

TO: All Design Section Staff  
 FROM: Bijan Khaleghi  
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 SUBJECT: Bridge deck protection system and future overlay requirements

This Design Memorandum summarizes revisions to the bridge deck protection system and future overlay requirements. The recent implementation of wide flange deck girder (WF-DG) girders with ultra high performance concrete (UHPC) connections requires changes to the deck protection requirements defined in the BDM. Additionally, precast/prestressed girder designs shall account for a 3" future HMA overlay instead of 2", to meet future mill-and-fill pavement practices. To incorporate these changes, portions of Chapters 3 and 5 of the BDM for deck protection system and future overlay requirements are revised as follows:

### ***BDM 3.8.1 Future Wearing Surface***

Vehicular traffic will generate wear and rutting on a concrete bridge deck over the life of a bridge. One option to correct excessive wear is to add a Hot Mix Asphalt (HMA) overlay on top of the existing concrete deck. This type of overlay requires less construction time and is less expensive compared to removing a portion of the deck and adding a modified concrete overlay. The initial bridge design needs to incorporate the future overlay dead load. **All new bridge designs with a concrete driving surface, excluding modified concrete overlays, shall be designed for a 35 psf future wearing surface load. The future wearing surface load does not apply to girder deflection, "A" dimension, creep, or profile grade calculations.**

Concrete bridge deck protection systems shall be in accordance with Section 5.7.4 for new bridge construction and widening projects. ~~To accommodate a future deck overlay, bridges shall be designed as shown in Table 3.8-2 below.~~

### ***BDM 3.9.4 Bridge Load Rating***

Bridge designers are responsible for Design, Legal, and Permit load rating of new bridges in accordance with the National Bridge Inspection Standards (NBIS) and the AASHTO *Manual Bridge Evaluation*. See Chapter 13 for detailed information on loading requirements for bridge load rating.

<b>Superstructure Type</b>	<b>Concrete Cover</b>	<b>Overlay shown in the plan</b>	<b>Future Design Overlay</b>
<del>Deck Protection Systems 1 and 4: • Precast concrete, steel I or box</del>	<del>2 1/2" (Including</del>	None	2" HMA

<del>girder with cast-in-place slab</del> <del>• Precast slabs with cast-in-place slab</del> <del>• Reinforced and post-tensioned box beams and slab bridges</del> <del>• Mainline Bridges on State Routes</del>	<del>1/2" wearing surface)</del>		
<b>Deck Protection Systems 1 and 4:</b> <del>• Undercrossing bridge that carries traffic from a city street or county road</del> <del>• Bridges with raised sidewalks</del>	<del>2 1/2" (Including 1/2" wearing surface)</del>	None	None
<b>Deck Protection System 2:</b> <del>• Concrete Overlays</del>	Varies	Varies	None
<b>Deck Protection System 3:</b> <del>• HMA Overlays</del>	Varies	Varies	None
<b>Deck Protection System 5:</b> <del>• Segmental bridges</del> <del>• Bridge Decks with longitudinal or transverse post-tensioning</del>	<del>1 3/4" (Including 1/4" wearing surface)</del>	<del>1 1/2" Modified Concrete Overlay</del>	None
<del>Bridge Overlay Requirements Table 3.8-2</del>			

~~The effect of the future deck overlay on girders camber, "A" dimension, creep, and profile grade need not be considered in superstructure design. Deck overlay may be required at the time of original construction for some bridge widening or staged construction projects if ride quality is a major concern.~~

## **BDM 5.7.4 Bridge Deck Protection**

### **A. Deck Protection Systems**

#### **1. Type 1 Protection System**

This is the minimum default protection system for cases where a protection system has not been specified on a structure. Type 1 protection system shall be used for cast-in-place bridge decks with two layers of reinforcement. This also applies to CIP slab bridges, deck replacements and the widening of existing decks. System 1 consists of the following:

- i. A minimum 2 1/2" of concrete cover over top bar of deck reinforcing for cast-in-place decks. The cover includes a 1/2" wearing surface and 1/4" tolerance for the placement of the reinforcing steel.

- ii. Both the top and bottom mat of deck reinforcing shall be epoxy-coated.
- iii. Girder stirrups and horizontal shear reinforcement do not require epoxy-coating.

## 2. Type 2 Protection System

This protection system consists of concrete overlays, see Figure 5.7.4-2. Concrete overlays are generally a 1.5" **minimum** unreinforced layer of modified concrete. Overlay concrete is modified to provide a low permeability that slows or prevents the penetration of water into the bridge deck, but also has a high resistance to rutting.

Bridges with WF-DG series girders with integral structural connections between flanges, such as with ultra-high performance concrete, shall use epoxy-coated steel in the top flange, 2" of top cover on the top flange reinforcement and a 1.5" modified concrete overlay.

WSDOT Bridge Management Unit shall ~~determine the type of concrete~~ be consulted when determining the type of overlay placed on all new or existing decks; and may specify similar overlays such as a polyester or RSLMC in special cases when rapid construction is cost effective.

## 4. Type 4 Protection System

This system is a minimum 5" cast-in-place (CIP) topping with one mat of epoxy coated reinforcement and placed on prestressed concrete slab girder and deck girder members connected with grouted keyways. This system eliminates girder wheel distribution problems, provides a quality protection system and provides a durable wearing surface.

- i. A minimum concrete cover of 1" applies to the top mat of the top flange of the prestressed member.
- ii. Epoxy coating the prestressed member top mat reinforcement is not required.

## 5. Type 5 System

This system requires a layered, 3" concrete cover for double protection, see Figure 5.7.4-5. All segmentally constructed bridges shall use this system to protect construction joints and provide minor grade adjustments during construction. Bridge decks with transverse ~~or longitudinal~~ post-tensioning in the deck shall use this system since deck rehabilitation due to premature deterioration is very costly. The 3" cover consists of the following:

- i. The deck is constructed with a 1<sup>3</sup>/<sub>4</sub>" concrete cover.
- ii. Both the top and bottom mat of deck reinforcing are epoxy-coated. Girder/web stirrups and horizontal shear reinforcement does not require epoxy-coating.

- iii. The deck is then scarified ¼" prior to the placement of a modified concrete overlay. Scarification shall be diamond grinding to preserve the integrity of the segmental deck and joints.
- iv. A Type 2a, 1½" Modified Concrete Overlay is placed as a wearing surface.

Deviation from the above bridge deck protection system and future overlay requirements needs Bridge Design Engineer's approval.

**Background:**

The recent design memo for WF-DG girders with UHPC connections has made changes that are incompatible with deck protection requirements defined in the BDM. Additionally, precast/prestressed girder designs should account for a 3" future overlay, instead of 2". As the result, corresponding sections of Chapters 3 and 5 of the BDM for deck protection system and future overlay requirements are revised. BDM Table 3.8-2 is deleted; the content of BDM Table 3.8-2 is covered in Section 5.7.4.

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