

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 848
BRIDGE DECK REPAIR AND OVERLAY
WITH CONCRETE USING HYDRO-DEMOLITION
APRIL 15, 2005

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848.01 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 reasonably close conformity with the grades, thickness, and cross sections shown on the plans or as directed by the Engineer. This work shall include the removal of patches other than sound portland

cement concrete and all loose and unsound concrete by hydro-demolition; preparation of the sound existing concrete surface; removal, forming and concrete for full-depth repairs; blast cleaning or high pressure water cleaning; furnishing, placing, finishing, texturing and curing of a micro silica modified concrete (MSC) overlay, a latex modified concrete (LMC) overlay, or a superplasticized dense concrete (SDC) overlay, as specified; and all other operations necessary to complete this work according to these specifications and to the satisfaction of the Engineer.

Removal of flexible (asphalt) concrete overlays and rigid concrete overlays are included as part of this work if the following bid items are part of the project plans:

Item 848, Wearing Course Removed, Asphalt,

Item 848, Existing Concrete Overlay Removed ____ Nominal Thickness

Item 848, Removal Debonded, Deteriorated Existing Variable Thickness Concrete Overlay

848.02 Bridge Decks with No Existing Rigid Concrete Overlay. The overlay surface shall be finished to a dimension "T" above the surface of the existing portland cement concrete deck. The existing deck shall be removed to a uniform depth of "D" across its entire surface. The uniform removal depth will be exceeded where unsound concrete is encountered. Unless the plans state otherwise, "D" shall be 1 inch (25 mm).

848.03 Bridge Decks with an Existing Rigid Concrete Overlay. When a rigid concrete overlay exists on a deck, the thickness of concrete "D" to be removed and the thickness of the new overlay "T" replaced is a function of the existing concrete overlay thickness and shall be as called out in the plans. The cost of removing the rigid concrete overlay shall be included in the price bid for Item 848, Existing Concrete Overlay Removed ____ Nominal Thickness and an additional Item 848, Removal Debonded, Deteriorated Existing Variable Thickness Concrete Overlay. The second bid item is intended for the removal of unsound variable thickness overlay concrete not removed in the 848, Existing Concrete Overlay Removed, ____ Nominal Thickness.

Spalled or delaminated tops of backwalls shall be repaired with the specified overlay material for the bridge deck (variable thickness).

848.04 Micro-silica Modified Concrete Materials. The materials shall conform to the following requirements:

Fine aggregate (natural sand).....	703.02*
Coarse aggregate (No.8)	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	705.12, ASTM C 494, Type F (High Range Water Reducer)
Curing materials.....	705.05 or 705.06, White opaque
Micro-silica admixture.....	701.10

* Deleterious material shall not exceed one-half the requirement for superstructure aggregate. 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.

The Contractor will obtain a written statement from the manufacturers of the chemical admixtures verifying the compatibility of the combination of materials and the sequence in which they are combined. The manufacturers will further designate a technical representative from their company or

the ready-mix supplier to be in charge of the dispensing of the admixture products. The technical representatives shall act in an advisory capacity and will report to the Contractor and the Engineer any operations and procedures which are considered by the representative as being detrimental to the integrity of the placement. The manufacturer's technical representative will be present during concrete placement unless his presence is waived by the Engineer.

848.05 Latex Modified Concrete Materials. The materials shall conform to the following requirements:

Fine aggregate (natural sand)	703.02*
Coarse aggregate (No. 8)	703.02*
Portland cement, Type I.....	701.04**
Water.....	499.02
Latex emulsion.....	SS No. 953***
Curing materials.....	705.05 or 705.06, White opaque

* 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.

**705.10 admixture shall not be used.

***The latex emulsion shall be protected from freezing and prolonged exposure to temperatures in excess of 85 °F (29 °C). Emulsions in storage facilities shall be re-circulated in accordance with the manufacturer's recommendations.

848.06 Superplasticized Dense Concrete Materials. The materials shall conform to the following requirements:

Fine aggregate (natural sand).....	703.02*
Coarse aggregate (No. 8)	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	705.12, ASTM C 494, Type F (High Range Water Reducer)
Curing materials.....	705.05 or 705.06, White opaque

* 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 superplasticizing admixture that he is satisfied with the compatibility of the combination of materials and the sequence in which they are combined. The manufacturer shall further designate a technical representative from the ready-mix supplier or his company to be in charge of dispensing the admixture products. Operations and procedures which are considered by the designated representative as being detrimental to the integrity of the overlay will not be permitted.

848.07 Mixers - Micro-silica Modified or Superplasticized Dense Concrete. Concrete shall be mixed in a central mixing plant or by a ready-mixed concrete truck capable of discharging concrete having a maximum water-cementitious ratio of 0.36. Mixing equipment shall meet the requirements of 499.06(B). Admixtures shall be introduced into the concrete in such a manner that will disperse them 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.

848.08 Mixers - Continuous Mobile for Latex Modified Concrete. Requirements for continuous mobile mixers for latex modified concrete are as follows. The proportioning and mixing equipment shall be an integral mobile unit having the capacity and continuous mixing capability to permit the finishing operations to proceed at a constant rate so that final finishing can be completed prior to the formation of a plastic film on the LMC surface. It shall consistently produce a uniformly blended mixture within the specified air content and slump limits. The mixer shall also:

- (1) Be capable of producing not less than 6 cubic yards (4.6 m³) of LMC without recharging.
- (2) Be equipped with a recording meter with a ticket printout device to record an indication of the cement quantity being introduced into the mix. The metering device shall be accurate within a tolerance of -1 to +3 percent.
- (3) Be equipped with a latex metering device to indicate volume dispensed. The metering device shall be accurate within a tolerance of -1 to +2 percent. In addition the latex tank shall have a stand pipe marked in gallons (liters).
- (4) Be equipped with a water flow indicator, and have a water flow control that is readily adjustable to provide for minor variations in aggregate moisture content. The flow indicator shall be accurate within a tolerance of + 1 percent in the range of expected use.
- (5) Be equipped with a control to regulate the quantity of each of the LMC components to permit production of a mix having the specified composition. To ensure that the mixer can accurately proportion and blend all components of the LMC on a continuous or intermittent basis, the mixer shall be calibrated prior to the start of the overlay placement.

The Engineer may require re-calibration of the cement, latex, and water metering devices as he deems necessary.

- (6) Be capable of discharging mixed LMC through a conventional chute directly in front of the finishing machine.
- (7) Be kept clean, free of partially dried or hardened materials, and properly operating at all times.

848.09 Finishing Machine. An approved self-propelled finishing machine shall be used with supports outside the prepared deck surface to be overlaid, except where hand finishing equipment is authorized. The finishing machine shall be equipped with forward and reverse drive mechanisms that enable precise velocity control of the machine while it is moving in either direction. It shall be equipped with one or more rotating rollers. It shall be equipped with augers and either a vibrating pan or vibrating rollers. Vibrating frequency for pans and rollers shall be variable from 1500 to 5000 pulses per minute. The Contractor shall furnish the necessary verification of these vibration frequencies. Screeds shall have provisions for raising above the finished concrete surface.

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

848.10 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 (3 m) 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 (3 mm in 3.0 m) 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.

848.11 Hydro-demolition Equipment. The hydro-demolition equipment shall be a self-propelled machine that utilizes a high pressure water jet stream capable of removing concrete to the depth specified herein and/or as shown on the plans and be capable of removing rust and concrete particles from reinforcing steel. Hand held high pressure [10,000 psi (690 bar) minimum] wands or 35 lb (16 kg) maximum jackhammers operated at no more than a 45 degree angle from horizontal shall be used in areas that are inaccessible to the self-propelled machine or in patching areas that require work to remove the remaining unsound concrete.

848.12 Proportioning and Mixing of Micro-silica Modified Concrete. 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 of the micro silica modified concrete shall be combined into a workable mixture of uniform composition and consistency. They shall be proportioned as follows:

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

Type of Coarse Aggregate	Coarse Aggregate lb (kg)	Fine Aggregate lb (kg)	Cement lb (kg)	Micro Silica lb (kg)	Max. Water Cementitious Ratio^^
Gravel	1355 (805)	1355 (805)	700 (415)	50 (30)	0.36
Limestone	1370 (815)	1355 (805)	700 (415)	50 (30)	0.36
Slag	1190 (705)	1355 (805)	700 (415)	50 (30)	0.36

* The specific gravities used for determining the above weights are: natural sand 2.62, gravel 2.62, limestone 2.65, slag 2.30 and micro silica 2.20.

^^ The water cementitious ratio shall be calculated based upon the total cementitious material. Cementitious material shall include Portland cement and microsilica (solids).

The proportions of coarse and fine aggregate shall be adjusted to provide the maximum amount of course aggregate possible and still provide a workable and finishable mix. The Contractor may modify the mixes shown by adjusting the coarse and fine aggregates up to 100 pound (50 kg) each, unless otherwise approved by the Engineer.

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 (4.6 cubic meters), whichever is the smaller, unless a larger size is approved by the Engineer.

The specified cementitious content shall be maintained and a maximum water-cementitious material ratio of 0.36 shall not be exceeded. Any admixture added at the job site shall be mixed a minimum of 5 minutes at mixing speed. After all components have been added, the slump range shall be 6 inches (150 mm) plus or minus 2 inches (50 mm). The air content of plastic concrete at the time of placement shall be 8 plus or minus 2 percent.

The use of Micro-silica admixture in dissolvable bags shall not be allowed.

If a slump loss occurs after mixing and before placement, 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. The load shall still be placed within the 90 minute limitation as per 848.07. 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.

848.13 Proportioning and Mixing of Latex Modified Concrete. Prior to each day's placement, each mixer shall be checked to assure that specified air content, slump and yield have been attained. Trial concrete shall not be incorporated into the work. Additional testing will be done in accordance with 848.31.

The LMC shall be a workable mixture having a uniform composition and consistency with the following proportions, properties or limits:

QUANTITIES OF MATERIALS PER CUBIC YARD (CUBIC METER)(DRY WEIGHT)*

Type of Coarse Aggregate	Fine Aggregate lb (kg)**	Coarse Aggregate lb (kg)	Cement lb (kg)	Latex Emulsion gal (L)	Maximum Net Water gal (L)
Gravel	1645 (974)	1300 (769)	658 (389)	24.5 (121)	17.5 (86)
Limestone	1645 (974)	1315 (778)	658 (389)	24.5 (121)	17.5 (86)
Slag	1645 (974)	1140 (675)	658 (389)	24.5 (121)	17.5 (86)

Slump*** 4 to 6 inches (100 to 150 mm)

Air content of plastic mix shall not exceed 7 percent.

* The specific gravities used for determining the above weights are: natural sand 2.62, gravel 2.62, limestone 2.65 and slag 2.30.

** The dry weights are approximate. This proportion should produce good workability, but due to gradation variability, the fine aggregate content may be increased, with approval by the Engineer, as much as 8 percent by weight if the coarse aggregate is reduced an equal volume.

*** The slump shall not be measured until after the concrete has been discharged from the mixer and left undisturbed for 4 to 5 minutes. The water content may be adjusted to control the slump within the prescribed limits.

848.14 Proportioning and Mixing of Superplasticized Dense Concrete. The SDC mix shall be proportioned and mixed in accordance with 499 of the CMS except as modified herein.

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 superplasticized dense concrete shall be combined into a workable mixture of uniform composition and consistency. They shall be proportioned as follows:

QUANTITIES OF MATERIAL PER CUBIC YARD (CUBIC METER), DRY WEIGHTS*

Type of Coarse Aggregate	Coarse Aggregate lb (kg)	Fine Aggregate lb (kg)	Cement lb (kg)	Maximum Water-Cement Ratio
Gravel	1300 (769)	1300 (769)	825 (489)	0.36
Limestone	1315 (778)	1300 (769)	825 (489)	0.36
Slag	1140 (675)	1300 (769)	825 (489)	0.36

* The specific gravities used for determining the above weights are: natural sand 2.62, gravel 2.62, limestone 2.65 and slag 2.30.

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 (4.6 m³), 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. 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 fresh unvibrated SDC at the time of placement shall be

8 ± 2 percent. Two compressive cylinders shall be made for every other ready-mix truck load of SDC incorporated into the work.

If a slump loss occurs after addition and mixing of the superplasticizing admixture and before placement of the SDC 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 "re-tempering" is such as to cause segregation of the components, this will be cause for rejection of the load.

848.15 Test Slab. At the option of the Engineer, the Contractor shall make one or more trial batches of overlay material 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 slabs demonstrating the ability to finish and texture the concrete in accordance with 848.26. These slabs shall be 8 feet (2.4 m) long, a width which is wide enough to accommodate the tinning equipment and 1 1/4 inch (32 mm) thick.

848.16 Preparation of Existing Deck. 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 blasting operation.

The Contractor is responsible for protecting traffic under the bridge while removing deck concrete.

848.17 Removal of Existing Asphaltic Concrete Overlays. If an item "848, Wearing Course Removed, Asphalt" is specified in the plans, the Contractor shall remove the existing asphaltic concrete course to the original concrete deck and any waterproofing material that was part of the deck. Removal shall comply with the requirements of CMS 202 and be completed before hydro-demolition is performed. This item shall be a separate operation from 848.18.

848.18 Removal of Existing Concrete Overlays. If an item "848, Existing Concrete Overlay Removed ____ Nominal Thickness" is specified in the plans, the Contractor shall remove the existing concrete overlay to the nominal specified thickness. Removal shall comply with the requirements of CMS 202 and as amended below:

Nominal thickness is defined as the specified thickness +/- 1/4 inch (6 mm).

If the Engineer determines during the nominal thickness removal that not enough existing concrete overlay is removed to expose only variable thickness existing concrete overlay islands, the Engineer will require the Contractor to adjust the removal depth, as required, until only variable thickness islands of concrete overlay are visible.

848.19 Removal of Existing Concrete Overlay, Variable Thickness. If an item "Item 848, Removal Debonded, Deteriorated Existing Variable Thickness Concrete Overlay" is specified in the plans the Contractor shall perform the following:

After removing the existing uniform concrete overlay, the Contractor shall clean the deck to allow sounding. With Contractor supplied aerosol paint, the Engineer shall sound and mark the areas of unbonded variable thickness existing concrete overlay for removal. The Contractor shall remove by chipping all obviously loose, debonded and/or deteriorated concrete overlay (variable thickness). Chipping hammers shall not be heavier than the nominal 35 pound (16 kg) class and shall be operated at an angle of less than 45 degrees from the deck surface. Concrete shall be removed in a manner that prevents cutting, elongating or damaging reinforcing steel. Any reinforcing steel damaged shall be replaced at the Contractor's expense. Additionally, any "islands" of existing overlay that will not allow the minimum uniform thickness of new concrete overlay to be obtained shall be removed. Upon the Engineer's approval of the marked removal areas, Concrete Removal by Hydro-demolition 848.20 may be performed.

848.20 Concrete Removal by Hydro-demolition. The intent of this specification is to remove all unsound concrete, both uniform and variable depth, by using hydro-demolition, not scarification or jacking.

The entire top surface of the concrete bridge deck shall be completely removed to a depth "D" of 1 inch (25 mm) or as specified in the plans. The measurement shall be nominal and shall be taken from the Portland cement concrete surface to the mortar line.

The Contractor may choose to use conventional scarifying equipment to make an initial pass across the deck to remove a portion of the total depth, "D", required. In all cases the final 1 inch (25 mm) will be removed using hydro-demolition equipment. If the Contractor's choice of using mechanical scarifying equipment results in exposing or snagging the top mat of reinforcing steel, the scarifying equipment shall be immediately stopped and any remaining removal will be by hand chipping, if necessary, and hydro-demolition.

Damaged or dislodged reinforcing steel shall be repaired or replaced at the Contractor's expense. Replacement shall include the removal of any additional concrete required to position the new reinforcing steel at the correct height and to provide the required lap splice lengths as defined in 509.

Prior to the commencement of the removal operation with hydro-demolition, the equipment shall be calibrated on an area of sound concrete as designated by the Engineer. In case of an existing overlay, calibration shall be performed on original deck concrete that is sound and not on any remaining concrete overlay material. After calibration, the equipment shall be moved to a known unsound area to verify that all unsound concrete is removed by the established recorded settings.

The Engineer shall verify the following settings:

1. Water pressure gauge
2. Machine staging control (step)
3. Nozzle size
4. Nozzle speed (travel)

During the calibration, any or all of the above settings may be modified in order to achieve removal of all unsound concrete. The settings may be changed by the Contractor to achieve total removal of unsound concrete, but the Engineer must be notified of all changes. The Engineer may change any or all of the settings in order to achieve the goal of removing unsound concrete with hydro-demolition. The removal shall be verified, as necessary, and at least every 30 feet (10 m) along the cutting path. The readings shall be documented and, if necessary, the equipment re-calibrated to insure the goal of removing all unsound concrete with hydro-demolition is achieved.

Calibration shall be required on each structure, each time hydro-demolition is performed and as required to achieve the results specified by the plan. The depth of removal shall be verified as necessary, and at least every 30 feet (10 m) along the cutting path. The readings shall be documented and, if necessary, the equipment re-calibrated to insure the specified depth of removal.

The Contractor shall block all drains on the deck and install aggregate dams every 150 feet (50 meters) 6 inches (150 mm) high by 1 foot (300 mm) wide minimum, to strain run-off. The deck shall be used as a settlement basin within itself. A settlement basin outside or at the end of the structure is required if further straining is necessary to produce visibly clear water.

The Contractor shall provide shielding, as necessary, to ensure containment of all dislodged concrete within the removal area in order to protect the traveling public from flying debris both on and under work site.

848.21 Resounding. After the hydro-demolition operation has completed the removal, and the deck is allowed to dry, the deck shall be resounded to assure that all unsound material has been removed. The final sounding of the deck shall be done by the Engineer and shall not be performed within 24 hours after a rain. In no case shall the final sounding be made unless the deck is dry. Final sounding shall consist of as many successive resoundings as required to ensure that all deteriorated and fractured concrete has been removed. Additional removal shall be performed with the hand held wand [10,000 psi (690 bar) min] or 35 pounds (16 kg) maximum weight jackhammer operated at an angle of no more than 45 degrees from horizontal. If jackhammering results in the exposure of ½ of the reinforcing steel, the adjacent concrete shall be removed to a depth that will provide a minimum ¾ inch (19 mm) clearance around the reinforcing steel except where other reinforcing steel makes this impractical.

Aerosol spray paint for outlining shall be provided by the Contractor.

848.22 Cleaning. Cleaning shall be performed with a vacuum system capable of removing wet debris and water all in the same pass. Cleaning shall be done in a timely manner, before debris and water is allowed to dry on the deck surface. All exposed reinforcing steel which is left unsupported by the hydro-demolition process shall be adequately supported and protected from bending from all construction traffic.

All reinforcing steel damaged or dislodged by these operations shall be replaced with bars of the same size and coating at no additional cost to the State. Replacement shall include the removal of any additional concrete required to position the new reinforcing steel at the correct height and to supply the required lap splice lengths as defined in 509.

848.23 Full Depth Repair. Where the deck is sound for less than one half of its original depth, the concrete shall be removed full depth except for limited areas as may be designated by the Engineer. Forms shall be provided to support concrete placed in full-depth repair areas. The forms for areas of up to 4 square feet (0.4 square meter) may be suspended from wires from the reinforcing steel. For areas greater than 4 square feet (0.4 square meter), the forms shall be supported from the primary members of the superstructure or by shoring from below. Areas of full-depth repair shall have the concrete faces and reinforcing steel cleaned as described in 848.24

848.24 Preparation Prior to Overlay Placement. Not more than 24 hours prior to placing the overlay, all surfaces to which the overlay is to bond, including exposed reinforcing and structural steel, the work face of a previously placed overlay, and the faces of curbs and barriers up to a height of at least 1 inch (25 mm) above the proposed overlay surface shall be blast cleaned. Exposed reinforcing and structural steel shall be cleaned to remove all loose and built-up rust, asphalt residue, and all other contaminants detrimental to achieving an adequate bond. Pockets of rust (corrosion cells) on exposed reinforcing steel shall be cleaned of all corrosion products. Areas of steel where the original hydroblasting was applied should normally be adequately cleaned but steel shall be inspected to assure cleanliness requirements are met. Suitable blast methods may include high pressure water blasting [10,000 psi (690 bar) min], water blasting [less than 10,000 psi (690 bar)] with abrasives in the water, abrasive blasting with containment, or vacuum abrasive blasting. Listed concrete surfaces shall be made free of spalls, laitance, and all contaminants detrimental to achieving an adequate bond.

Bridge scuppers shall be cleaned of all foreign matter and plugged prior to placement of the overlay. Scuppers shall be unplugged to permit free drainage of water from the deck surface following overlay placement.

Vehicles other than approved construction equipment will not be permitted on those sections of the deck where hydro-demolition has begun. Contamination of the deck by construction equipment or from any other source shall be prevented.

848.25 Finishing Machine Dry Run. After the screed rails have been set to proper profile and prior to placing the overlay, the Contractor shall check the finishing machine clearance to assure the Engineer that the specified nominal thickness of overlay will be attained over the entire deck.

848.26 Placing, Consolidating and Finishing. The deck surface which will contact the overlay shall be cleaned with compressed air, wetted, and kept wet for at least one hour immediately prior to placing the overlay. Any standing water shall be removed prior to placement of the overlay. The newly exposed surfaces in full-depth repair areas shall be similarly cleaned and prepared immediately prior to placing concrete.

Overlays shall be placed, consolidated and finished to the plan surface. Hand vibrators shall be used for full-depth repair, variable depth areas, at all edges and adjacent to joint bulkheads.

Concrete for full-depth repairs shall be the overlay concrete placed either simultaneously with the overlay or, if preplaced separately from the overlay operation, the concrete may be either the overlay concrete or 511 Class S Concrete. If the full-depth repair is preplaced separately, it shall be placed up to the plan lower boundary of the overlay, given a broom finish, and cured as specified in 511.17. [on a LMC or SDC overlay project, the faces of existing sound concrete shall be similarly wetted and coated with bonding grout prior to placing concrete.]

Contamination of the wetted deck by construction equipment or from any other source shall be prevented by placement of a clean 4-mil (100 μ m) polyethylene sheet (or any other covering as approved by the Engineer) on the surface of the prepared deck.

Where reinforcing steel is exposed, the Contractor shall provide adequate supports for the concrete mixer so that reinforcing steel and its bond with the concrete will not be damaged by the weight and movement of the concrete mixer, or shall provide means to convey concrete from the mixer to the finishing machine.

After the overlay material has been consolidated and finished, it 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.

At the Contractor's option an evaporation retardant may be used after finishing, or after texturing, or both. This material shall not be finished into the plastic concrete at any time. Only products specifically marketed for such usage shall be utilized. The evaporation retardant shall be applied as per the manufacturer's written recommendations and shall consist of a fine mist using a suitable sprayer. Application in a stream shall not be allowed. The wet burlap cure, 848.28 or 848.29, shall follow this operation as closely as possible.

The Contractor shall stencil the date of construction (month and year) and the letters MS, LM or SD into the overlay before it takes its final set. The date shall be located in the right-hand corner of the deck at the forward abutment. It shall be placed parallel to the edge of the overlay and centered at 12 inches (300 mm) in from both the edge of the overlay and end finish. The numerals shall be 3 to 4 inches (75 to 100 mm) in height, 1/4 inch (6 mm) in depth and face the centerline of the roadway.

Longitudinal joints are permitted, but only to the extent necessary to accommodate the width of the finishing machine, to facilitate changes in roadway crown, and to permit maintenance of vehicular traffic, except as approved by the Engineer. Longitudinal joints shall not be used in close proximity to faces of curbs or barriers or at edges of decks. All joints in the overlay shall be formed.

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

A 10 foot (3 meter) straightedge shall be used to check the overlay directly behind the finishing machine. It shall also be used to check 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.

848.27 Curing. If a full-depth repair is placed separately, it shall be water-cured as described below for the applicable overlay concrete and shall have attained a modulus of rupture of 400 psi (2.8 MPa).

A cure day shall be defined as a 24-consecutive hour period of time. The temperature of the overlay surface shall be maintained above 35 °F (2 °C) until the curing period is completed. Any day during which the air temperature at the overlay surface falls below 45 °F (7 °C) shall not be counted as a cure day.

When curing is completed, all joints and abutting surfaces in the overlay shall be sealed with an approved high molecular weight methacrylate sealer meeting 705.15. The sealer shall be prepared and applied in accordance with the manufacturer's recommendations. Joints to be sealed shall include transverse joints in the overlay concrete, joints between overlay concrete and steel enddams, longitudinal joints between overlay concrete placements, and longitudinal joints between overlay concrete and safety curb, barriers, parapets, bulb angles, etc. In the edges of decks without curbs, the interface between the overlay and the existing deck shall be sealed in a similar manner. Any cracking which occurs prior to opening to traffic shall be sealed as above or repaired or corrected in another manner as directed by the Engineer at no cost to the State. The deck shall be sounded and any delaminated area shall be removed and replaced at the Contractor's expense.

Any improperly cured overlay may be ordered to be removed and replaced at no cost to the State. Regardless of what type of overlay, curing shall start after the concrete has been tined and the surface will not be damaged by the cure.

848.28 Curing Application LMC Overlays. As soon as the tining operation is completed, the finished overlay surface shall be covered with a single layer of clean wet burlap. The burlap shall be kept wet by a continuous flow of water through soaker hoses and covered with a 4-mil (100 µm) white opaque polyethylene film or a wet burlap - white opaque polyethylene sheet for 48 hours. After this initial wet curing period, the covering shall be removed and the surface dry-air cured for an additional 2 days before subjecting the new surface to vehicular traffic.

Traffic will not be permitted on the finished overlay surface until after completion of the 4-day cure.

848.29 Curing Application MSC and SDC Overlays. As soon as the tining operation is completed, the finished overlay surface shall be covered with a single layer of clean wet burlap. The fresh overlay surface shall receive a wet burlap cure for 3 days. For the entire curing period of 72 hours the burlap shall be kept wet by the continuous application of water through soaker hoses. Either a 4-mil (100 µm) white opaque polyethylene film or a wet burlap-white opaque polyethylene sheet shall be used to cover the wet burlap for the entire 72 hour period.

Traffic will not be permitted on the finished overlay surface until after completion of the 3 day wet cure.

848.30 Limitation on Placing Operations. Prior to overlay placement, the Engineer shall establish the Contractor's ability to place the overlay on a continuous basis and to consolidate, finish, texture, prior to the formation of plastic surface film, and commence curing.

When directed by the Engineer, a representative of either the latex manufacturer or the micro-silica supplier shall be present during the proportioning, mixing, placing and finishing of the overlay. Operations and procedures which are considered by this representative to be detrimental to the integrity and durability of the repaired and overlaid bridge deck will not be permitted.

Once the finishing machine has made the first pass, workers shall not be allowed to walk in the freshly placed overlay.

No overlay concrete shall be placed when it is raining, when the ambient air temperature is below 45 °F (7 °C) or when it is predicted to fall below 45 °F (7 °C) for the duration of the curing period

Overlays shall be placed only when the overlay surface evaporation rate, as affected by ambient air temperature, concrete temperature, deck temperature, relative humidity and wind velocity, is 0.1 pound per square foot (0.5 kg/m²) per hour or less. The Contractor shall determine and document the atmospheric conditions, subject to verification by the Engineer. No overlay concrete shall be placed if the ambient air temperature is 85 °F (29 °C) or greater or predicted to go above 85 °F (29 °C) during the overlay placement regardless of the surface evaporation rate.

Figure 1 in ACI 308 (see 511.10) shall be used to determine graphically the loss of surface moisture for the overlay. In no case shall the temperature of the overlay concrete exceed 85 °F (29 °C) during placement. The measurement of weather parameters shall be made within 10 feet (3 m) of the placement area. No overlays shall be placed after October 15 except by specific permission of the Director.

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 concrete's placement operations of more than 10 minutes and/or when a plastic surface film develops on a LMC overlay, 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.

Vehicles other than approved construction equipment will not be permitted on those sections of the deck where concrete removal operations have begun. Contamination by construction equipment or from any other source shall not be permitted.

Prior to the end of the full curing period for any section, no power driven tools heavier than a 15 pound (7 kg) chipping hammer shall be used adjacent to the new overlay.

848.31 Sampling and Testing. After each charging of the concrete mixing unit (LMC) or transit mixer (MSC or SDC), the following testing shall be performed by the Department: Testing shall be performed at the point of discharge onto the deck.

a. Slump

4 to 6 inches (100 mm to 150 mm)(LMC)

6 +/- 2 inches (150 mm +/- 50 mm)(MSC or SDC)

b. Unit weight

c. Air

7% max. (LMC)

8% +/- 2% (MSC or SDC)

d. Compressive strength cylinders shall be made for every 50 cubic yards (40 cubic meters)

The Contractor shall furnish the required materials and samples without charge to the State as per 106.02.

For LMC, with all controls set for the desired mix, activate the mixer and discharge the mixed material into a 1/4 cubic yard (0.25 m³) container 36 x 36 x 9 inches (1 x 1 x 0.25 m). When the cement recording meter indicates a discharge of 1 3/4 bags (97 kg) of cement or 1/4 cubic yard (0.25 m³), the container should be filled flush with consolidated LMC. This test will be accepted as evidence of satisfactory performance for each truck.

848.32 Method of Measurement. Wearing Course Removed, Asphalt shall be measured as the actual square yards (square meters) of existing asphalt wearing course and waterproofing material removed and shall include all labor, materials, equipment required to complete the work.

Existing Concrete Overlay Removed ____ Nominal Thickness shall be measured as the actual square yards (square meters) of existing concrete overlay removed and shall include all labor, materials, and equipment required to complete the work.

Removal Debonded, Deteriorated Existing Variable Thickness Concrete Overlay shall be measured as the actual square yards (square meters) of marked removal areas defined in 848.19, and shall include all labor, materials, equipment, paint, to remove unsound variable thickness concrete overlays before hydro-demolition.

For measurement of quantities, the overlay is divided by a horizontal plane into two items, consisting of an upper part of uniform thickness "____ Concrete Overlay Using Hydro-demolition (____inches (mm) thick)" and a lower part of variable thickness "____ Concrete Overlay (Variable Thickness) - Material Only". "Full-Depth Repair with ____ Concrete" is measured as an additional separate pay item.

____ Concrete Overlay using Hydro-demolition (____inches (mm) thick) shall be measured as the actual deck area in square yards (square meters) overlaid. The thickness shall be as determined in 848.02 and 848.03. The bid price for this item includes the cost of furnishing, placing, finishing, texturing and curing the specified thickness overlay. Placement shall also include all labor and equipment to place the variable thickness overlay (since the variable thickness and the constant thickness overlay are placed in one operation).

Surface Preparation Using Hydro-demolition shall be measured as the actual deck area in square yards (square meters) overlaid and shall include the cost of surface preparation, hydro-demolition, milling, removal of the surface preparation debris, cleaning, and all other materials, materials, labor and equipment required to complete this work, but not specifically included in the other items for payment.

Full-Depth Repair shall be measured as the volume in cubic yards (cubic meters) based on the measured area of full-depth openings in the deck and the existing slab thickness, minus D as defined in 848.02. The bid price for this item includes the cost of removing sound concrete where the depth of sound concrete is less than half of the original thickness of the deck furnishing and installing forms and supports, furnishing and placing the overlay concrete and if the full-depth repair is preplaced, the finishing and curing required.

____ Concrete Overlay (variable thickness) Material Only shall be the volume in cubic yards (cubic meters) measured as the difference between the total volume (as indicated by the batch quantity tickets for the ready-mix trucks) of overlay placed and accepted, less the calculated volume of the overlay concrete (plan specified thickness), less the volume of overlay concrete used for full-depth repair, and less any wasted overlay concrete. The volume of overlay concrete remaining in the drum of the last ready-mix truck shall be weighed or measured by the Engineer. The bid price for this item includes the cost of material only, furnished to the job site. No separate payment shall be made for the placement of the concrete or for any tools, labor, equipment or incidentals necessary for such placement

complete and in conformance with these notes. The intent of this item is to pay material costs only for all materials, other than uniform thickness overlay material, regardless of the depth of removal incurred and including any material required for grade correction.

Concrete for the test slabs required under 848.15 shall be paid for on a lump sum basis. All other concrete for testing purposes shall be furnished without charge to the department per 106.02.

Hand chipping shall be based on the square yards (square meters) of material removed regardless of depth. Included shall be all labor and equipment required to remove unsound concrete by jackhammer or hand held wand in accordance with 848.16 and to clean the surface and remove debris accumulated as part of this operation. Further, this item is intended for unsound areas remaining after hydro-demolition and shall not include hand chipping of concrete which is inaccessible by hydro-demolition equipment.

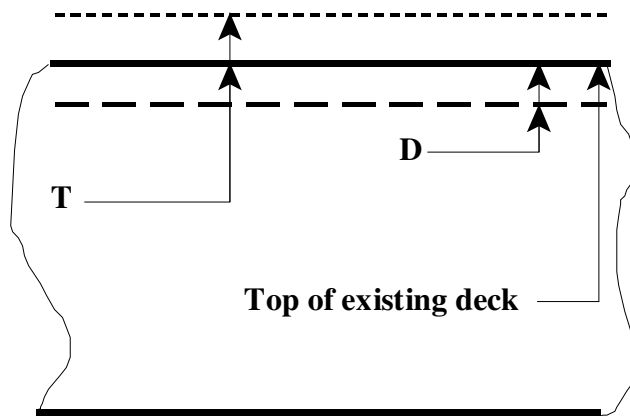
848.33 Basis of Payment. Payment for completed and accepted quantities as measured above will be made at the contract price bid for:

Item	Unit	Description
848	Square yard (square meter)	_____ Concrete overlay using hydro-demolition [____inch (mm)] thick
848	Square yard (square meter)	Surface preparation using hydro-demolition
848	Cubic yard (cubic meter)	_____ Concrete overlay (variable thickness), material only
848	Square yard (square meter)	Hand chipping
848	Lump sum	Test slab
848	Cubic yard (cubic meter)	Full-depth repair
848	Square yard (square meter)	Wearing course removed, asphalt
848	Square yard (square meter)	Existing concrete overlay removed ____ nominal thickness
848	Square yard (square meter)	Removal debonded or deteriorated existing variable thickness concrete overlay

Designer's Note for Supplemental Specification 848:

For Bridge Decks with No existing Rigid overlay

1. Plan detailed finished height "T" (see section 848.02) specifying the final elevation of the MSC, SDC or LMC concrete overlay above the existing Portland cement concrete deck.
2. Plans shall specify a uniform removal depth "D" (see section 848.02) of the existing Portland cement concrete deck. Exception if "D" is to be 1 inch (25 mm) removal of existing deck.



BID ITEMS REQUIRED

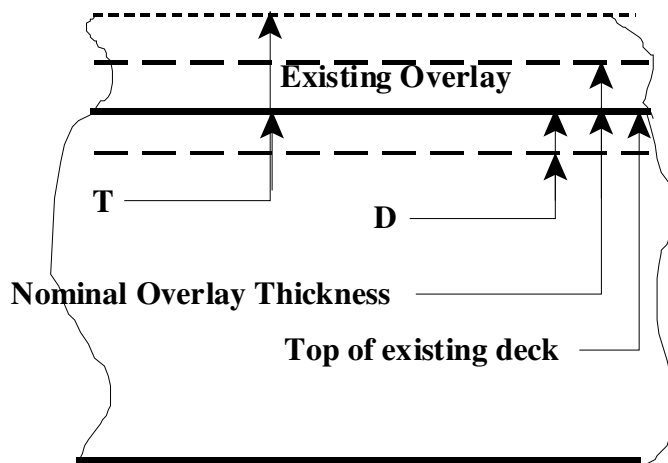
1. If an asphaltic overlay is on the concrete bridge deck a bid item is required
848 Square yard Wearing course removed, asphalt
2. Specify the overlay. Include type (LMC, SDC or MSC), thickness() and quantity in square yard (square meter). The thickness is the total of "T" and "D"
848 Square yard _____ Concrete overlay using hydro-demolition [____inch (mm)] thick (square meter)
3. Specify the removal quantities in square meter
848 Square yard Surface preparation using hydro-demolition (square meter)
4. Specify the variable thickness quantity required. Quantity shall be based on required bridge deck survey and evaluation required in section 400 of the Bridge Design Manual. Additionally type of overlay concrete (LMC, SDC or MSC) shall be specified.
848 Cubic yard _____ Concrete overlay (variable thickness), material only (cubic meter)
5. A nominal quantity of hand chipping shall be specified. Recommend 10% of the estimated variable thickness area of the deck (If 30% of deck is considered to require variable thickness repair the $30 \times .10 = 3\%$ of deck square yardage would be specified for hand chipping. Other methods for quantities that have been developed are acceptable.
848 Square yard Hand chipping (square meter)
6. Test Slab bid item shall be included for all projects
848 Lump sum Test slab

- Quantities shall be specified for full depth repair based on required bridge deck evaluation. Required quantities shall be based on the definition for pay item in section 848.32.

848 Cubic yard Full-depth repair
 (cubic meter)

Bridge Decks with an existing Rigid overlay

- Plan detailed finished height “T” (see section 848.03) specifying the thickness of either the MSC, SDC or LMC concrete overlay. For bridge decks with an existing rigid overlay this thickness “T” is a function of the designer required finished grade and the “nominal depth” of the existing rigid concrete overlay.
- Plans shall specify a uniform removal depth “D” (see section 848.03) of the existing Portland cement concrete deck.
- The item “Removal of variable thickness rigid overlay” is intended to remove unsound variable thickness before the uniform hydro-demolition removal is performed.



BID ITEMS REQUIRED

- If an asphaltic overlay is on the concrete bridge deck a bid item is required
848 Square yard (square meter) Wearing course removed, asphalt
- A nominal depth of existing concrete overlay shall be specified in addition to the square yard(square meter) quantity. The nominal depth should be based on existing plan specified verified by actual field measured depths of the existing concrete overlay based on either cores taken during the bridge deck survey and/or additional cores or drilling performed in the field to evaluate the actual thickness of the existing concrete overlay. Contact with the original overlay project’s project engineer, or other original project personnel, may be beneficial in establishing the nominal depth.
848 Square yard Existing concrete overlay removed ____ nominal thickness
 (square meter)
- A item removal of Debonded or Deteriorated Existing Variable Thickness Concrete Overlay, is intended for removal, by hand chipping, any debonded, unsound, variable thickness existing rigid

concrete overlay before hydro-demolition is performed. The square yard (square meter) should be based on three (3) items:

- A. Original overlay project's bridge deck survey.
- B. New project's bridge deck survey depth measurement
- C. Contact with the original overlay project's project engineer and other project personnel.

The final number will be a guess. Comparison of expected variable thickness area for the new project as compared to original project may help establish a quantity.

848 Square yard Removal debonded or deteriorated existing variable thickness concrete
(square meter) overlay

4. Specify the overlay. Include type (LMC, SDC or MSC), thickness() and quantity in square yard (square meter). The thickness is the total of T and D.

848 Square yard Concrete overlay using hydro-demolition [____inch (mm)] thick
(square meter)

5. Specify the removal quantities in square yard

848 Square yard Surface preparation using hydro-demolition
(square meter)

6. Specify the variable thickness quantity required. Quantity shall be based on required bridge deck survey and evaluation required in section 400 of the Bridge Design Manual. Additionally type of overlay concrete (LMC, SDC or MSC) shall be specified.

848 Cubic yard _____ Concrete overlay (variable thickness), material only
(cubic meter)

7. A nominal quantity of hand chipping shall be specified. Recommend 10% of the estimated variable thickness area of the deck (If 30% of deck is considered to require variable thickness repair the 30 x .10 = 3% of deck square yardage would be specified for hand chipping. Other methods for quantities that have been developed are acceptable.

848 Square yard Hand chipping
(square meter)

8. Test Slab bid item shall be included for all projects

848 Lump sum Test slab

9. Quantities shall be specified for full depth repair based on required bridge deck evaluation. Required quantities shall be based on the definition for pay item in section 848.32.

848 Cubic yard Full-depth repair
(cubic meter)