

## **5.14 DURABILITY**

### **General**

All State and Locally sponsored projects shall be required to provide a deck protection system in the design and construction on all new concrete bridge decks, regardless of the winter roadway maintenance salt policy. Both mats of reinforcing steel should be considered for epoxy coating in deck slabs that will be carrying high volumes of traffic and will be subjected to frequent winter salting applications. Since both high traffic and frequent salting will occur primarily in urban areas, all structures located in urban areas shall be evaluated for a dual protection system.

A Single Deck Protection System is the minimum acceptable deck protection for decks exposed to traffic on all interstate, state, or county highways unless additional deck protection is required. The single deck protection system shall meet the requirements listed below. The type of deck protection system shall be shown or noted on the Situation and Layout Drawing.

### **EXPOSED DECK SLAB**

The deck slab is considered exposed to traffic when the distance between the finished grade and the top of the concrete deck is less than 4 inches between the paved roadway shoulders.

### **SINGLE DECK PROTECTION SYSTEM**

- The concrete deck shall have an 8-inch minimum thickness of Class 40A concrete, which includes a ½ inch expendable wearing surface that is considered as added dead load and not having structural capabilities.
- The top mat of reinforcement shall have 2½ inches of cover.
- All reinforcement within 4 inches of surfaces exposed to traffic shall be epoxy coated, including concrete parapets.

### **DUAL DECK PROTECTION SYSTEM**

A dual deck protection system shall be utilized for all structures requiring special construction techniques or that have been classified as major or unusual bridges. Any structure that will require shoring for removal and repair of the deck (e.g. CIP box girders, CIP tee beams, CIP slab bridges) shall have a dual protection system. Deck slabs on box girder bridges are difficult and costly to repair unless the deck is designed so a portion of the deck can be removed without requiring shoring, such as the Type 1 dual deck protection system.

The dual deck protection system shall meet the requirements listed for one of the 3 following types. The type selected will require the approval of the Bridge Design Engineer prior to incorporating that system in the design.

#### **TYPE 1**

- The concrete deck shall have a 7½ inch minimum thickness of Class 40A concrete, which does not include the 1½ inch of replaceable wearing surface that is considered as added dead load and not having structural capabilities.
- The top mat of reinforcement shall have 1¾ inches initial cover (before scarification of ¼ inches).
- The deck shall be designed so that the top 1½ inches can be removed without requiring shoring while maintaining traffic on a portion of the deck. The replaceable wearing surface of 1½ inches shall be latex modified concrete or micro silica modified concrete.
- All reinforcement within 4 inches of surfaces exposed to traffic shall be epoxy coated, including concrete parapets.

#### **TYPE 2**

- The concrete deck shall have an 8½-inch minimum thickness of Class 40A concrete, which includes a 1-inch expendable wearing surface that is considered as added dead load and not having structural capabilities.
- The top mat of reinforcement shall have 3 inches of cover.
- All reinforcement within 4 inches of surfaces exposed to traffic shall be epoxy coated, including concrete parapets.

#### **TYPE 3**

- Bridges using precast prestressed boxes or slabs as the deck to support traffic shall use the Type 3 Dual Deck Protection System. The concrete class and member sizes for precast, prestressed deck members shall be determined by design.
- The top mat of reinforcement shall have 2½ inches of cover.
- The top surface of precast beams that act as the bridge deck shall have an asphalt overlay of 0.2' with an interlayer

spray-applied waterproofing membrane. All reinforcement within 4 inches of surfaces exposed to traffic shall be epoxy coated, including concrete parapets.

#### **BURIED DECK SLABS**

The deck slab is considered buried when the distance between the finished grade and the top of the concrete deck is greater than 4 inches between the paved roadway shoulders. This generally applies to box culverts and stifflegs where roadway ballast is carried over the top slab.

#### **UNDER ROADWAY WITH LESS THAN 2 FEET FILL**

- The deck slab shall be Class 40A concrete with a waterproof membrane applied as specified in Section 511 of the Standard Specifications.
- The top mat of reinforcement shall have 2½ inches of cover.
- Both mats of reinforcement in the deck slab shall be non-epoxy coated bars.

#### **OUTSIDE ROADWAY OR FILL EXCEEDS 2 FEET**

- The deck slab shall be Class 40B concrete.
- The top mat of reinforcement shall have 2 inches of cover.
- Both mats of reinforcement in the deck slab shall be non-epoxy coated bars.

#### **REHABILITATION**

The following guidelines for deck protection should be considered when the bridge requires rehabilitation work.

##### **CONCRETE OVERLAY**

A silica fume or latex concrete overlay should be used when:

The deck thickness is less than 8"

The top mat of reinforcement is not epoxy coated

The cover for the top mat of reinforcement is less than 2½".

The existing deck concrete should be removed to the top of the top mat of reinforcement or to a depth where the chloride concentration is  $\leq 3$  lb/cy. The concrete overlay thickness should provide 2½" cover for the top mat of reinforcement. Refer to article A5.7 for concrete overlay details.

##### **EPOXY OVERLAY**

An epoxy overlay should be considered when the deck has minimal cracks/delaminations and the deck meets the criteria for new exposed decks. The overlay completely covers the deck and provides waterproofing and skid resistance. For a new construction deck, the overlay is normally applied 2-3 years after construction. The profile grade across the bridge is increased ⅜" for an epoxy overlay.

Recent research provided to ITD, and completed in partnership with the FHWA, has shown that there are no aggregates that perform as well as calcined bauxite for friction and polish resistance. The research showed that calcined bauxite is hands down the best aggregate while a handful of other aggregates lie in a second tier, for polish resistance and friction.

It is the Bridge Section's intent to specify two separate aggregates. For high volume roads and bridges carrying the interstate we would specify calcined bauxite. For all other bridges we would specify an aggregate that meets material properties from the second tier. For Bridge preservation projects that have multiple bridges that require an epoxy overlay, specify only one type of aggregate for the entire project. Designate the type of aggregate and the table corresponding to that aggregate on the plans since the Special Provision includes both types of aggregate (e.g. Calcined Bauxite Aggregate – Table 501.51-2).

Use the Special Provision bid item at X:SPB/2012 Spec Book Format/Deck Overlays/S501-51A Epoxy Overlay 6-11-18. Do not use the 2018 Standard Specification bid item because it is not the most current version.

##### **POLYMER CONCRETE OVERLAY**

A polyester polymer concrete (PPC) overlay should be considered when the deck has minimal cracks/delaminations and the deck meets the criteria for new exposed decks. The overlay completely covers the deck and provides waterproofing and skid resistance. Due to the cost of PPC overlays, they should only be considered for bridges with high traffic volumes or where life cycle costs would be less than an epoxy overlay. PPC overlays are not applied to decks that have a concrete overlay. The profile grade across the bridge is increased ¾" for a polyester polymer concrete (PPC) overlay.

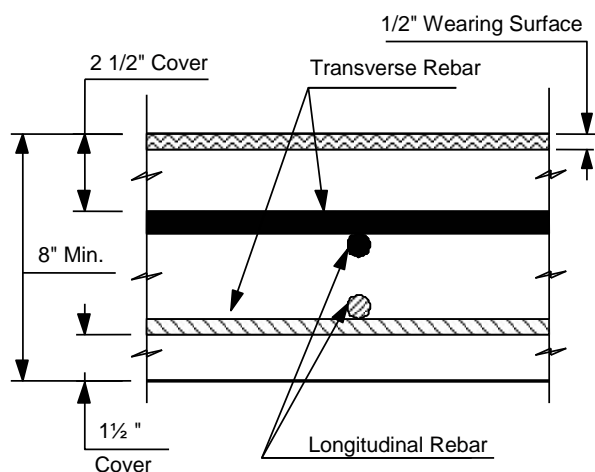
#### DECK SEALER

A high weight methacrylate (HMWM) or a low modulus polymer deck sealer should be considered when the deck has minimal cracks/delaminations and the deck meets the criteria for new exposed decks. The sealer only fills the cracks. Consult with the Bridge Engineer to determine if a deck sealer or epoxy overlay should be used.

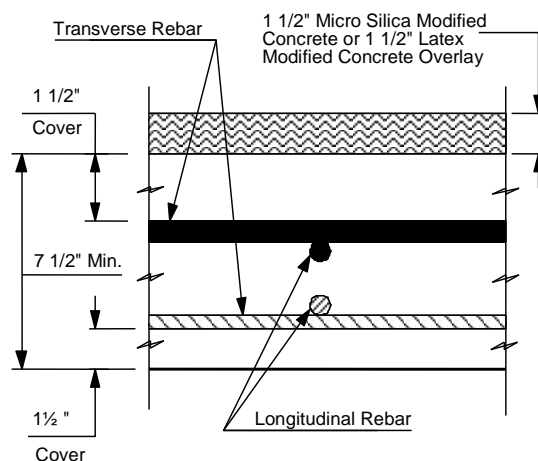
#### **Revisions:**

June 2006	Added paragraph for Electrical Connections to Bridge Decks that was in the ITD Bridge Metric/English Manuals.
Feb 2012	Added paragraph for Rehabilitation of bridge decks.
June 2013	Added reference to A5.7 in Concrete Overlay paragraph.
Oct 2014	Revised Type 3 Protection System to use 0.2' asphalt overlay with a spray-applied waterproofing membrane. Corrected reference to B5.8 for electrical connection details.
August 2016	Increased the cover to the bottom mat of reinforcement from 1" to 1½". This change provides 1" cover to the reinforcement over the ½" v-drip groove.
October 2017	Changed reference to "polymer overlay" to "polyester polymer concrete (PPC) overlay". Added thickness of epoxy and polyester polymer concrete (PPC) overlays. Renumbered article from 5.12 to 5.14 to conform to the 8th Edition of the AASHTO LRFD Bridge Design Specifications.
March 2018	Enhanced the description/use of Epoxy and PPC overlays.
June 2018	Added the requirements for use of two different aggregates for epoxy overlays.
Nov 2019	Deleted requirement for electrical connection.

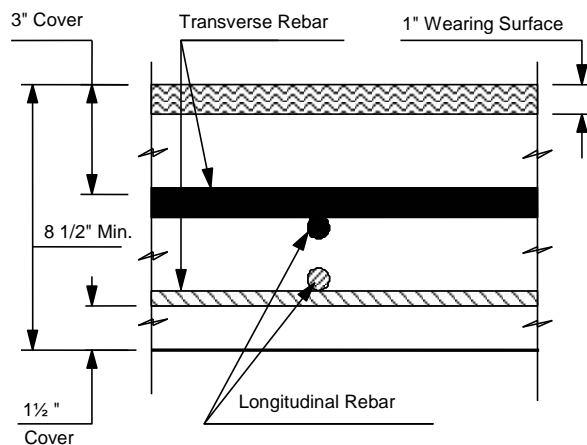
## DECK PROTECTION SYSTEM DETAILS FOR NEW CONCRETE BRIDGE DECKS



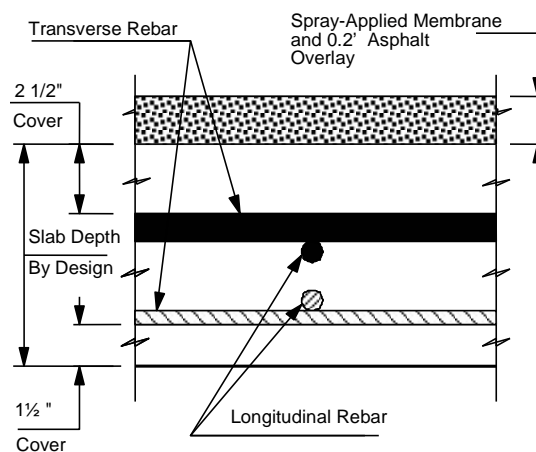
**SINGLE PROTECTION SYSTEM**



**TYPE I  
DUAL PROTECTION SYSTEM**



**TYPE 2  
DUAL PROTECTION SYSTEM**



**TYPE 3  
DUAL PROTECTION SYSTEM**

Epoxy Coated Reinforcement



Non Coated Reinforcement

