SECTION 528 Concrete Deck Removals, Overlays, and Structure Repairs

Standard spec 509 should be referred to in conjunction with this subsection.

528.1 Deck Removals

Contact BOS Structures Design at (608) 261-0261 if damage to steel or concrete girders occurs during deck removal.

The contractor is responsible for submitting a Damaged Girder Report to BOS prior to repairs to damaged girders commencing. The Damaged Girder Report can be found on the BOS Construction Resources website:

https://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/strct/construction-resources.aspx

Deck removal plans submitted for review by the contractor that include sawcutting that will damage or remove sections of the underlying girder flanges, shear stirrups projecting out of the top of the existing girder, or shear studs attached to the top flange of the existing girder shall be rejected by the engineer.

528.2 Cleaning and Preparation

The items of cleaning involve removal of rubber, oil, glaze, paint, salts, and other residue from structure decks and approaches scheduled to be overlaid. The items of preparation involve removing asphaltic patches and unsound concrete from bridge decks and approaches to be overlaid. Construction usually follows the following sequence:

1. The deck or approach is ground down by a mechanical scarifier. In areas where the scarifier cannot be maneuvered, the unsound concrete is removed by pneumatic air-hammers.

   Mechanical grinding should remove at least one inch of concrete or as shown on the plans. Grinding to this depth will remove top float, residue, and salt-contaminated concrete and allow minor grade correction. The grinder must be operated in a manner that avoids snagging or tearing of the reinforcing steel.

   Scarification should result in a clean, fresh concrete surface that will provide proper adhesion for the overlay, without loosening of aggregate.

   The faces of curbs should be cleaned of paint and residue by grinding or blasting from the surface of the deck up to the top elevation of the planned overlay. This operation will present a clean surface for proper adhesion, but it is one that is frequently overlooked.

2. The deck and portland cement concrete (PCC) approach is "sounded" by the engineer. Areas of unsound concrete are marked for removal.

   During the process of sounding, the entire deck and PCC approach must be tested, and the deteriorated areas marked for removal. There are several types of sounding equipment on the market for the detection of unsound or delaminated concrete. An adequate job can be done by sounding with a hammer or by dragging a chain or similar metal object. A dull, hollow sound indicates unsound concrete.

   Deep laminations can be detected by feeling vibrations in the concrete when it is struck with the hammer, or by seeing small particles of dust or dirt moving or bouncing when the concrete is struck. Thus, the limits of unsound and delaminated areas can be defined and marked by spray paint. Sounding in this manner is an onerous and time-consuming task, but it is extremely important that all unsound areas be detected.

   If the areas are few and widely separated, some time and effort may be saved using a chain drag to determine their general location, after which the exact limits are defined by the method described above. Sounding should be done during periods of quiet, when traffic is absent or minimal, and when machines are shut down.

3. Unsound concrete and remaining asphaltic patching is removed by air-hammer.

   Care must be taken not to damage sound concrete and reinforcing steel during removal of unsound concrete. Pneumatic hammers used for initial breakout should not exceed 35 lb. total weight except with the written approval of the engineer. The engineer should observe the use of each allowed hammer that is in excess of 35 lb. to determine if the benefit of increased performance is coming at the expense of increased damage.

   For removals below the top of reinforcing steel and within one inch of the steel, 16 lb. hammers are the maximum weight allowed.

   Before the sounding and marking operation, the contractor may voluntarily begin removal of areas of approach and deck where it is visually evident there is surface deterioration. This practice should be minimized and discouraged since over-break and loss of sound concrete can easily occur. Timely sounding by the engineer should avoid this problem.

4. Steps 2 and 3 must be repeated until the engineer is sure all unsound concrete has been removed.

   After the contractor has chipped and removed the deteriorated concrete in the marked areas, these areas must be sounded again. Often the surface exposed by the chipping operation will appear sound and durable but sounding will detect further laminations. These areas should be marked, and the entire process repeated until all unsound concrete has been removed. This is where the engineer must use good

judgment. Enough concrete must be removed to ensure the rehabilitated deck or approaches will provide adequate support.

5. The entire deck or approach surface to be overlaid, and all exposed reinforcing steel, is blast cleaned. Steel is spliced, realigned, and tied as needed. The steel should be free from layered rust and scale.
6. Debris, dust, blast material, and concrete remaining from the scarification and blast cleaning are removed. Final cleanup should be done by pressurized water, because water keeps down dust and removes small surface de-laminations that have escaped removal.

   Vehicles in adjacent traffic lanes must be protected from damage by flying debris and from obscured visibility by blowing dust. Water used in the cleanup operation should be prevented from flowing across live traffic lanes. The cleanup equipment should be inspected to ensure that oil from the compressor is not mixing with the pressurized air or water.

   The item of Full-depth Deck Repair is expensive, as it requires forming; therefore, the minimum thickness consistent with good construction practices should be placed. Any equipment that damages remaining portions of the deck, reinforcement, or girders must not be used. If an item scheduled for reuse in the new work is damaged, the contractor must replace it at the contractor's expense.

528.3 Mixing and Placing Concrete

528.3.1 Grades of Concrete

The grade of concrete used in the overlay or repair work is specified in the contract special provisions.

528.3.2 Pre-pour Meeting

A pre-pour conference should be held well in advance of the operation of placing overlay concrete. Refer to CMM 515 for details to be considered.

528.3.3 Mixing

Grade E concrete must be proportioned and mixed in a volumetric mixer at the site of the work. Requirements for volumetric plants are contained in standard spec 501.3.6.4.

528.3.4 Surface Preparation

Light films of surface rust appearing on the reinforcing steel between the blast cleaning and concrete pouring operations do not need to be removed, as light surface rust is not considered detrimental to obtaining a good bond to the concrete.

Areas receiving the items of Curb Repair, Concrete Surface Repair and Full-Depth Deck Repair are to be kept continuously wet for at least two hours before coating with neat cement and placing concrete.

When placing Grade E Concrete Masonry Overlay, ensure the surface of the existing deck is moist without having any standing water before coating with neat cement mixture. The reason for requiring the existing concrete to be moist is not necessarily for better adhesion, but to prevent moisture loss from the newly poured concrete.

For all overlay or repair work (except Concrete Surface Repair, for which using a neat cement can be approved as an option to concrete masonry) immediately before the concrete is placed, a neat cement mixture must be spread uniformly over the old concrete receiving the repair or overlay. The neat cement should have the consistency of a thick, smooth cream or smooth paste that can be spread effectively with a stiff bristle broom. The old concrete should be free of standing water. The admixture in the tank should be agitated at frequent intervals to maintain proper consistency. The area where the neat cement is applied should be kept to a minimum to prevent the slurry from drying out before new concrete can be placed. Accumulations of neat cement in low areas must be swept out.

Concrete for joint repair work made in preparation for a Grade E concrete overlay, and concrete for full-depth deck repair work must be placed, vibrated, and struck off at the old deck elevation before placing concrete for an overlay. Any powder or laitance on the surface of this prior work should be removed by blast cleaning before applying the neat cement.

528.3.5 Placement, Curing, and Finishing

The concrete mixtures specified for the repairs or overlays are high in cement content and consequently quite susceptible to high shrinkage and checking during the setting process. Therefore, it is desirable to keep the water content of the mix as low as is possible to minimize the amount of shrinkage, and to start the curing of the concrete as soon as possible, desirably just as soon as it is struck off and given the required surface texture.

Concrete masonry, overlay must not be placed when the surrounding air temperature will exceed 88 F. This specification will require the contractor to anticipate working conditions and plan ahead for the possibility of a night or early morning placement.

In contrast to the specifications for concrete bridges on skew, the specifications for overlays allow the finishing machine to operate with the screeds at right angles to the center line of the structure, even for

structures 20 degree or more on skew. This reduces overhang into the adjacent lane, providing a greater clear width for live traffic.

528.3.5.1 Grade E Concrete

Grade E concrete overlay must receive a tined finish. However, the turf drag or the alternative broom finish that is normally required before tining may be omitted.

The curing period for Grade E concrete overlay is 3 days.

Traffic may travel over a Grade E overlay or joint repair work 72 hours after completion unless the engineer extends the time period. Exception to this would be construction loadings on previously placed concrete overlay stages as indicated in standard spec 509.3.9.4(2). The intention is that all the concrete placed in previous overlay stages has cured a minimum of 12 hours (i.e., the last of the placed concrete on a previous pour has cured a minimum of 12 hours, and the remaining concrete has cured for longer). In addition to this curing requirement, the expectation is that the contractor maintains their curing process on all areas of the previously placed concrete overlay stages for the required 3 days; even throughout the set-up, placement, and finishing operations of an adjacent overlay.

528.4 Measurement and Payment

Concrete for the Concrete Masonry bid items is measured and paid for by the nominal cubic yard. The usual practice is for the engineer to ensure that the ready-mix plant or volumetric mixer is batching to the correct proportions and then to accept tickets from the ready-mix truck drivers upon delivery without further verification. Quantity determination for the mobile mixer is done by dividing the total counts on the mixer counter by the counts needed to produce one cubic yard. The engineer should verify the initial setting of the counter before production, plus the final count.