8-8 DECK FINISHING AND QUIET DECKS

Introduction

Prior to 2012, the concrete deck surface was transversely tined and then checked for compliance with friction requirements in accordance with the Standard Specifications. The contractors adopted transverse tining since it suited their Bidwell operations (though transverse tining was not explicitly spelled out in the Standard Specifications).

Studies conducted by the Caltrans Division of Environmental Analysis (Caltrans-DEA) show that the noise levels on transversely textured decks are generally greater than 105 dB. In some cases, noise levels of up to 110 dB have been measured. Since these noise levels are considered unacceptable, the FHWA and Caltrans have embarked on a major program to reduce bridge deck noise. As a part of this program, Caltrans is implementing several alternative strategies that will bring down the noise level to around 100 dB. Table 1 shows typical measured noise levels for different types of bridge deck finishes. [Donavan, P. (2005); Kohler, E. (2010); Rasmussen, et al. (2003)]

Table 1 Bridge Deck Finish Strategies

Strategy	Tire/Riding Surface Noise (dBA)
Caltrans transversely textured surface (transverse drag)	107-112
Longitudinally tined surface	103-105
Longitudinally tined polyester concrete surface	103-105
Longitudinally textured surface (longitudinal drag)	101-102
Surface subjected to grinding and (longitudinal) grooves	100-103

In general, sound walls are built when they can provide a noticeable reduction of 5 dBA in the noise level. Sound walls interrupt the pathway between the noise source and the receiver and are costly to build. However, it is more efficient and economical to lower noise levels at the source by reducing the noise generated at the interface between the tire and the riding surface (bridge deck).

Deck noise mitigation strategies depend on a bridge's location. For the purposes of noise mitigation, a bridge may be located within a "Noise Sensitive Area" (NSA) or a quiet corridor as determined by the Caltrans-DEA, or outside the NSA. The following sections describe the specification changes (implemented into 2010 Standard Specifications as well as 2006 Standard Specifications amended in 2011) and the role of Bridge Design PE in implementing noise reduction.

New Bridges [Standard Specifications 51-1.03F(5)b]

Depending on a bridge's location, the Standard Specifications now require the following:

- **All bridges in freeze-thaw zones:** The polyester concrete overlay, which is a standard requirement for these bridges, will be longitudinally tined.
- **Bridges outside the freeze-thaw zones, and not within a NSA:** The deck surface can have either a "Longitudinal Tining" finish or an optional "Grinding and Grooving" finish.
- **Bridges outside the freeze-thaw zones, and within a NSA:** The deck surface will have a "Grinding and Grooving" finish.

"Grinding and Grooving" is implemented by adding an extra 1/4″ of concrete thickness to the top of the deck (the clear cover to the top rebar will increase from 2″ to 2 1/4″). Then this additional 1/4″ of concrete is completely removed by grinding and the deck is subjected to longitudinal grooving.

The proper steps needed to implement "Grinding and Grooving" are addressed in the Standard Specifications and the Bridge Construction Records and Procedures Manual. The Structure Representative will implement the Specifications. DES Standard Bridge Deck Design and Details are still applicable.

Widening Existing Bridges [Standard Special Provision 51-1.03F(5)b]

Depending on a bridge's location, the Standard Special Provisions now require the following:

- **All bridges in freeze-thaw zones:** The polyester concrete overlay (which is standard for these bridges) will be longitudinally tined.
- **Bridges outside the freeze-thaw zones (and either within or outside a NSA):** The deck surface will be longitudinally tined.

If adequate funding is available, then for a bridge widening project located within a NSA but not in a freeze-thaw zone, a longitudinally tined polyester concrete overlay may be applied over the entire deck (existing deck and the widening). When the request for an Advanced Planning Study (APS) is received, the Structure Project Engineer should discuss the viability of this option with the District PM as it will affect project costs significantly.

Impact of Noise Mitigation Strategies on Deck Life

Several rounds of discussions, including discussions with people who are nationally renowned in this area, were held to assess the consequences of implementing noise mitigation methods, both for new bridges as well as for widenings. Through these discussions, it was determined that the noise reduction strategies that are presented in this document will not have a negative impact on safety, constructability-particularly for decks curved in plan and skewed bridges, bridge deck drainage, and long-term deck performance.

Implementation

1. The District should identify whether a bridge is located in a quiet corridor (NSA). For new bridges, this information should be furnished along with the request for an APS, but if such identification is included later in the Bridge Site Data submittal, the impact on project costs will likely be minimal. For a bridge widening, the information concerning quiet corridor should be furnished along with the request for APS.
2. "Grinding and Grooving" will increase the bridge cost (in comparison to longitudinal tining) and the potential for such cost increase should be conveyed to the District if a change is requested past the APS phase.
3. The Structures PE should check the box corresponding to "Quiet Corridor/Noise Sensitive Area" in "Memo to Specifications Engineer" so that the specifications associated with the deck for quiet corridor are included. No additional design calculations are required because the added dead load from an overlay is significantly greater than the temporary increase in dead load due to the implementation of "Grinding and Grooving".
4. For bridges that are in construction, or are past the "PS&E" phase, Structure Construction will assess the need for implementation of "Quiet Decks" specifications through a Contract Change Order.
5. Structure Construction has briefed the Contractors on deck noise mitigation strategies.
6. For additional information on quieter decks, please refer to the Bridge Construction Records and Procedures Manual, Volume II, Section 112-6.

   http://dot.ca.gov/hq/esc/construction/manuals/OSCCompleteManuals/BCRPVol2.pdf

   http://dschq.dot.ca.gov/sc_manuals/construction_records_and_procedures_vol_II/112-6.0_BCM.pdf

References

1. Donavan, P. "*Quieting of Portland Cement Concrete Highway Surfaces with Texture Modifications*", NOISE-CON, 2005.
2. Kohler, E. "*Quiet Pavement Research Report; Bridge Deck Tire Noise Report*" (Draft Report), University of California Pavement Research Center, 2010.
3. Rasmussen, R. O., et al. "*How to Reduce Tire-Pavement Noise: Interim Better Practices for Constructing and Texturing Concrete*", Pooled Fund TPF-5(139) study, NCPTC, 2003.

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