16.1 BRIDGE WIDENINGS AND MODIFICATIONS

16.1.1 GENERAL

This policy specifies the design criteria for bridge widenings and other modifications that add mass to a bridge or increase demands on existing components.

New components shall be designed in accordance with AASHTO-CA BDS and SDC.

Existing components shall be evaluated in accordance with STP 16.2 *Change in Dead Load of Existing Structures*.

Existing deck overhangs shall be evaluated and strengthened in accordance with AASHTO CA Amendment Articles A13.4.1 to A13.4.3.

For seismic evaluation and design, a bridge modification shall be classified as Minor or Major, depending on the degree to which it affects the seismic response of the existing structure.

Seismic retrofit, where required, shall satisfy MTD 20-4 *Seismic Retrofit Guidelines for Bridges in California* and additional requirements herein.

16.1.2 DEFINITIONS

Base Shear – The weight of a structure multiplied by the spectral acceleration coefficient associated with its primary mode of vibration.

Bridge modification – an increase in the width or mass of an existing structure.

Major Modification – A bridge widening or modification that meets any of the following conditions:

- Columns or piers are added, or modified

- Foundation fixity is modified

- The increase in mass, excluding the substructure, exceeds 20% of the existing superstructure mass

- The response spectrum has been revised, such that the base shear of the modified structure is increased by more than 20% relative to the original structure

Minor Modification – A bridge widening or modification that does not meet the definition of a Major Modification.

16.1.3 DESIGN AND ANALYSIS

Minor Modification requires neither a seismic evaluation nor a retrofit of the substructures and foundations. However, superstructure members and components shall be capable of resisting the seismic forces caused by the new mass.

Major Modification requires comprehensive seismic evaluation, analysis, and design. Except for single-span bridges, Major Modification widenings shall be supported on new bents and foundations.

16.1.3.1 Seismic Demand

Seismic demands shall be based on an analysis of the combined (new plus existing) structure. The combined structure model shall appropriately reflect the connectivity between the new components and the existing structure.

Modeling of the existing structure shall be in accordance with MTD 20-4.

16.1.3.2 Seismic Capacity

The seismic capacity analysis shall be based on a structural model that reflects the displacement compatibility and interaction between the widening and the existing structure.

The capacity of existing components shall be estimated in accordance with MTD 20-4.

16.1.3.3 Seismic Performance

The combined structure shall satisfy the performance criteria specified in MTD 20-4.

The performance of the new widening shall satisfy *Caltrans Seismic Design Criteria* (SDC) requirements except:

- The ductility demand limits for Seismic Critical Members may be waived.
- When matching the existing bridge configuration unavoidably precludes a balanced system, the SDC requirements for balanced stiffness and geometry may be waived.

16.1.3.4 Structure Compatibility

The structural compatibility of the widening and the existing bridge shall be considered. Consideration shall include, but is not limited to structure type, location and skew of substructures, member stiffness, boundary conditions, expansion joint type and location, bearing type, and support length.

16.1.4 REFERENCES

1.   Caltrans. (2020). Caltrans Structure Technical Policy 16.2, *Change in Dead Load of Existing Structures*, California Department of Transportation, Sacramento, CA.

2.   Caltrans. (2019). *California Amendments to AASHTO LRFD Bridge Design Specifications*, 8th Edition, California Department of Transportation, Sacramento, CA.

3.   Caltrans. (2016). Caltrans Memo to Designers 20-4, *Seismic Retrofit Guidelines for Bridges in California*, California Department of Transportation, Sacramento, CA.