

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION**

SUPPLEMENTAL SPECIFICATION 852

**ULTRA-THIN WHITETOPPING OVERLAY WITH
STEEL FIBER REINFORCED CONCRETE**

April 19, 2002

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852.01 Description. This work shall consist of milling the specified depth of existing asphalt concrete pavement and replacement with an ultra thin whitetopping (UTW) pavement overlay composed of steel fiber reinforced concrete in accordance with these specifications. The new pavement shall be in reasonable close conformity with lines, grades, thickness and typical sections shown in the plans or established by the Engineer.

This work shall include milling of the existing asphalt surface; removal of debris, and blast cleaning; furnishing, placing, finishing, texturing, curing and jointing of a fiber reinforced concrete overlay; and all other operations necessary to complete this ultra-thin whitetopping (UTW) work according to these specifications. The UTW overlay shall be not less than the plan specified thickness and shall be constructed as a single monolithic element of the composite pavement structure.

852.02 Materials. The materials shall conform to the following requirements:

Fine aggregate (natural sand)	703.02
Coarse aggregate (No. 57 or 67 size)	703.02, 703.13
Portland cement, Type I	701.04
Water	499.02
Chemical admixture	705.12, ASTM C 494, Type A or D
Air-entraining admixture	705.10

High range water reducing admixture (Superplasticizing admixture)	705.12, ASTM C 494, Type F or G
Portland cement concrete	499.03, Class S, modified w/ steel Fibers
Fibers for Concrete (Steel)	ASTM C 1116 *
Curing materials	705.07, white

* The steel fibers shall be ASTM A 820 material with a minimum ultimate tensile strength of 120,000 psi (827 Mpa). The length shall be 2 inches (50 mm) +/- 5 percent. The average equivalent diameter shall be 0.899 mm with an aspect ratio of 57 +/- 15 percent. The material shall be continuously deformed circular segment, clean and free of rust, oil and deleterious materials and corrugated full length for increased mechanical anchorage.

852.03 Equipment.

A Mixers. Concrete shall be mixed in a central mixing plant or by a ready mixed concrete truck capable of discharging plasticized concrete having a maximum water-cement ratio of 0.40. Mixing equipment shall meet the requirements of 499.06(B). The admixtures and fibers shall be introduced into the concrete in such a manner that they shall be disbursed throughout the entire load. Batch plants shall meet the requirements of 499.06(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 Superplasticizer Dispenser. The Contractor shall be responsible for furnishing a volumetric dispenser for the superplasticizer. The dispenser shall be capable of dispensing the admixture to within ± 3.0 percent of the desired amount.

C Finishing Equipment. An approved vibrating screed, paving machine or bridge deck finishing machine shall be used, except where hand finishing is authorized.

The placing and finishing equipment shall be designed so that the elapsed time between depositing concrete on the pavement and final finishing shall not exceed 10 minutes.

D Milling Equipment. Planing equipment shall be self-propelled with sufficient power and stability to consistently and efficiently produce the required results. The cutting element may be of the grinding, sawing, or milling type. Planing cutters shall be mounted rigidly to the carrier and shall be adjustable and controllable as to depth of cut and cross-slope. Longitudinal planing action may be produced either by means of a suitable carrier wheelbase or by means of an automatic control system having an external reference. Cross-slope adjustments or automatic controls shall be capable of producing either a variable or a constant cross-slope as required.

If traffic will be permitted on the prepared asphalt surface, planing cutters shall be designed, maintained and operated so as to produce a surface free from grooves, ridges,

gouges or other irregularities detrimental to the safe operation of vehicles in traffic routed onto the planed surface, temporarily or permanently.

Suitable supplemental equipment or methods, approved by the Engineer, may be used in small or confined areas.

852.04 Proportioning and Mixing. The ultra-thin whitetopping mix shall be proportioned and mixed in accordance with 499 except as modified herein.

All required characteristics of the mix, i.e. air entrainment and slump, shall be adjusted before placement of the overlay begins. The components for ultra-thin whitetopping concrete shall be combined into a workable mixture of uniform composition and consistency. They shall be proportioned as follows:

CONCRETE TABLE
Quantities Per Cubic Yard (Meter)
CLASS S W/ Steel Fibers (Using No. 57 or No. 67 Size)

Type of Coarse Aggregate	Dry Aggregates			Steel Fibers	Cement Content	Water- Cement Ratio
	Fine Aggregate lb (kg)	Coarse Aggregate No 57 or 67 size lb (kg)	Total Aggregate lb (kg)			
Gravel	1125 (667)	1735 (1029)	2860 (1697)	60(36)	715(424)	0.40
Limestone	1260 (747)	1530 (908)	2790 (1655)	60(36)	715(424)	0.40
Slag	1280 (759)	1370 (813)	2650 (1572)	60(36)	715(424)	0.40

The transit mixer load size shall be limited to 3/4 of its rated capacity or 6 cubic yards (4.6 m³), whichever is the smaller, unless a larger size is approved by the Engineer. The steel fibers shall be batched into each load of concrete such that they are uniformly distributed throughout the load. A chemical admixture (705.12, Type A or D) shall be used.

The specified cement content shall be maintained and a maximum water-cement ratio of 0.40 shall not be exceeded. If superplasticizing admixture is added at the job site, the load shall be mixed a minimum of 5 minutes at mixing speed. After all of the superplasticizer has been added, the slump range shall be 6 ± 2 inches (150 ± 50 mm). The air content of the fresh un-vibrated concrete at the time of placement shall be 6 ± 2 percent.

If a slump loss occurs after addition and mixing of the superplasticizing admixture and before placement of the ultra-thin whitetopping overlay, the charge may be "re-tempered" 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 of the load. The ultra-thin whitetopping overlay shall be placed within the 90 minute limitation as per 852.03 (A).

852.05 Preparation of Existing Asphalt. The existing asphalt surface shall be removed by milling, to a depth necessary to achieve an overlay of plan thickness, and the plan finish grade specified.

No operations without reasonably available engineering controls that limit fugitive dust will be acceptable. The Contractor shall be aware that there are state, regional, and local government agencies throughout the State that have requirements regarding control of dust generated by the construction operations.

Overmilling shall not be permitted. The cost of additional concrete material caused by overmilling shall be borne by the Contractor. Vehicles other than approved construction equipment will not be permitted on those sections of the pavement where asphalt milling has begun. Contamination of the asphalt surface by construction equipment or from any other source shall be prevented.

Not more than 24 hours prior to placing the overlay, the entire surface to which the ultra-thin whitetopping overlay is to bond shall be cleaned by an approved method of waterblasting with a minimum of 7,000 psi (48 Mpa) water pressure. These surfaces shall be made free of dust, laitance, and all contaminants detrimental to achieving an adequate bond.

852.06 Finishing Machine Dry Run. After the existing pavement is cleaned and immediately prior to placing the ultra-thin whitetopping overlay, the finishing machine with filler blocks attached to the bottom of the screed, shall be traversed over the area to be paved. The thickness of the filler blocks shall be the plan specified overlay thickness minus 1/8 inch (3 mm). The filler blocks shall clear the milled asphalt surface by not less than 1/8 inch (3 mm). Asphalt which is not cleared by the filler blocks shall be removed and the area re-cleaned as specified above.

852.07 Placing, Consolidating and Finishing. Immediately before the ultra-thin whitetopping overlay is placed, the newly milled asphalt surface shall be cleaned with an air blast. The milled asphalt surface shall be surface dry prior to placement of the ultra-thin whitetopping overlay.

Contamination of the milled asphalt by construction equipment or from any other source shall be prevented by placement of a clean 4-mil (100 um) polyethylene sheet (or any other covering as approved the Engineer) on the surface of the pavement following the air blast cleaning.

The ultra-thin whitetopping overlay shall be placed, consolidated and finished to the plan surface. Hand vibrators shall be used at all edges and adjacent to joint bulkheads.

After the ultra-thin whitetopping overlay has been consolidated and finished, it shall be broom textured longitudinally or transversely. Immediately after brooming the surface shall be textured transversely to provide a random pattern of grooves spaced at 3/8 inch

to 1 3/4 inch (10 mm to 45 mm) centers with 50 percent of the spacings being less than 1 inch (25 mm). Grooves shall be approximately 0.15 inches (4 mm) deep and 0.10 inches (2.5 mm) wide. A strip of surface 9 to 12 inches (225 to 300 mm) wide adjacent to curbs and barriers shall not be textured to allow gutter self cleaning.

Any water ponding problem which is noted prior to final acceptance of the overlay shall be corrected by the Contractor at no cost to the owner.

Except where the overlay must conform to adjacent existing surfaces a 10 foot (3.0 m) straightedge shall be used to check the overlay directly behind the finishing machine, and transversely along the edges of the overlay where hand finishing is done. Any irregularities exceeding 1/8 inch in 10 feet (3 mm in 3 m) shall be corrected immediately.

Edging is required at all slab perimeters and at all isolation joints. Before the concrete has taken its initial set, the edges of the ultra-thin whitetopping overlay along each side of each slab, and on each side of an isolation joint, shall be worked with an approved tool and rounded to a 1/8 inch radius. Any toolmarks left by the edging shall be eliminated before texturing the surface.

852.08 Curing. White pigmented curing compound meeting 705.07 shall be applied at a rate of one gallon (1 L) of material for each 150 square feet (3.7 square meters) of surface area treated, immediately after the transverse grooving operation.

When temperatures are expected to drop below 7° C (45 °F), heat retention curing, such as insulating blankets, shall be used. The Contractor is responsible for protecting the ultra-thin whitetopping overlay from freezing until concrete test beams attain a modulus of rupture of 600 psi (4.2 MPa).

852.09 Jointing. Prior to ultra-thin whitetopping overlay placement, isolation joints shall be created by installing a minimum 1/4 inch (6 mm) thickness of preformed filler, at all existing structures such as manholes, inlets, curbs, walls and buildings that will abut or otherwise interface with the new ultra-thin whitetopping concrete overlay. The filler shall extend the full width and depth of the ultra-thin whitetopping overlay interface. Isolation joints are not required at construction joints within the concrete overlay or at the edges where the ultra-thin whitetopping overlay will interface with existing asphalt.

Construction joints shall be formed with a bulkhead at the end of each day's work, and whenever necessary to suspend work for more than 30 minutes. Longitudinal construction joints not shown on the plans are permitted, but only to the extent necessary to accommodate the width of the finishing machine, to facilitate changes in roadway crown, to permit maintenance of vehicular traffic, and as approved by the Engineer.

Contraction joints shall be installed with a lightweight saw. Sawing shall begin as soon as possible so that there is minimal raveling of the concrete adjacent to the cut. Saw cuts shall be a minimum depth of 1/4 of the thickness of the ultra-thin whitetopping overlay, and shall be 1/8 inch (3 mm) in width. The joints shall be equidistantly spaced at

approximately 12 inches per inch of plan thickness (longitudinally and transversely). Jointing shall result in square panels, or rectangular panels with the length of the long side not greater than 1.5 times the length of the short side.

Sealing of joints in the ultra-thin whitetopping overlay is not required.

852.10 Opening to Traffic. Traffic will not be permitted on the finished overlay surface until after completion of the specified curing period. The completed ultra-thin whitetopping overlay may be opened to traffic after 3 days or earlier provided test beams have obtained a modulus of rupture of 600 psi (4.2 MPa).

852.11 Limitation on Placing Operations. Prior to overlay placement, the Engineer shall establish the Contractor's ability to place the ultra-thin whitetopping overlay on a continuous basis, and to consolidate, finish, texture, commence curing and saw joints, within the time intervals specified. Once the finishing machine has made the first pass, workers shall not be allowed to walk in the freshly placed overlay.

The ultra-thin whitetopping overlay shall be placed only when the local ambient temperature is above 7° C (45° F) and is forecast to remain above 7° C (45° F) and for the curing period. The overlay shall not be placed when rain is forecast within the intended working period. Overlays shall be placed only if the overlay surface evaporation rate, as affected by ambient air temperature, concrete temperature, pavement temperature, relative humidity and wind velocity, is 1.0 kg/ml (0.2 pounds per square foot) per hour or less. The Contractor shall determine and document the atmospheric conditions, subject to verification by the Engineer. Figure 1 shall be used to determine graphically the loss of surface moisture for the overlay. In using this figure, the concrete temperature shall be taken at the average of the prepared pavement surface temperature and the plastic concrete temperature.

No ultra-thin whitetopping overlay shall be placed if the ambient air temperature is 85° F (29° C) or higher or predicted to go above 85° F (29° C) during the overlay placement regardless of the surface evaporation rate. In no case shall the temperature of the plastic ultra-thin whitetopping overlay concrete exceed 90° F (32° C) during placement.

If rain occurs during placing of the overlay, all operations shall cease and the concrete shall be protected. No ultra-thin whitetopping overlay shall be placed after October 15th except by written permission of the Engineer.

If placement of the overlay is to be made at night, the Contractor shall submit a plan which provides adequate lighting for the work area. The plan shall be submitted at least 15 calendar days in advance and be approved by the Engineer before concrete is placed. The lights shall be so directed that they do not affect or distract approaching traffic.

During delays in the overlay placement operations of more than 10 minutes, the work face of the overlay shall be temporarily covered with wet burlap. If an excessive delay is

anticipated, a bulkhead shall be installed at the work face and the overlay placement operation terminated.

Unless otherwise authorized by the Engineer, an overlay shall not be placed adjacent to a previous overlay which has cured for less than 36 hours.

Adequate precautions shall be taken to protect the freshly placed overlay from rain.

852.12 Method of Measurement. For measurement of quantities the area will be the number of square yards (square meters) of ultra-thin whitetopping overlay completed and accepted in place. The width of the measurement will be the width of the pavement shown in the typical cross section of the plans, additional widening where called for, or otherwise directed in writing by the Engineer. The length shall be the measured horizontally along the centerline of the roadway or ramp. The plan quantities as adjusted for changes, errors and deviation in excess of the allowable tolerances will be the method of measurement.

The bid price for the ultra-thin whitetopping overlay includes that cost of furnishing, placing, finishing, texturing, curing and jointing the plan specified thickness overlay. It also includes the cost of surface milling, removal of milling debris, cleaning, and all other material, labor and equipment required to complete this work, but not specifically included in the other items for payment.

852.13 Basis of Payment. Payment for completed and accepted quantities as measured above will be made at the contract price bid for:

Item	Unit	Description
852	Square yard (Square meter)	Ultra-thin whitetopping (plan specified thickness) ____ inches (mm) thick

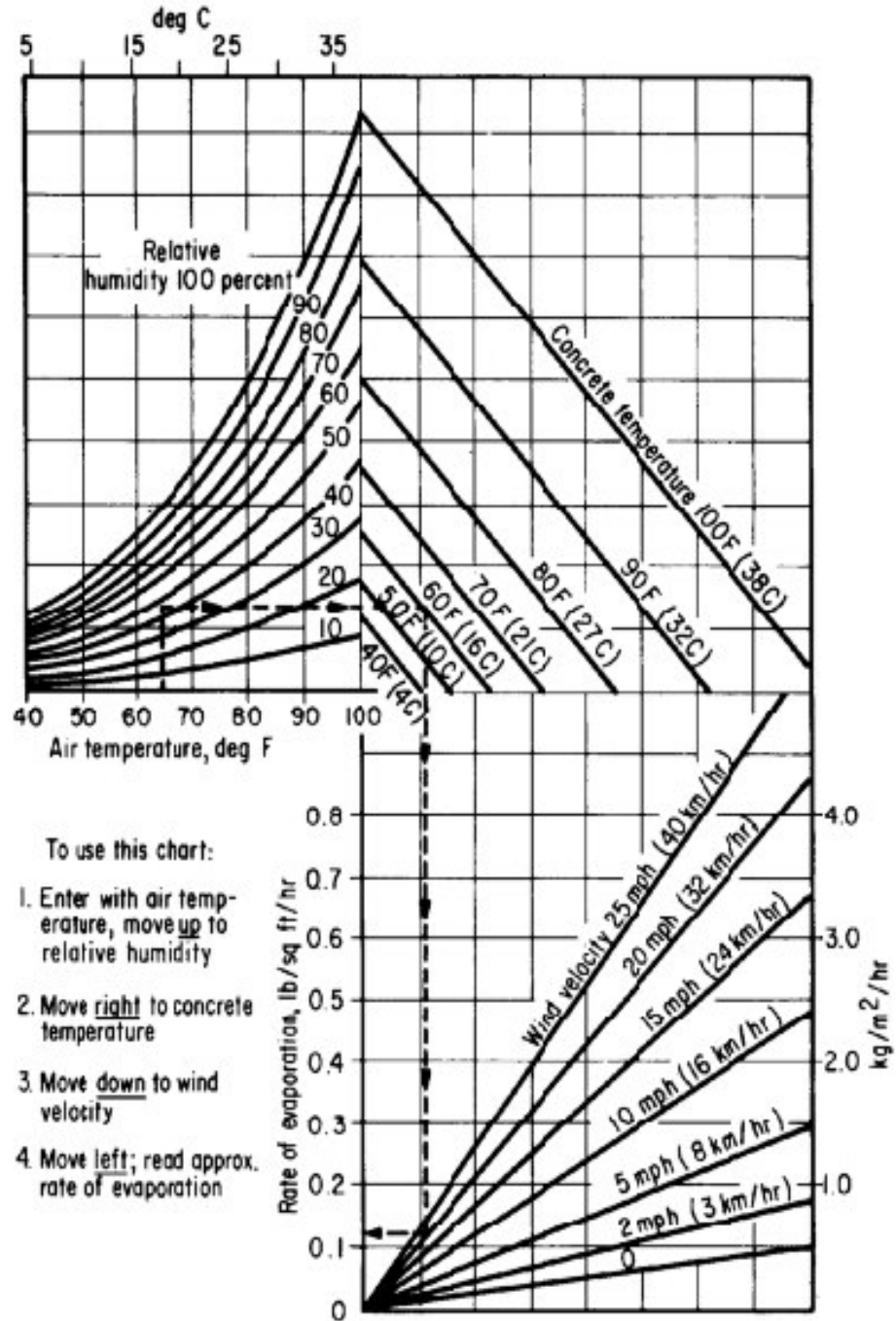


Fig. 1 *- Effect of concrete and air temperatures, relative humidity, and wind velocity on the rate of evaporation of surface moisture from concrete. This chart provides a graphic method of estimating the loss of surface moisture for various weather conditions. To use the chart, follow the four, steps outlined above.

* ACI Committee 308, "Standard Practice for Curing Concrete (ACI 308)", American Concrete Institute, Detroit, Michigan.

** In using this figure, the concrete temperature shall be taken as the average of the pavement surface temperature and the plastic concrete temperature.