

DESIGN DEVIATION NO. 4

Supersedes Deviation #4 Approved on December 18, 2008
Superelevation Rate on Principal Arterial (P-1 Design Class)
SR 99 S. Holgate St to S. King St. Viaduct Replacement Stage 2
MP 29.60 TO MP 30.78

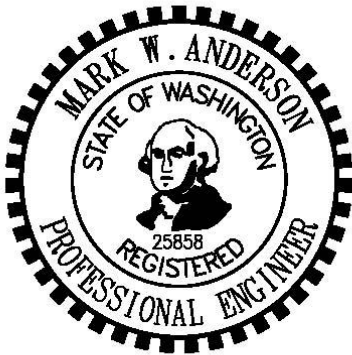
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WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

Alaskan Way Viaduct and Seawall Replacement Program
Seattle, Washington

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Design Approval:

By _____, P.E.
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Date _____



By _____
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Date _____

Deviation Revision

This document “Design Deviation #4 Superelevation Rate on Principal Arterial (P-1 Design Class)” supersedes the project’s Design Deviation #4 “Vertical Clearance through the Transition Section”, approved Dec. 18, 2008. The design of the Transition Section substantially changed after the January 2009 decision to adopt a Deep Bore Tunnel, and it was decided that the Interim Bridge Transition Structure would be documented in the SR 99 Construction Corridor Analysis.

Description of Design Element, Matrix, Design level, and WSDOT Reference

Superelevation Rate on Principal Arterial (P-1)

Matrix 3-7, Full Design Level (Fig. 440-6, May 2008)

Max. 8% (Chapter 642.04 and Fig. 642-4b)

Existing Conditions

SR 99 is classified as a Class 1 Managed Access Highway from Spokane St (MP 28.61) to Thomas St. (MP 32.58). Speed limits are posted between 40-50mph.

On SR 99 within the program corridor limits, existing Average Daily Traffic (ADT) ranges from approximately 32,400 to 56,100 in the northbound direction and from 31,000 to 55,000 in the southbound direction. Ingress and egress on SR 99 from just north of S. Spokane Street (MP 29.26) to Thomas St. (MP 32.58) is currently limited to on- and off-ramps connecting to First Ave. S, Columbia Street, Seneca Street, Elliot Ave, Western Ave, and Denny Way.

Topography in the vicinity of S Holgate Street is mostly level terrain. The posted speed limit is 50 mph in this segment for both the northbound and southbound roadways.

Within the project limits (MP 29.60 to 30.78), SR 99 existing lane widths range from 9.5 to 12 feet and shoulder widths range from 0 to 3 feet. Near S Holgate Street (MP 29.89 vic.), the existing lane widths are 12 feet and the shoulder widths are approximately 1 foot. The existing transition between the six-lane surface highway and the viaduct occurs near S. Holgate Street. The existing curve near S. Holgate Street is built on separate elevated structures for both northbound and southbound. The northbound roadway has a radius of 920 feet, and the southbound roadway has a radius of 1040 feet, with a superelevation rate of 6% for both roadways. The roadway is currently classified as a Class 1 Managed Access highway within the project limits, and in order to confirm the existing roadway’s 50mph design speed, a check was made based upon the current design guidelines for a design class $U_{M/A-1}$ roadway using existing horizontal geometrics and the 6% maximum superelevation rate table. (*WSDOT Design Manual* Figure 642-4c, November 2007). The vertical curve lengths in this area for both northbound and southbound roadways are 350 feet. The maximum grade for both roadways within the project limits is 5 percent. Figure 650-11 from the *WSDOT Design Manual* (May 2008) indicates these existing sag curves meet 50 mph design criteria.

Deviation description and Justification

This roadway was originally designed to Urban Managed Access design class ($U_{M/A-1}$), for which the max. 6% superelevation table was applicable. The design class was set as $U_{M/A-1}$ in the original SR 99 Corridor Analysis, Appendix B (approved July 2006), and SR 99 within the project limits was designed using the max. 6% superelevation table.

After the announcement in February 2009 of the Deep Bore Tunnel under First Ave in downtown Seattle and that it would be designed to P-1 guidelines, it was decided that SR 99 within the H2K Stage project would also be classified as a P-1 roadway for corridor continuity.

WSDOT's design manual states that the max. 8% superelevation table (fig. 642-c) may be used for freeways in urban design areas. The criteria in figure 642-c gives a maximum superelevation of 7%. However, the impacts of this 1% change in superelevation have significant effects on the project because the bridge structure and retaining wall will be affected.

The proposed roadway does not meet current WSDOT superelevation rate design criteria for a P-1 roadway with a design speed of 50mph⁽¹⁾. However, it does meet AASHTO guidelines⁽²⁾ for a low-speed freeway in an urban area. "...this design speed should not be less than 50 mph." "Superelevation rates of 6 to 8 percent are generally the maximum that should be used on viaducts...In lower speed situations, a maximum superelevation rate of 6 percent may be applicable."

The posted speed will be 50mph, which is a low-speed freeway. Therefore, the maximum 6% superelevation rate is applicable.

(1) *SR 99 Corridor Analysis*, approved July 2009

(2) *A Policy on Geometric Design of Highways and Streets*, 2004, pages 503 (design speed) and 505 (superelevation)

Recommendation

Use the 6% max. superelevation rate table (WSDOT Design Manual Fig. 642-4c, Nov. 2007).