmospheric temperature is 50° F or above. Placement is not permitted if it is raining, when the pavement surface is wet, or when temperatures are forecasted to be below 32° F within 24 hours of placement.

1512.06 Construction

The Contractor shall follow the construction methods as described.

1. The Contractor shall establish stations, at 1,000 foot intervals on the entire project, prior to placing the treatment. The stations shall be maintained until the project is completed.
2. Preparation of the surface shall be in accordance with ODOT CMS 407.05. The surface shall be cleaned by the Contractor and shall be dry when the bituminous binder is applied. Material cleaned from the surface shall be disposed of in accordance with ODOT CMS 203.01.
3. The specified aggregate shall be spread uniformly onto the bituminous binder/fiber within 30 seconds of the bituminous spray and shall be placed in accordance with ODOT CMS 422.08.
4. Projects greater than 12,000 sy² shall use a minimum of two rollers. Rollers shall proceed at maximum speed of 5 mph. The entire surface shall receive a minimum of two roller passes. The first roller pass shall be performed within one minute of aggregate spreading.
5. Brooming of the completed surface shall be accomplished prior to unrestricted use by traffic. The entire surface shall be clean of all loose material prior to placement of surface course material.
6. 6. The Contractor shall protect all utility castings using tarpaper or other approved material. All covers shall be properly fitted to the casting and removed prior to sweeping.

1512.07 Application of the Fiber Reinforced Bituminous Membrane Surface Treatment

Fibers and bituminous materials shall be applied by means of a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range, sandwiching the in-place chopped fibers between the two layers of asphalt emulsion. The distributor shall be moving forward at the proper application speed at the time the spray bar and fiber chopper bars are opened. If any skipped areas or deficiencies occur, the operation shall be immediately stopped. Junctions of spreads shall be carefully made to assure a smooth riding surface and the deficient areas corrected in a manner approved by the Engineer.

BITUMINOUS BINDER

The bituminous binder shall be applied at a temperature of 150 F to 180 F, and at the rate specified.

COURSE AGGREGATE

Stockpiling and loading methods shall permit ready identification of material and to minimize segregation and contamination of the aggregate. The moisture content of the course aggregate shall be below 4% and maintained throughout the project.

Course aggregate shall be spread uniformly without ridges or gaps at the specified rates. Spreading of the aggregate shall be adjusted to produce a minimum of excess loose particles and shall provide complete coverage after rolling.

The spreading operation shall be accomplished in such a manner that the tires of trucks or the spreader at no time comes into contact with the newly applied bituminous material.

MATERIAL APPLICATION RATES

BINDER/FIBER APPLICATION RATE Gallons per Square Yard

APPLICATION TYPE Emulsion Tolerance Fiber

Type A 0.40 – 0.55 ± 0.02 1 – 4 oz. Type B 0.40 – 0.60 ± 0.02 1 – 4 oz.

Aggregate application rate shall be as determined by the supplier of the Fiber Reinforced Bituminous Membrane Surface Treatment binder and shall produce a completed surface with no exposed binder. The supplier of the Fiber Reinforced Bituminous Membrane Surface Treatment binder shall determine the application rate for emulsion and aggregate, based on the existing pavement condition and aggregate size. This information shall be reported to the Engineer prior to beginning work and shall include an aggregate gradation on the job specific materials.

1512.08 Quality Control

The Contractor to measure compliance shall use the methods described in this section.

- Aggregate gradation
- Aggregate Moisture Content
- Yield Check on Bituminous Binder
- Yield Check on Fiber
- Temperature Check on Bituminous Binder

If the Contractor's test results exceed any of the identified quality control tolerances, the Engineer shall be immediately notified. The Engineer will review the explanation and the corrective action taken by the Contractor. Another test will be taken and if the results still exceed the quality control tolerance, placement shall stop. The Contractor shall immediately notify the Engineer, and identify the cause of the excessive deviation and detail corrective action necessary to bring the deficiency into compliance. The Engineer will give approval prior to resuming work.

BITUMINOUS BINDER

The application rate shall not exceed a tolerance of 0.02 gallons per square yard from the specified rate, and within the temperature range as specified in 1512.07.

COURSE AGGREGATE

The aggregate shall be clean and uniform, and shall be within the gradation range as specified in 1512.02, Moisture content shall not exceed the tolerance as specified in 1512.07.

1512.09 Documentation

The Contractor shall provide the Engineer a daily report with the following information:

- Control Section/Project Number/County/Route
- Date/Air Temperature/Pavement Temperature
- Bituminous Binder Temperature (3 per day)
- Station Location per Test
- Beginning and Ending Stations
- Yield Check on Bituminous Binder (3 per day)
- Yield Check on Fiber (3 per day)
- Aggregate Gradation & Moisture (1 per day)
- Length/Width/Total Area

Other required documentation shall include:

- Bill of lading on aggregate, fiber and bituminous binder, to be provided as requested or at project completion.

1512.10 Acceptance

The Contractor shall inspect the completed Treatments during the application process for any deficiencies. The deficiencies will be limited to flushing, surface patterns and loss of stone retention.

Workmanship shall be inspected for the following:

- Untreated areas (missed)
- No overlap on longitudinal joints
- No overlap on construction joints

All corrective work shall be accomplished prior to resurfacing with bituminous materials, or within 24 hours. The Contractor shall furnish materials, equipment and labor to make corrections at no additional cost to the Contract. The Engineer shall give final approval on inspection and corrective work.

1512.11 Placement of Asphalt Overlay

If the Fiber Reinforced Bituminous Membrane Surface Treatment application is used as an intermediate layer for an asphalt overlay, a minimum period of 24 hours shall be observed prior to the placement of the asphalt surface course after placement of the Fiber Reinforced Bituminous Membrane Surface Treatment material. This time limit may be increased or decreased by the Engineer dependent on ambient temperatures and conditions.

1512.12 Method of Measurement

Fiber Reinforced Bituminous Membrane Surface Treatment will be measured by the square yard as provided for in the Contract Documents. The accepted quantities, measured as provided for above, will be paid for at the contract unit price for Fiber Reinforced Bituminous Membrane Surface Treatment.

1512.13 Basis of Payment

Fiber Reinforced Bituminous Membrane Surface Treatment shall be paid for per square yard for furnishing all preparation, materials, equipment, labor, clean up, and incidentals necessary to complete the work as specified.

Item	Description	Unit
1512	Fiber Reinforced Bituminous Membrane Surface Treatment, Type A	Square Yard
1512	Fiber Reinforced Bituminous Membrane Surface Treatment, Type B	Square Yard

**CITY OF MARYSVILLE
PUBLIC SERVICE DEPARTMENT
TRANSPORTATION DIVISION**

**SUPPLEMENTAL SPECIFICATION 1523
ROLLER COMPACTED CONCRETE PAVEMENTS (RCC)**

DECEMBER 17, 2007

- 1523.01 Description**
- 1523.02 Materials Requirements**
- 1523.03 Mix Design**
- 1523.04 Equipment**
- 1523.05 Placing RCC**
- 1523.06 Compaction and Finishing**
- 1523.07 Small Areas**
- 1523.08 Joints**
- 1523.09 Curing**
- 1523.10 Tolerances**
- 1523.11 Quality Assurance and Control**
- 1523.12 Defective RCC**
- 1523.13 Asphalt Surfacing / Opening to Traffic**
- 1523.14 Warranty**
- 1523.15 Basis of Payment**

**ROLLER COMPACTED CONCRETE PAVEMENTS
(RCC)**

1523.01 Description

This Supplement outlines the requirements for production and construction of Roller Compacted Concrete (R.C.C.) pavement for City streets. In addition to this supplement, items 305, 306, 401, 407, 451, and 700 of ODOT Construction and Material Specifications (CMS) apply where applicable.

1523.02 Materials Requirements

Cement: Portland Cement shall conform to the standard specification for Portland Cement Type I, ASTM C 150 (latest edition).

Fly Ash: Fly Ash shall conform to ASTM C 618 Class F.

Aggregates: Fine and course aggregates shall meet the requirements of section 703.02 of the CMSC for Portland Cement Concrete, item 305 and 306. The aggregates shall be well graded to conform to the following composite gradation.

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
3/4"	85 – 100
1/2"	70 – 90
3/8"	60 - 85
#4	40 – 70
#16	10 – 40
#100	5 – 20
#200	2 - 8

Water: Clean, potable and free from oil, acid, and strong alkalies or organic materials.

Admixtures (other than fly ash): Meet applicable ASTM standards.

1523.03 Mix Design

The Contractor/Supplier shall develop an R.C.C. mixture proportioned in accordance with this specification and procedures discussed in ACI 325.10R-95 "State-of-the-Art Report on Roller-Compacted Concrete Pavements" sections 4.2 and 4.3. Once the mix has been designed, certified test data shall be submitted in accordance with Section 101.10 of the CMS from a recognized testing laboratory that shows the proposed mix design will meet the following requirements.

Compressive Strength, Cylinders: 3500 psi @ 28 days
Flexural Strength, Beams: 500 psi @ 14 days
Splitting Tensile Strength, Cores: 400 psi @ 14 days

The minimum Cementitious Material shall be 350 pounds per C.Y.

Fly Ash may only be used between April 1 and November 1 unless otherwise authorized by the Project Engineer.

1523.04 Equipment

Mixing Plants: Mixing plants shall be of a design that can produce an R.C.C. pavement mixture of the proportions defined in the approved mix design and within the specified tolerances in ASTM C 94 and ASTM C 685. The mixing plant may be a Central-Mix Drum or a Stationary Continuous-Mixing Twin-Shaft Pugmill mixer. The plant shall have a minimum manufacturer's rated capacity of

200 tons per hour.

Paver: RCC shall be placed with a high-density or conventional asphalt type paver subject to approval by the Engineer. The paver shall be capable of placing RCC to a minimum of 85% of the maximum wet density in accordance with ASTM D 1557 or equivalent test method. The paver shall be of suitable weight and stability to spread and finish the RCC material, without segregation, to the required thickness, smoothness, surface texture, cross-section and grade.

Alternative Paving Equipment. In areas not accessible to paving machines, alternative paving equipment including graders and dozers may be used, if approved by the Engineer. The equipment shall be capable of producing a finished product that results in a smooth, continuous surface without segregation, excessive tearing, or rock pockets. Work in areas inaccessible to paving machines will be performed according to 1523.07 of these specifications.

Pneumatic Rollers: Pneumatic rollers shall be self-propelled, with overlapping tire positions capable of providing full compaction in a single pass. Static weight shall be no less than 10 tons, or more than 20 tons. Tire configuration shall be 5 front and 6 rear.

Vibratory Rollers: Vibratory rollers shall be self-propelled, double drum, steel wheel vibratory rollers having a static weight of at least 10 tons. Each roller drum shall be equipped with a properly operating scraper and brush. The rollers shall transmit a dynamic impact to the surface through smooth steel drums by means of revolving weights, eccentric shafts or other equivalent methods. The roller drum shall be between 4 and 5-1/2 foot in diameter and 5-1/2 to 8 feet in width.

Finish Rollers: Finish rollers shall be self-propelled, double drum, steel wheel rollers having a static weight of between 3 and 10 tons. Each drum shall be equipped with a properly operating scraper and brush. A single drum vibrator roller with a vulcanized rubber coating may be utilized for finish rolling, at the approval of the engineer.

Equipment for Vertical Cuts in R.C.C. Pavement: To cut vertical joints in fresh R.C.C. pavement, equipment such as a wheel cutter or other approved equipment capable of cutting vertically, the full depth of the layer, shall be used. If the Contractor waits until the R.C.C. hardens to make vertical cuts, concrete sawing equipment shall be used to make the vertical cuts.

1523.05 Placing RCC

Cold Weather Limitations: R.C.C. shall not be placed on any surface containing frost or frozen material. R.C.C. shall only be placed when the ambient temperature is a minimum of 35°F and rising. When the ambient temperature is expected to fall below 35° F, the Contractor must follow the procedures set forth

in section 451.061 of the ODOT CMS.

Hot Weather Precautions: During periods of hot weather or windy conditions, special precautions shall be taken to minimize moisture loss due to evaporation. Precautions may include cooling of aggregate stockpiles by the use of a water spray, protective covers on dump trucks, temporary windbreaks to reduce wind velocity, cooling of concrete mix water, decreasing the allowable time between mixing and final compaction, and keeping the surface of the newly placed R.C.C. pavement damp with a light spray during compaction and finishing operations.

Rain Limitations: No placement of R.C.C. pavement shall be done while it is raining hard enough to be detrimental to the finished product. Placement may continue during light rain or mist provided the surface of the R.C.C. pavement is not eroded or washed. Dump truck covers must be used during these periods. The Engineer will be the sole judge as to when placement must be stopped due to rain.

Subgrade Preparation: Prepare the subgrade according to Section 204 of the ODOT CMS. If required, construct a granular base according to Section 304.

Moisten the surface of the subgrade or base without creating mud or ponding water, to minimize absorption of water from R.C.C. mix to be deposited.

Transporting: Transport the R.C.C. mixture to the site in dump trucks with boxes cleaned out before loading and provided with protective covers properly secured in place until discharge. The trucks shall dump directly into the hopper of the paver unless placement is by hand as directed by the Engineer. Hauling over the freshly placed R.C.C. will not be permitted.

Continuity: Co-ordinate R.C.C. delivery so the mix can be spread and rolled within the specified time limit and to ensure uniform progress of the paver until the paving operation is complete. The time between mixing, and compacting shall not exceed ninety (90)minutes, for all RCC placed, provided that the temperature of the RCC does not exceed 90 degrees (F). This time limit may be increased or decreased by the Engineer dependent upon ambient conditions of temperature and humidity.

Spreading: Spread the material to a sufficient depth that will produce the specified thickness when compacted and conform to the required cross-sections and grade. Operate the paver in a manner that will prevent segregation and will produce a smooth continuous surface without tearing, pulling or shoving. Placing of the R.C.C. mix shall be done in a pattern so that the water from previously placed R.C.C. will not affect the fresh surface or subgrade. Where required, broadcasting or fanning of R.C.C. must be performed immediately behind the paver. Any R.C.C. surface that has been compacted "rolled" but is not cured, must be scarified at least one inch deep prior to broadcasting fresh R.C.C. over

the top. Broadcasting must be completed in the allotted time within these specifications.

Segregation: If segregation occurs, suspend the paving operation until the cause is determined and corrected. Rake off segregated coarse aggregate before rolling. Broadcasting or fanning of R.C.C. mixture onto areas being compacted is not permitted.

Placing Adjacent Lanes: All R.C.C. on both sides of the longitudinal joint formed by placing an adjacent lane, must be compacted within 90 minutes of plant mixing, unless a cold joint is provided.

1523.06 Compaction and Finishing

Required Density: The Contractor is responsible for achieving 98% of the maximum wet density, as determined in the laboratory according to ASTM D 1557.

Start of Rolling: Begin compaction operations within fifteen (15) minutes after spreading of the R.C.C. mix. Any additional delay will result in the coring of the affected area at the Contractors expense to ensure that it meets the requirements of this specification.

Rolling Pattern: Establish a rolling pattern that will achieve the required density with a minimum number of roller passes.

Vibratory Rolling: During vibratory compaction, the roller shall not be started, stopped, or left standing in vibratory mode. Stagger the stopping point of successive rolling passes to avoid forming depressions on the surface.

Surface Check: Continually check the R.C.C. surface while still plastic to ensure surface and grade tolerances are met. Immediately correct excessive variations in accordance with the spreading requirements.

Finish Rolling: Remove any roller marks on the surface using a steel drum roller in static mode.

Lane Edge: Each edge of each lane shall be constructed with a vertical or a 15-degree from vertical configuration.

1523.07 Small Areas

Spread RCC mix by hand in areas not accessible by the paver, as directed by the Engineer.

Compact the mix to the required density using suitable walk-behind vibratory

compaction equipment. The vibratory equipment must have a minimum centrifugal force of 2,200 pounds and/or 70 pounds per square inch. Compaction of these areas must be performed immediately after placement of the R.C.C. in order to avoid moisture loss.

1523.08 Joints

Fresh Joint: A fresh joint is made when R.C.C. on both sides of the joint are compacted within 90 minutes of plant mixing. Ensure that the contact face is moist and not segregated. Before rolling, hand-finish the joint as necessary to produce a tight surface. Roll extra passes as necessary to achieve the required density and smoothness in the joint area.

Cold Joint: A cold joint is made when either side of the joint is not compacted within 90 minutes of plant mixing. Sawcut the edge of previous lane back to sound R.C.C. to form a vertical face. Trimming by grader blade may be permitted if done at the end of the workday or the first thing the following day. Place fresh grout on the vertical face just before placing fresh R.C.C. against it. Before rolling, hand-finish the joint as necessary to produce a tight surface. Roll extra passes as necessary to achieve the required density and smoothness in the joint area. Every effort shall be made to maintain longitudinal joints as a fresh joint as described in "Fresh Joint" above.

Transverse Joint: May be a Fresh Joint or Cold Joint as described above. They shall be spaced at a maximum of 30 foot intervals, or at intervals directed by the Engineer and cut to a depth 1/3 of the specified pavement thickness.

Longitudinal Joint: Leave the outer 12 to 18 in. of the paving lane uncompacted during the initial rolling operation. This uncompacted edge is then used to set the height of the paver screed for paving the adjacent lane. After the adjacent lane is placed, the joint is compacted by centering the roller drum over the joint and compacting the adjacent lane edges simultaneously.

1523.09 Curing

R.C.C. without Asphalt Surfacing applied within 72 hours: Keep the R.C.C. surface continuously moist by water, fog spray, wet burlap, or an approved membrane-forming curing compound, or polyethylene sheeting for a period of 7 days. Apply curing compound at 1-1/2 times the rate specified by the manufacturer.

R.C.C. with Asphalt Surfacing applied within 72 hours: Immediately after final rolling, apply an asphalt emulsion per item 407 of the ODOT CMS. Apply at 1-1/2 times the rate specified by the manufacturer.

1523.10 Tolerances

R.C.C. pavement construction shall be subject to Section 451 of the ODOT CMS.

1523.11 Quality Assurance and Control

Responsibility: Testing at the plant and the paving site is the responsibility of the Contractor or Developer and shall be performed by a private Independent Testing Laboratory approved by the City. The Contractor and Supplier shall provide safe and convenient access, acceptable to the Engineer, for the inspection and sampling of the R.C.C. and constituent materials, at both the production plant and the paving site, and shall cooperate in the inspection and sampling process at all times.

Test Strip: The contractor shall construct a test section of a thickness equal to the design thickness with at least 100 tons of R.C.C. The test strip will be used to resolve anticipated problems with equipment, mix behavior, compaction, and/or strength characteristics. The test strip shall be constructed at a location chosen by the contractor at least 30 days before the start of paving operations. The contractor shall cooperate fully with the Engineer during construction and testing of the test strip. During construction of the test section, the Contractor will establish an optimum rolling pattern and procedure for obtaining a density of not less than 98% of the maximum wet density in accordance with ASTM D 1557. In addition, the Contractor must also demonstrate the ability to achieve a smooth, hard, uniform surface free of excessive tears, ridges, spalls and loose material. After completion of the test section, beams and cores will be extracted to verify mix compliance. This will be performed by the Independent Testing Laboratory, at the expense of the Contractor. During the trial placement, the City's Testing Personnel shall calibrate their nuclear density gauges in accordance with ASTM C 1040, with a sample of the test section mix. Moisture readings of the gauge shall be calibrated using oven dry samples of the plant-mixed R.C.C. If all aspects of the test strip have been previously satisfied, the engineer may waive this requirement on a project-by- project basis.

Pre-placement: The Contractor shall ensure quality control at the plant, by controlling materials, obtaining test samples and ensuring segregation is not occurring while loading haul trucks.

The private Testing Laboratory will develop a moisture/density relationship of the actual job materials in accordance with ASTM D 1557. Optimum moisture content, maximum dry and wet densities will be established.

Compressive Strength Testing: During the mix design development, the Independent Testing Laboratory shall produce six (6" x 12") diameter cylinders, in accordance with ASTM C 1435, to perform a 28 day compressive strength test of the material to verify mix conformance. Handling and curing shall be in

accordance with ASTM C 31. The Engineer may require additional tests at different ages. Compressive strength testing shall be in accordance with ASTM C 39.

During Placement: The Contractor, in cooperation with the Independent Testing Laboratory, shall ensure that compaction and grade specifications are met and time limits are adhered to.

Field Density: The Contractor's Testing Laboratory shall perform density testing of the R.C.C. in accordance with ASTM C 1040, direct transmission mode, as soon as possible, but no more than 30 minutes, after completion of rolling. Only wet density shall be used for evaluation. The required density shall be a minimum of 98% of the maximum wet density. At least 5 tests shall be performed for each 250 cubic yards placed. The Contractor shall be responsible for verifying required densities are achieved by the paver.

If density tests indicate that the material does not meet the required density, the Engineer, in collaboration with the Contractor and the Contractor's Testing Laboratory, shall determine the source of the problem, whether mix properties, segregation, or gauge calibration. If mix properties have changed, or the concerns cannot be resolved, placement shall be suspended until the problem is corrected.

After Placement: The Contractor's Testing Laboratory shall core at least nine (9) 3 1/2 inch diameter cylindrical specimens from the interior of the slab for compliance verification. Length measurements of the cores and compressive strength testing shall be in accordance with ASTM C 42. The actual number of cores will be determined as defined in section 451.17 of the ODOT CMS. Testing will be conducted as follows:

Compressive Strength Testing: Three (3) of the cores obtained for thickness verification will be tested for compressive strength at 28 days.

Splitting Tensile Strength: Three (3) of the cores obtained for thickness verification will be tested for splitting tensile strength at 14 days.

Density Test: The three (3) core samples obtained for splitting tensile strength will also be tested for density PCF.

The remaining three cores will be held for backup testing and/or further review as necessary.

Flexural Strength Testing: At the option of the project Engineer, the Contractor/Independent Testing Laboratory shall cut at least three (3) rectangular beams from the interior of the slab, in accordance with ASTM C 42, to perform a 14 day flexural strength test of the material. Additional tests at different ages

may be required by the Engineer.

1523.12 Defective RCC

Repairs: All repairs are subject to the Engineers approval. Correct deficiencies while R.C.C. is still plastic; otherwise do repairs after seven (7) days. After seven (7) days, the R.C.C. shall be removed by saw cutting full depth before removal. Replace the R.C.C. utilizing a Cast-in-Place concrete meeting the requirements of ODOT CMS section 499; Class B or E Concrete as directed by project Engineer. The new concrete shall be doweled into the existing R.C.C. utilizing epoxy coated reinforcing bars unless the RCC option is utilized.

Remove and replace R.C.C. if determined deficient in thickness by following the procedure set forth in section 451.17 of ODOT CMS.

Any R.C.C. pavement found to be of unacceptable thickness, or deficient in any testing done according to 1523.11, may be subject to removal and replacement by the contractor, at no cost to the City, including removal and replacement of any intermediate and surface asphalt courses.

Grind off high surface variations to a finish acceptable to the Engineer.

Filling of low areas with fresh R.C.C. is not permitted.

If asphalt surfacing is specified, low areas shall be made up with additional surfacing material without extra payment.

1523.13 Asphalt Surfacing / Opening to Traffic

The R.C.C. pavement may be asphalt surfaced as specified on the plans once the requirements of Section 1523.06 have been met and all transverse contraction joints have been constructed.

If the R.C.C. pavement is not to be asphalt surfaced immediately, all traffic shall be restricted from using the R.C.C. until seven (7) days has elapsed or all strength requirements of Section 1523.03 have been met. At any time prior to the expiration of the above mentioned seven (7) day period, the R.C.C. may be asphalt surfaced as specified on the plans and then opened to traffic.

1523.14 Warranty

This new process is being evaluated on a preliminary approval basis for use as base pavement on City of Marysville projects. The preliminary approval period shall begin after the first installation of the new product and extend for a period of five (5) years thereafter. During this period, a five (5) year unlimited warranty shall be provided by the Contractor for each and every installation of this product.

In order for this warranty to take effect, the installation must have been performed in accordance with this supplemental specification and the applicable sections of the City of Marysville, Construction and Material Specifications.

At any time during the five (5) year evaluation period, and in the judgment of the City, the product has failed to meet the specification requirements, the Contractor shall, at his expense, remove and replace the R.C.C. base with the applicable 305 or 306 base pavement and any intermediate/surface course(s).

1523.15 Basis of Payment

The accepted quantities of R.C.C. pavement will be paid for at the contract unit price per square yard (*square meter*), which price and payment shall be full compensation for furnishing and placing all materials including reinforcing steel, dowels, and joint materials.

No additional payment over the unit contract bid price will be made for any pavement which has an average thickness in excess of that shown on the plans.

Payment for accepted quantities, complete in place, will be paid for at the contract price for item Supplemental Specification 1523.

<u>Item</u>	<u>Unit</u>
<u>Description</u>	
1523 Square Yard	Roller Compacted Concrete
(<i>Square Meter</i>)	

**CITY OF MARYSVILLE
PUBLIC SERVICE DEPARTMENT
STREET AND STORM DIVISION**

**SUPPLEMENTAL SPECIFICATION 1540
ASPHALT REJUVENATING AGENT
(Reclamite Sealer)**

June 10, 2009

- 1540.1 Description**
- 1540.2 Specifications and Materials**
- 1540.3 Material Performance**
- 1540.4 Applicator Experience**
- 1540.5 Handling of Rejuvenating Agent**
- 1540.6 Resident Notification**
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- 1540.11 Method of Measurement**
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ASPHALT REJUVENATING AGENT
(Reclamite Sealer)

1540.01 Description

This work shall consist of furnishing all labor, material, and equipment necessary to perform all operations for the application of an asphalt rejuvenating agent to asphalt concrete surface courses. The rejuvenation of surface courses shall be by spray application of a cationic rejuvenating agent composed of petroleum oils and resins emulsified with water. All work shall be in accordance with the specifications, the applicable drawings, and subject to the terms and conditions of this contract.

1540.02 Material Specifications

The asphalt rejuvenating agent shall be an emulsion composed of a petroleum resin oil base uniformly emulsified with water. Each bidder must submit with their bid a certified statement from the asphalt rejuvenator manufacturer showing that the asphalt rejuvenating emulsion conforms to the required physical and chemical requirements.

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

¹ ASTM D-244 Modified Evaporation Test for percent of residue is made by heating 50 gram sample to 149°C (300°F) until foaming ceases, then cool immediately and calculate results.

² Test procedure identical with ASTM D-244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.

³ Test procedure identical with with ASTM D-244 except that distilled water shall be used in place of two percent sodium oleate solution.

⁴ Test procedure is attached.

⁵ Chemical composition by ASTM Method D-2006-70:

PC = Polar Compounds, A₁ = First Acidaffins

A₂ = Second Acidaffins, S = Saturated Hydrocarbons

1540.03 Material Performance

The rejuvenating agent shall have a record of at least five years of satisfactory service as an asphalt rejuvenating agent and in-depth sealer. Satisfactory service shall be based on the penetration value of the asphalt binder as follows. The viscosity shall be reduced by a minimum of 45 percent and the penetration value shall be increased by a minimum of 25 percent. Testing shall be performed on extracted asphalt cement from a pavement to a depth of three eighths inch (3/8"). In addition, the pavement shall be in-depth sealed to the intrusion of air and water.

The bidder must submit with their bid the manufacturer's certification that the material proposed for use is in compliance with the specification requirements. The bidder must submit with their bid, previous use documentation and test data conclusively demonstrating that; the rejuvenating agent has been used successfully for a period of five years by government agencies such as cities, counties, etc.; and that the asphalt rejuvenating agent has been proven to perform, as heretofore required, through field testing by government agencies as to the required change in the asphalt binder viscosity and penetration number. Testing data shall be submitted indicating such product performance on a sufficient number of projects, each being tested for a minimum period of three years to insure reasonable longevity of the treatment, as well as product consistency.

The product "Reclamite"® for the asphalt rejuvenating agent as manufactured by Golden Bear oil, a division of Tricor Refining, LLC. is the standard for these specifications. Any product substituted for "Reclamite"® must meet this Standard, and be approved by the City Engineer.

1540.04 Applicator Experience

The asphalt rejuvenating agent shall be applied by an experienced applicator of such material. The bidder shall have a minimum of three years experience in applying the product proposed for use. They must submit with their bid a list of

five projects on which they applied said rejuvenator. They shall indicate the project dates, number of square yards treated in each, and the name and phone number of the representative in charge of each project.

A project superintendent knowledgeable and experienced in application of the asphalt rejuvenating must be in control of each day's work. The bidder shall submit a written experience outline of the project superintendent.

The contractor responsible for applying the asphalt rejuvenating agent shall maintain a current, written Storm Water Pollution Prevention Plan (SWPPP) that complies with all relevant Ohio Environmental Protection Agency (OEPA) regulatory requirements. Prior to the commencement of application operations, the contractor shall conduct SWPPP training of all personnel actually applying the asphalt rejuvenating agent. At all times, the contractor shall ensure that a current copy of their SWPPP is present on-site, wherever the asphalt rejuvenating agent is being applied.

1540.05 Handling of Asphalt Rejuvenating Agent

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

1540.06 Resident Notification

The Contractor shall distribute by hand, a typed notice to all residents and businesses on the street to be treated. The notice will be delivered no more than 24 hours prior to the treatment of the road. The notice will have a local phone number that the residents may call to ask questions. The notice shall be of the door hanger type which secures to the door handle of each dwelling. Unsecured notices will not be allowed. The contractor shall also place the notice on the windshield of any parked cars on the street. Hand distribution of this notice will be considered incidental to the contract.

1540.07 Application Equipment

The distributor for spreading the emulsion shall be self-propelled, and shall have pneumatic tires. The distributor shall be designed and equipped to distribute the asphalt rejuvenating agent uniformly on variable widths of surface at readily determined and controlled rates from 0.05 to 0.5 gallons per square yard of surface, and with an allowable variation from any specified rate not to exceed 5 percent of the specified rate.

Distributor equipment shall include full circulation spray bars, pump tachometer, volume measuring device and a hand hose attachment suitable for application of the emulsion manually to cover areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the emulsion within the tank.

A check of distributor equipment as well as application rate accuracy and uniformity of distribution shall be made when directed by the Engineer.

The truck used for sanding shall be equipped with a spreader that allows the sand to be uniformly distributed onto the pavement. The spreader shall be able to apply 1/2 pound to 3 pounds of sand per square yard in a single pass. The spreader shall be adjustable so as not to broadcast sand onto driveways or treelawns.

The sand to be used shall be free flowing, without any leaves, dirt stones, etc. Any wet sand shall be rejected from the job site.

Any equipment which is not maintained in full working order, or is proven inadequate to obtain the results prescribed, shall be repaired or replaced at the direction of the Engineer.

1540.08 Application of Rejuvenating Agent

The temperature of the asphalt rejuvenating emulsion, at the time of application shall be as recommended by the manufacturer. The asphalt rejuvenating agent shall be applied only when the existing surface to be treated is thoroughly dry. Additionally, application of the asphalt rejuvenating agent shall be prohibited when weather forecasts indicate a chance of a rain event in the work area, which would produce in excess of 0.10 inches of rain within four hours of the application of the asphalt rejuvenating agent. The contractor shall perform follow-up inspections of stormwater inlets, culverts, and drainage ditches (in accordance with the contractor's SWPPP) in the vicinity of the asphalt rejuvenating agent application operations, whenever a precipitation event, in excess of 0.10 inches of rain, occurs during a two day period following application of the asphalt rejuvenating agent. The asphalt rejuvenating agent shall not be applied when the ambient temperature is below 40° F.

The asphalt rejuvenating agent shall be applied by a distributor truck at the

temperature recommended by the manufacturer and at the pressure required for the proper distribution. The emulsion shall be applied so that uniform distribution is obtained at all points of the areas to be treated. Distribution shall be commenced with a running start to insure full rate of spread over the entire area to be treated. Areas inadvertently missed shall receive additional treatment as may be required by hand sprayer application.

Application of asphalt rejuvenating agent shall be on one-half width of the pavement at a time. When the second half of the surface is treated, the distributor nozzle nearest the center of the road shall overlap the previous application by at least one-half the width of the nozzle spray. In any event the centerline construction joint of the pavement shall be treated in both application passes of the distributor truck.

Before spreading, the asphalt rejuvenating agent shall be blended with water at the rate of two(2) parts rejuvenating agent to one(1) part water, by volume or as specified by the manufacturer. The combined mixture of asphalt rejuvenating agent and water shall be spread at the rate of 0.05 to 0.10 gallons per square yard, or as approved by the Engineer.

Where more than one application is to be made, succeeding applications shall be made as soon as penetration of the preceding application has been completed and approval is granted for additional applications by the Engineer.

Grades or super elevations of surfaces that may cause excessive runoff, in the opinion of the Engineer, shall have the required amounts applied in two or more applications as directed.

After the street has been treated, the area within one foot of the curb line on both sides of the road shall receive additional treatment of the asphalt rejuvenating emulsion. Said treatment shall be uniformly applied by a method acceptable by the Engineer.

The Contractor shall furnish a quality inspection report showing the source, manufacturer, and the date shipped, for each load of asphalt rejuvenating agent. When directed by the Engineer, the Contractor shall take representative samples of material for testing.

1540.09 Street Sweeping

The Contractor shall be responsible for sweeping and cleaning of the streets prior to, and after treatment.

Prior to treatment, the street will be cleaned of all standing water, dirt, leaves, foreign materials, etc. This work shall be accomplished by hand brooming, power blowing or other approved methods. If, in the opinion of the Engineer, the hand cleaning is not sufficient then a self-propelled street sweeper shall be used.

All sand used during the treatment must be removed no later than 48 hours after treatment of the street. This shall be accomplished by a combination of hand and mechanical sweeping. All turnouts, cul-de-sacs, etc. must be cleaned of any material to the satisfaction of the Engineer. Street sweeping will be included in the price bid per square yard for asphalt rejuvenating agent.

If, after sand is swept and in the opinion of the Engineer, a hazardous condition exists on the roadway, the contractor must apply additional sand and sweep same no later than 24 hours following reapplication. No additional compensation will be allowed for reapplications and removal of sand.

1540.10 Traffic Control

The Contractor shall schedule his operations and carry out the work in a manner to cause the least disturbance and/or interference with the normal flow of traffic over the areas to be treated. Treated portions of the pavement surfaces shall be kept closed and free from traffic until penetration, in the opinion of the Engineer, has become complete and the area is suitable for traffic.

When, in the opinion of the Engineer, traffic must be maintained at all times on a particular street, then the Contractor shall apply asphalt rejuvenating agent to one lane at a time. Traffic shall be maintained in the untreated lane until traffic may be switched to the completed lane.

The contractor shall be responsible for all traffic control and signing required to permit safe travel. The contractor shall notify the police and fire departments as to the streets that are to be treated each day.

If, in the opinion of the Engineer, proper signing is not being used, the Contractor shall stop all operations until safe signing and barricading is achieved.

1540.11 Method of Measurement

Asphalt rejuvenating agent will be measured by the square yard as provided for in the Contract Documents. The accepted quantities, measured as provided for above, will be paid for at the contract unit price for asphalt rejuvenating agent.

1540.12 Basis of Payment

Asphalt rejuvenating agent shall be paid for per square yard for furnishing all materials, equipment, labor and incidentals necessary to complete the work as specified.

Item Description Unit

1540 Asphalt Rejuvenating Agent Square Yard

**CITY OF MARYSVILLE
STREET/STORM DIVISION**

**SUPPLEMENTAL SPECIFICATION 1541
THERMAL BOND ASPHALT REPAIR
“HEATWELD”**

MARCH 15, 2007

1541.01	Description
1541.02	Equipment
1541.03	Materials
1541.04	Construction Methods
1541.05	Disposal of Waste Materials
1541.06	Maintenance of Traffic
1541.07	Quality of Work
1541.08	Method of Measurement
1541.09	Basis of Payment

THERMAL BOND ASPHALT REPAIR “HEAT-WELD”

1541.01 Description

The following items represent thermal bond asphalt repair specifications and workmanship guidelines to be used on all “heat-welds”. This work shall consist of furnishing all labor, material, and equipment necessary to perform all operations of a heat-weld to asphalt concrete surface courses. Thermal bond asphalt repairs shall consist of heating asphalt concrete pavement, scarification of the surface, applying a rejuvenating agent, applying a wearing course of new asphalt concrete, and compaction of the repair. Any changes to these specifications must be submitted in writing and approved by the Engineer prior to use.

1541.02 Equipment

The equipment shall include a heating panel that provides radiant heat uniformly distributed over its entire surface and adjustable from 20,000 BTU’s to 40,000 BTU’s per square foot. Propane gas shall be the only combustible fuel used and shall be stored within 10 feet of the heating panel. No open flames for heating the pavement will be permitted.

The heating panel shall be controlled by an automatic timer consisting of a main cycle, adjustable for both “ON” and “OFF” periods, and a repeat cycle, adjustable for the overall time of the repeat cycling action. The main cycle shall automatically start the repeat cycles at the end of its maximum adjusted time span. The repeat cycle shall be easily operated without any tools required. Complete manual override and general manual operation shall be incorporated in the system.

The heated area of the panel shall be:

- A) 6 feet by 8 feet minimum area.
- B) Divided into 4 quadrants sized between 1/2 and 1/3 of the panel dimensions each respective side.
- C) Each quadrant shall be operable independently of the others and in all possible combinations with each other.

The heat panel shall have instant kill switches located on each side of the unit that can be activated by a rapid strike of a button. All other controls or panel activity other than the kill switches shall be at one location and include another instant kill switch at that location. All electrical and fuel devices shall comply with all applicable federal, state, and local regulations at all times.

If applicable, the equipment shall include an automated asphalt delivery system from a thermostatically controlled heated storage compartment with delivery of Item 404 asphalt concrete by a mechanical conveying system to the repair. The heated asphalt storage hopper shall be insulated and so constructed that it will keep its contents thermostatically

controlled in a good workable condition (between 225 and 250 degrees Fahrenheit). Design of the unit is to be such that no direct flames contact the hopper walls that would overheat or degrade the contents.

The heating unit shall have a yellow flasher light per OSHA standards, which shall be clearly visible from all points in front of the equipment, and an arrow board clearly visible from behind.

Compaction equipment must be a vibratory steel wheeled roller. The vibratory roller shall be equipped with a water system and have a minimum certified force of 2,000 pounds.

1541.03 Materials

The contractor must submit a certified statement from the asphalt rejuvenator manufacturer showing that the asphalt rejuvenating emulsion conforms to the following physical and chemical requirements:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Requirements</u>
Viscosity @ 25°C, SFS	D-244	20 – 145
Sieve Test, %w	D-244 (mod.) ¹	0.1 max.
Particle Charge Test	D-244	Positive
Cement Mixing Test, %w	D-244	1.8 max.
Pumping Stability	- ²	Pass
5-Day Settlement Test, %w	D-244	4.77 max.
Residue, %w	D-244 (mod.) ³	64 – 66
<u>Tests on Residue from Distillation:</u>		
Viscosity @ 60°C, CST	D-2170	990 – 4,100
Maltene Distribution Ratio	D-2006-70	0.7 – 1.1
$\frac{PC + A_1^4}{S + A_2}$		
PC/S Ratio	D-2006-70	0.5 min.
Asphaltenes, %w	D-2006-70	10.8 max.
Aniline °C	D-611	29 – 44
Total Acid Number	D-664	0.5 max.

¹ Test procedure with ASTM D-244 except that distilled water shall be used in place of two percent sodium oleate solution.

² Pumping stability is determined by charging 450 ml of emulsion into one-liter beaker and circulating the emulsion through a gear pump have ¼" inlet and outlet. The emulsion passes if there is no significant oil separation after circulating for ten minutes.

³ ASTM D-244 Evaporation Test for percent of residue is modified by heating a 50 gram sample to 149°C (300°F) until foaming ceases, then cooling immediately and calculating results.

⁴ In the Maltene Distribution Ratio Test by ASTM Method D-2006-70:

PC = Polar Compounds,
A₂ = Second Acidaffins,

A₁ = First Acidaffins
S = Saturated Hydrocarbons

Conversion: 242 gal/ton.

The rejuvenating agent shall be approved by the Engineer prior to use.

If applicable, the asphalt concrete used in the repair shall meet the requirements of Item 404, unless an alternate material is approved.

1541.04 Construction Methods

A project superintendent knowledgeable and experienced in construction of a thermal bond asphalt repair must be in control of each day's work. If it becomes apparent that the work is not being performed in a neat and workman like manner, the Engineer will suspend the day's activities until a qualified supervisor is brought in.

PREPARATION

All dirt, debris, vegetation, loose and foreign material shall be cleared from the repair area before the work begins.

HEATING AND SCARIFYING

The panel shall be positioned such that the heated surface of the panel extends a minimum of 4 inches beyond the area of repair. The area of repair shall include all cracked areas at the location of the repair that are less than 8 inches from each other. Only the panel quadrants needed for heating the repair area shall be used.

Pavement shall not be heated to temperatures that are harmful to the surface asphalt. An appropriate adjustment of the timer shall be made to eliminate any tendency for such effects. Once adjusted for a particular street, controls shall remain unchanged unless a change of pavement surface reveals a changed condition, or it is demonstrated to the Engineer that a modified cycle is appropriate.

The repair shall be scarified over the entire area to the required depth by viscous shearing without scratching or scraping the underlying hard asphalt. The outside perimeter shall have straight edges, which are located at least one inch inside the perimeter of the heat panel as it was positioned during heating.

PROCESSING THE REPAIR

After scarification, rejuvenating agent shall be uniformly applied at approximately 0.05 gallons per square yard over the scarified surface or at a rate directed by Engineer. A volume meter shall be provided on the flow line to the spray device, with incremental gauge units of 0.1 gallon maximum. Any piece of aggregate or other material greater than 1/2 inch in size shall then be removed with a lute after which the entire scarified surface shall be raked smooth.

If applicable, a minimum 1/2 inch thick wear course shall then be delivered from the automated delivery system. Edges shall be carefully raked to provide a smooth transition to the main repair area. The overall patch shall be raked to a smooth flat surface.

The repair shall be rolled, pinched edges first with the roller in unprocessed pavement with 6 inches over the edge of the repair. A small vibratory roller shall be used with a minimum weight of 600 pounds. The site of the repair shall be left clean.

An additional 0.05 gallon per square yard of rejuvenating agent shall then be applied to the 3 inch wide area around the perimeter after rolling and lightly mist over the entire repair. A thin layer of sand shall be applied over the entire repair if immediate opening of the street is required. If sand is not used, cones shall be adjusted to delineate traffic around the repair and shall be left in place until the asphalt will not ravel from traffic.

1541.05 Disposal of Waste Material

The contractor shall be responsible for the disposal of all waste, excess, and removed materials from the jobsite. No material will be permitted to stay on the site after the contractor has left the repair area.

1541.06 Maintenance of Traffic

Unless otherwise noted in the contract documents, the contractor shall furnish all labor, materials, equipment, signs, arrow boards, and barricades necessary for maintaining traffic control in accordance with the Ohio Manual of Traffic Control for Construction and Maintenance Operations, current edition.

The Contractor shall schedule his operations and carry out the work in a manner to cause the least disturbance and/or interference with the normal flow of traffic over the areas to be treated. Treated portions of the pavement surfaces shall be kept closed and free from traffic until penetration of the rejuvenating agent, in the opinion of the Engineer, has become complete and the area is suitable for traffic.

When, in the opinion of the Engineer, traffic must be maintained at all times on a particular street, the Contractor shall apply asphalt rejuvenating agent to one lane at a time. Traffic

shall be maintained in the untreated lane until traffic may be switched to the completed lane.

1541.07 Quality of Work

All phases of the work are subject to approval by the City. Any work or materials not passing inspection by the Engineer shall be corrected to the satisfaction of the Engineer and the cost of rework to be borne by the contractor. Work performed by the contractor shall be **guaranteed for a period of one year** exclusive of sub-base failures of materials placed by others and circumstances beyond control of the contractor. Failures are to be corrected at the contractor's expense and subject to the one year guarantee.

Any damage to existing structures and surrounding vegetation resulting from the contractor's operation shall be repaired or replaced by the contractor and subject to the inspection and approval of the Engineer.

1541.08 Method of Measurement

Thermal Bond Asphalt Repair will be measured by the square foot as provided for in the contract documents. The accepted quantities, measured as provided for above, will be paid for at the contract unit price for thermal bond asphalt repair (Heat-Weld).

1541.09 Basis of Payment

Thermal Bond Asphalt Repair shall be paid for per square foot for furnishing all materials, equipment, labor and incidentals necessary to complete the work as specified.

<u>Item</u>	<u>Description</u>	<u>Unit</u>
1541	Thermal Bond Asphalt Repair	Square Foot