16.10 OVERLAYS ON EXISTING BRIDGE DECKS

16.10.1 GENERAL

This policy specifies requirements for various types of overlays on bridge decks. The types of overlays covered in this policy are high friction surface treatment (HFST), polyester concrete, hydraulic cement concrete, and hot mix asphalt (HMA) concrete.

16.10.2 DEFINITIONS

*High Friction Surface Treatment (*HFST*)* – a polymer overlay placed by distributing a layer of epoxy or polyester resin binder followed immediately by depositing gap-graded calcined bauxite aggregate

Polyester Concrete – a concrete consisting of polyester resin binder and uniformly graded aggregate

Hydraulic Cement Concrete – refers to conventional portland cement concrete and rapid strength concrete

*Hot Mix Asphalt Concrete (*HMA*)* – as defined in Section 39 of the Standard Specifications

Overlay Curl – the tendency of a hydraulic cement concrete overlay to pull away from the existing deck because of drying shrinkage

16.10.3 NOTATION

A_{dp} = area of perimeter dowel reinforcement (in.^{2}/ft)

f_{by} = yield strength of perimeter dowel reinforcement (psi)

f_{da} = allowable stress of perimeter dowel reinforcement (psi)

h_o = thickness of hydraulic cement concrete overlay (in.)

L_c = nominal length of overlay slab curl (in.)

P_p = force to resist slab perimeter curl (lbs/ft)

16.10.4 POLICY

Overlays on existing bridge decks shall be designed in accordance with the applicable specifications of AASHTO-CA BDS (AASHTO, 2017; Caltrans, 2019), SM&I Policy and Procedures Memos (Caltrans, 2005; 2021), and additional requirements herein.

16.10.4.1 Analysis

Live load capacity shall be checked whenever an overlay is being considered on an existing bridge deck, due to the change in dead load per STP 16.2 (Caltrans, 2024b).

16.10.4.2 HFST

HFST shall be used solely for the purpose of improving the skid resistance of the roadway and shall not be used for deck protection or as mitigation for freeze-thaw zones or reactive aggregate.

16.10.4.3 Polyester Concrete

The stiffness of a polyester concrete overlay shall not be considered in structural analysis.

The conform taper length shall follow the Highway Design Manual (Caltrans, 2020) requirements for roadway grade changes.

16.10.4.4 Hydraulic Cement Concrete

Hydraulic cement concrete overlays shall be constructed with Structural Concrete, Bridge (polymer fiber).

The overlay may be taken as structurally composite with the existing bridge deck, provided that the surface treatment meets the requirements of Table 16.10.4.6-1.

Hydraulic cement concrete overlays shall be reinforced. The reinforcement requirements are shown in Table 16.10.4.4-1.

Table 16.10.4.4-1 Reinforcement for Hydraulic Cement Concrete Overlays

Overlay Thickness (in.)	Longitudinal Reinforcement	Transverse Reinforcement
4.5 to 6	#5@12	#5@12
Over 6.5	Follow Bridge Design Memo 9.4, Section 9.4.5 Deck and Overhang Reinforcement	Follow Bridge Design Memo 9.4, Section 9.4.5 Deck and Overhang Reinforcement

Hydraulic cement concrete overlays shall be attached to the existing deck using the following drill and bond dowel requirements:

- Drill and Bond in a 5-inch-deep hole, #5 @ 9 inches hooked dowel reinforcement along the centerline of each girder.
- Perimeter Drill and Bond hooked dowel reinforcement placed within 12 inches of the edge of the overlay to address the effects of overlay curl. The perimeter dowel reinforcement shall be designed with the following equations (F. Seible, et. al. 1988).

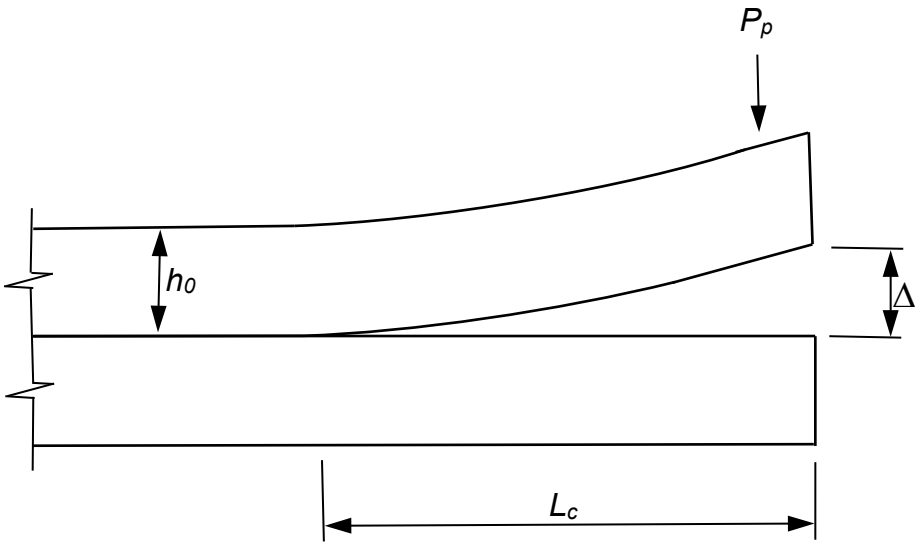

Figure 16.10.4.4-1 Overlay Curl Illustration

Nominal curl length:

$$L_c = 45\sqrt{h_o} \text{ in.} \quad (16.10.4.4\text{-}1)$$

Required perimeter force per unit length:

$$P_p = 88.67 h_o^{3/2} \text{ lbs/ft} \quad (16.10.4.4\text{-}2)$$

Perimeter dowel reinforcement area per foot:

$$A_{dp} = \frac{P_p}{f_{da}} \text{ in.}^2\text{/ft} \quad (16.10.4.4\text{-}3)$$

Where:

$$f_{da} = 0.4 f_{by} \quad (16.10.4.4\text{-}4)$$

16.10.4.5 HMA

Approval shall be obtained from SM&I when placement of HMA overlay is proposed on a bridge deck (Caltrans, 2005).

In addition to minimum protective measures for freeze-thaw areas, an HMA overlay shall include a preformed membrane deck seal system.

16.10.4.6 Overlay Placement Requirements

Table 16.10.4.6-1 provides the thickness and surface preparation requirements for bridge deck overlays.

Table 16.10.4.6-1 Overlay Placement Requirements

Overlay Type	Minimum Thickness (inches)	Maximum Thickness (inches)	Surface Preparation
HFST[a]	⅛	⅛	Abrasive steel shot blast, vacuum sweep clean
Polyester Concrete[b]	1	6	Abrasive steel shot blast, vacuum sweep clean
Hydraulic Cement Concrete	4½	No limit	Roughen surface to ¼ inch amplitude minimum, then abrasive steel shot blast, vacuum sweep clean
HMA	3	No limit	Vacuum sweep clean

[a] Apply one layer of HFST to the bridge deck surface.

[b] To account for irregularities in the bridge deck surface, increase Furnish Polyester Concrete item quantity by 20%.

16.10.5 REFERENCES

1. AASHTO. (2017). *AASHTO LRFD Bridge Design Specifications*, 8th Edition, American Association of State Highway and Transportation Officials, Washington DC.
2. Caltrans. (2005). Structure Maintenance & Investigations Policy and Procedures Memo Number: 2004.3 *Bridge Deck Overlay Policy*, California Department of Transportation, Sacramento, CA
3. Caltrans. (2019). *California Amendments to AASHTO LRFD Bridge Design Specifications, 8th Edition*, California Department of Transportation, Sacramento, CA.
4. Caltrans. (2020). *Highway Design Manual,* 7th Edition, California Department of Transportation, Sacramento, CA.
5. Caltrans. (2021). Structure Maintenance & Investigations Policy and Procedures Memo Number: 2021.1 *Bridge Rail Replacement or Upgrade Recommendations and Overlay Considerations,* California Department of Transportation, Sacramento, CA
6. Caltrans. (2024a). Bridge Design Memo 9.4 *Typical Deck, Overhang, and Soffit Design*, California Department of Transportation, Sacramento, CA

7. Caltrans. (2024b). Structure Technical Policy 16.2 *Modifications to Existing Structures that Increase Dead Load*, California Department of Transportation, Sacramento, CA

8. F. Seible, et. al. (1988). *Structural Concrete Overlays in Bridge Deck Rehabilitation*, FHWA, Caltrans, California University of San Diego.