

BRIDGE DECK REPAIR AND OVERLAY WITH MICRO-SILICA MODIFIED CONCRETE

1.0 DESCRIPTION

THIS WORK SHALL CONSIST OF FURNISHING THE NECESSARY LABOR, MATERIALS AND EQUIPMENT TO REPAIR AND OVERLAY CONCRETE BRIDGE DECKS IN ACCORDANCE WITH THESE SPECIFICATIONS AND IN REASONABLE CLOSE CONFORMITY WITH THE GRADES, THICKNESSES AND CROSS SECTIONS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THIS WORK IS SIMILAR TO A TYPICAL BRIDGE DECK OVERLAY EXCEPT THAT THE SURFACE PREPARATION, VARIABLE THICKNESS AND FULL DEPTH REMOVAL SHALL BE ACCOMPLISHED WITH THE USE OF HYDRODEMOLISHING EQUIPMENT, INSTEAD OF CONVENTIONAL SCARIFYING AND HEAD CHIPPING. THIS WORK SHALL INCLUDE THE REMOVAL OF PATCHES OTHER THAN SOUND PORTLAND CEMENT CONCRETE AND ALL LOOSE AND UNSOUND CONCRETE; HYDRODEMOLITION OF THE SOUND EXISTING CONCRETE SURFACE; REMOVAL, FORMING AND CONCRETE FOR FULL-DEPTH REPAIRS; BLAST CLEANING; FURNISHING, PLACING, FINISHING, TEXTURING AND CURING OF A MICRO-SILICA MODIFIED CONCRETE (MSC) OVERLAY; AND ALL OTHER OPERATIONS NECESSARY TO COMPLETE THIS WORK ACCORDING TO THE SPECIFICATIONS AND TO THE SATISFACTION OF THE ENGINEER.

THE MSC OVERLAY SHALL BE NOT LESS THAN 1 1/4 INCHES THICK (THICKER WHERE LOOSE OR DISINTEGRATED CONCRETE IS TO BE REPLACED) AND BE CONSTRUCTED AS A SINGLE MONOLITIC ELEMENT OF THE STRUCTURE. ITS SURFACE SHALL BE FINISHED TO THE SAME GRADE AS THE ORIGINAL CONCRETE DECK.

SPALLED OR DELAMINATED TOPS OF BACKWALLS SHALL BE REPAIRED WITH MSC (VARIABLE THICKNESS).

2.0 MATERIALS

THE MATERIALS SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:

FINE AGGREGATE (NATURAL SAND)	703.02*
COARSE AGGREGATE (NO. 8) (LIMESTONE OR SLAG)	703.02*
PORTLAND CEMENT, TYPE I OR IA**	701.04 OR 701.01
WATER	499.02
CHEMICAL ADMIXTURE	705.12, ASTM C 494, TYPE A OR D
AIR-ENTRAINING ADMIXTURE	705.10
SUPERPLASTICIZING ADMIXTURE (HIGH RANGE WATER REDUCER)	705.12, ASTM C 494, TYPE F
PORTLAND CEMENT CONCRETE (FOR FULL- DEPTH REPAIR)	511, CLASS S
CURING MATERIALS	705.05 OR 705.06, WHITE OPAQUE
CURING (FOR FULL-DEPTH REPAIR)	511.14
MICRO-SILICA ADMIXTURE	AS RECOMMENDED AND FURNISHED BY: ⊙

\* DELETERIOUS MATERIAL SHALL NOT EXCEED ONE-HALF THE REQUIREMENT FOR SUPERSTRUCTURE AGGREGATE, AND THE SODIUM SULFATE SOUNDNESS LOSS SHALL NOT EXCEED THAT SPECIFIED FOR SUPERSTRUCTURE CONCRETE IN 703.02.

\*\* ONLY ONE BRAND OF CEMENT SHALL BE USED FOR EACH BRIDGE DECK OVERLAY UNLESS OTHERWISE PERMITTED BY THE ENGINEER.

NOTE: THE CONTRACTOR SHALL OBTAIN A WRITTEN STATEMENT FROM THE MANUFACTURER OF THE MICRO-SILICA ADMIXTURE THAT HE IS SATISFIED WITH THE COMPATIBILITY OF THE COMBINATION OF MATERIALS AND THE SEQUENCE IN WHICH THEY ARE COMBINED.

3.0 EQUIPMENT

A. MIXERS

CONCRETE SHALL BE MIXED IN A CENTRAL MIXING PLANT OR BY A READY-MIXED CONCRETE TRUCK CAPABLE OF DISCHARGING CONCRETE HAVING A MAXIMUM WATER-CEMENT RATIO OF 0.36. MIXING EQUIPMENT SHALL MEET THE REQUIREMENTS OF 499.04(B). ADMIXTURES SHALL BE INTRODUCED INTO THE CONCRETE IN SUCH A MANNER THAT WILL DISPENSE IT THROUGHOUT THE ENTIRE LOAD. BATCH PLANTS SHALL MEET THE REQUIREMENTS OF 499.04(A) AND SHALL BE LOCATED SUCH THAT THE MAXIMUM TIME REQUIRED FROM START OF MIXING TO COMPLETION OF DISCHARGE OF THE CONCRETE AT THE SITE OF WORK SHALL NOT EXCEED 90 MINUTES.

B. FINISHING EQUIPMENT

THE PLACING AND FINISHING EQUIPMENT SHALL BE DESIGNED SO THAT THE ELAPSED TIME BETWEEN DEPOSITING CONCRETE ON THE DECK AND FINAL FINISHING SHALL NOT EXCEED 10 MINUTES.

AN APPROVED FINISHING MACHINE WITH ADJUSTABLE RAILS SHALL BE USED; THE FINISHING MACHINE RAIL SUPPORTS SHALL NOT BE SET ON THE SCARIFIED SURFACE TO BE OVERLAYED EXCEPT WHERE HAND FINISHING EQUIPMENT IS AUTHORIZED. PROVISION SHALL BE MADE FOR RAISING THE SCREEDS TO CLEAR THE CONCRETE SURFACE FOR TRAVELING IN REVERSE.

FINISHING EQUIPMENT SHALL BE INSPECTED PRIOR TO STARTING WORK ON THE PROJECT AND SHALL MEET THE FOLLOWING REQUIREMENTS:

A. THE DESIGN OF THE MACHINE AND APPURTENANT EQUIPMENT SHALL BE SUCH AS TO PERMIT SCREED CONSOLIDATION OF THE CONCRETE. TWO OR MORE VIBRATING SCREEDS SHALL BE LONG ENOUGH TO EXTEND ON ONE SIDE AT LEAST 6 INCHES BEYOND A FORMED FACE OR A PREVIOUSLY PLACED SECTION. THE BOTTOM FACE OF VIBRATING SCREEDS SHALL BE METAL. VIBRATION FREQUENCY FOR SCREEDS SHALL BE BETWEEN 3,000 AND 11,000 PULSES PER MINUTE. INTERNAL VIBRATION WILL BE REQUIRED FOR CONSOLIDATION OF CONCRETE IN AREAS REQUIRING HAND FINISHING.

OR

B. THE FINISHING EQUIPMENT MAY BE EQUIPPED WITH ONE OR MORE ROTATING ROLLERS, AUGERS AND VIBRATING PANS. VIBRATION FREQUENCY FOR PANS SHALL BE BETWEEN 1,500 AND 2,000 PULSES PER MINUTE.

C. FINISHING MACHINE RAIL AND SUPPORTS

FINISHING MACHINES SHALL BE SUPPORTED BY RAIL AND SUPPORTS MADE OF STEEL. RAIL SHALL BE FURNISHED IN SECTIONS NOT LESS THAN 10 FEET IN LENGTH AND BE OF SUFFICIENT CROSS-SECTION SO THAT THE WEIGHT OF THE FINISHING MACHINE CAUSES ZERO VERTICAL DEFLECTION WHILE IN MOTION. RAIL SHALL BE STRAIGHT WITH NO SECTIONS EXCEEDING A TOLERANCE OF 1/8 INCH IN 10 FEET IN ANY DIRECTION. RAIL SUPPORTS SHALL BE SCREW-TYPE, ADJUSTABLE SADDLES AND SHALL BE OF SUFFICIENT NUMBER UNDER THE RAIL SO THAT ZERO VERTICAL DEFLECTION OCCURS UNDER THE WEIGHT OF THE FINISHING MACHINE.

4.0 PROPORTIONING AND MIXING

ALL REQUIRED CHARACTERISTICS OF THE MIX, I.E. AIR ENTRAINMENT AND SLUMP, SHALL BE ADJUSTED OFF THE DECK BEFORE PLACEMENT OF THE OVERLAY BEGINS. THE COMPONENTS FOR MICRO-SILICA MODIFIED CONCRETE SHALL BE COMBINED INTO A WORKABLE MIXTURE OF UNIFORM COMPOSITION AND CONSISTENCY.

- ⊙ ELBORG TECHNOLOGY CO.  
PITTSBURG, PA.
- OR
- GRACE CONSTRUCTION PRODUCTS  
CAMBRIDGE, MA.
- OR
- SIKA CORP.  
LYNDHURST, NJ.

QUANTITIES OF MATERIAL PER CUBIC YARD (DRY WEIGHTS\*)

TYPE OF COARSE AGGREGATE	COARSE AGGREGATE (LBS)	FINE AGGREGATE (LBS)	CEMENT (LBS)	SILICA (LBS)	MAXIMUM WATER- CEMENTITIOUS RATIO
LIMESTONE	1280	1430	700	70	0.36
SLAG	1110	1430	700	70	0.36

\* THE SPECIFIC GRAVITIES USED FOR DETERMINING THE ABOVE WEIGHTS ARE: NATURAL SAND 2.62, LIMESTONE 2.65 AND SLAG 2.30, MICRO-SILICA 2.20.

THE BATCH WEIGHTS PREVIOUSLY DESCRIBED SHALL BE CORRECTED TO COMPENSATE FOR THE MOISTURE CONTAINED IN THE AGGREGATE AT THE TIME OF USE. A CHEMICAL ADMIXTURE (705.12, TYPE A OR D) SHALL BE USED. THE TRANSIT MIXER CHARGE SHALL BE LIMITED TO 3/4 OF ITS RATED CAPACITY OR 6 CUBIC YARDS, WHICHEVER IS THE SMALLER, UNLESS A LARGER SIZE IS APPROVED BY THE ENGINEER.

THE SPECIFIED CEMENT CONTENT SHALL BE MAINTAINED AND A MAXIMUM WATER-CEMENT RATIO OF 0.36 SHALL NOT BE EXCEEDED. ANY ADMIXTURE ADDED AT THE JOB SITE SHALL BE MIXED A MINIMUM OF 5 MINUTES. AFTER ALL COMPONENTS HAVE BEEN ADDED, THE SLUMP RANGE SHALL BE 6+2 INCHES. THE AIR CONTENT OF FRESH UNVIBRATED MSC AT THE TIME OF PLACEMENT SHALL BE 8+2 PERCENT. TWO CYLINDERS SHALL BE MADE FOR EACH READY-MIXED CONCRETE TRUCK LOAD OF MSC INCORPORATED INTO THE WORK.

IF A SLUMP LOSS OCCURS AFTER MIXING AND BEFORE PLACEMENT OF THE MSC OVERLAY, THE CHARGE MAY BE "RETEMPERED" WITH THE ADMIXTURE TO RESTORE PLASTICITY. THE SLUMP RANGE AND AIR CONTENT SHALL BE RECHECKED TO ENSURE CONFORMANCE TO THE ALLOWABLE VALUES. IF THE CONSISTENCY OF THE CHARGE AFTER "RETEMPERING" IS SUCH AS TO CAUSE SEGREGATION OF THE COMPONENTS, THIS WILL BE CAUSE FOR REJECTION ON THE LOAD. THE MSC OVERLAY SHALL STILL BE PLACED WITHIN THE 90 MINUTE LIMITATION AS PER 3.0 (A).

AT THE OPTION OF THE ODOT BUREAU OF TESTING THE CONTRACTOR SHALL MAKE ONE TRIAL BATCH OF THE MSC OF THE SIZE TO BE HAULED AT LEAST 4 DAYS BEFORE THE OVERLAY IS TO BE PLACED. HE SHALL CAST ONE OR MORE SMALL TEST SLAB, E.G. 8 FT. LONG X A WIDTH WHICH IS WIDE ENOUGH TO ACCOMMODATE HIS FINISHING EQUIPMENT X 1 1/4 INCHES THICK, FOR TEXTURING ACCORDING TO 7.0 AND SHALL PREPARE OTHER SAMPLES AND SPECIMENS AS DIRECTED BY THE ODOT TESTING LABORATORY. THE TESTING LABORATORY SHALL BE NOTIFIED 7 DAYS IN ADVANCE OF THE TEST BATCH PREPARATION AND IT SHALL CONDUCT ALL THE REQUIRED TESTS. ADDITIONAL BATCHES AND TEST SLABS WILL BE REQUIRED IF ANY OF THE MATERIAL SOURCES ARE CHANGED OR IF THE FIRST TEST SLAB DOES NOT MEET SPECIFICATIONS. ANY ADDITIONAL TEST SLABS SHALL BE AT THE CONTRACTORS EXPENSE.