2.2 DEFINITIONS

Revise as follows:

Base Flood–The flood or tide flow having a 1% chance of being equaled or exceeded in any given year. Also known as Q_{100}.

Check Flood for Bridge Scour–Check flood for scour. The flood resulting from storm, storm surge, and/or tide having a flow rate in excess of the design flood for scour, but in no case a flood with a recurrence interval exceeding ~~the typically used~~ 500 years. The check flood for bridge scour is used in the investigation and assessment of a bridge foundation to determine whether the foundation can withstand that flow and its associated scour and remain stable with no reserve. See also superflood.

Contraction Scour–See "General or Contraction Scour", below.

Design Discharge–Maximum flow of water a bridge is expected to accommodate without exceeding the adopted design constraints. (See CA Amendment 2.6.4.3 for additional comments.)

Design Flood–The flood or tide flow having a 2% chance of being equaled or exceeded in any given year. Also known as Q_{50}.

Flood of Record–The largest record flood at the bridge site.

Freeboard–The vertical distance from bridge soffit, bottom-of-girder, or other physical feature to the water surface at a given discharge.

General or Contraction Scour–Scour in a channel or on a floodplain that is not localized at a pier or other obstruction to flow. In a channel, general/contraction scour usually affects all or most of the channel width and is typically caused by a contraction of the flow within a specific reach due to channel geometrics.

Local (Pier) Scour–Scour in a channel or on a floodplain that is localized at a pier, abutment, or other obstruction to flow.

Scour–The summation of contraction scour, aggradation, degradation, and local scour. Also referred to as total scour.

Scupper–A feature ~~device~~ to drain roadway water immediately off ~~through~~ the deck.

Superflood–Any flood or tidal flow with a flow rate greater than that of the 100-year flood but in no case a flow rate ~~not~~ greater than a 500-year flood.

2.3.2.2.3 Geometric Standards

Revise as follows:

Requirements of the <u>*Caltrans Highway Design Manual*</u> ~~AASHTO publication *A Policy on Geometric Design of Highways and Streets*~~ shall either be satisfied or exceptions thereto shall be justified and documented. Width of shoulders and geometry of traffic barriers shall meet the specifications of the Owner.

2.3.3.2 Highway Vertical

Revise the first and second paragraphs.

The vertical clearance of highway structures shall be in conformance with the ~~AASHTO publication *A Policy on Geometric Design of Highways and Streets*~~ *Caltrans Highway Design Manual* for the Functional Classification of the Highway or exceptions thereto shall be justified. Possible reduction of vertical clearance, due to settlement of an overpass structure, shall be investigated. If the expected settlement exceeds 1.0 in., it shall be added to the specified clearance.

The vertical clearance to sign supports and pedestrian overpasses shall also be in conformance with the *Caltrans Highway Design Manual* ~~should be 1.0 ft. greater than the highway structure clearance~~, and the vertical clearance from the roadway to the overhead cross bracing of through truss structures should not be less than 17.5 ft.

2.3.3.3 Highway Horizontal

Revise the second paragraph.

Horizontal clearance under a bridge should meet the requirements of Article 2.3.2.2.1 and 2.3.2.2.3.

2.6.1 General

Revise the 3rd Paragraph as follows:

Evaluation of bridge design alternatives shall consider stream impacts, including but not limited to, stability, debris, backwater, flow distribution, stream velocities, scour potential, flood hazards, tidal dynamics where appropriate and consistency with established criteria for the National Flood Insurance Program.

C2.6.2

Revise the 1st Paragraph as follows:

The assessment of hydraulics necessarily involves many assumptions. Key among these assumptions are the roughness coefficients and projections of long-term flow magnitudes, e.g., ~~the 500-year flood or~~ other superfloods. The runoff from a given storm can be expected to change with the seasons, immediate past weather conditions, and long-term natural and man-made changes in surface conditions. The ability to statistically project long recurrence interval floods is a function of the adequacy of the database of past floods, and such projections often change as a result of new experience.

The above factors make the ~~check flood~~ investigation of scour an important, but highly variable, safety criterion that may be expected to be difficult to reproduce, unless all of the Designer's original assumptions are used in a post-design scour investigation. Obviously, those original assumptions must be reasonable given the data, conditions, and projections available at the time of the original design.

2.6.4.3 Bridge Waterway

Revise as follows:

The design process for sizing the bridge waterway shall include:

- The evaluation of flood flow patterns in the main channel and floodplain for existing conditions, and
- The evaluation of trial combinations of highway profiles, alignments, super elevations, and bridge lengths and widths should provide adequate freeboard to pass anticipated drift for the Q_{50} design flood, to pass the Q_{100} base flood without freeboard, or the flood of record without freeboard, whichever is greater ~~for consistency with design objectives~~.

2.6.4.4.2 Bridge Scour

Revise the 1st Paragraph as follows:

As required by Article 3.7.5, scour at bridge foundations is investigated for ~~two conditions~~ the following:

- For ~~the design flood for~~ scour analysis, the streambed material in the scour prism above the total scour ~~line~~ elevation shall be assumed to have been removed for design conditions. The~~ design~~ flood storm surge, tide, or mixed population flood shall be the more severe of the 100-year event or ~~from an~~ the overtopping flood of lesser recurrence interval.

- For the check flood for scour, the stability of the bridge foundation shall be investigated for scour conditions resulting from a designated flood storm surge, tide, or mixed population flood not to exceed the superflood ~~500-year event~~ or ~~from an~~ the overtopping flood of lesser recurrence interval. ~~Excess~~ ~~r~~Reserve beyond that required for stability under this condition is not necessary. The extreme event limit state shall apply.

Revise the 3rd paragraphs as follows:

Spread footings on soil or erodible rock shall be located so that the top of footing is below the design scour elevation and the bottom of footing is below the scour ~~depths~~ elevation determined for the check flood for scour. Spread footings on scour-resistant rock shall be designed and constructed to maintain the integrity of the supporting rock.

C2.6.4.4.2

Add the following after the 3rd Paragraph:

Total scour is the cumulative sum of contraction, degradation, and local scour. Figure C2.6.4.4.2-1 shows a typical spread footing foundation.

Add Fig. C2.6.4.4.2-1 as follows:

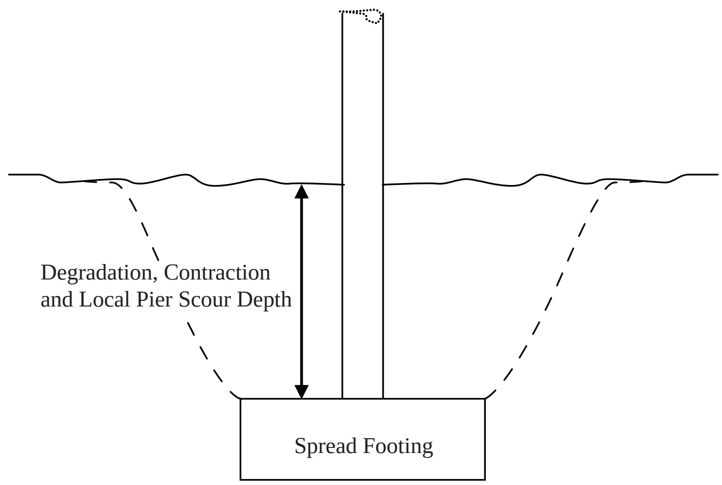

Figure C2.6.4.4.2-1 Spread Footing Location

2.6.4.4.2

Revise the 4th Paragraph as follows:

Deep foundations with footings shall be designed to place the top of the footing below the estimated degradation plus contraction scour ~~depth~~ elevation where practical to minimize local scour and obstruction to flood flows ~~and resulting local scour. Even~~ Lower elevations should be considered for pile-supported footings where the piles could be damaged by erosion and corrosion from exposure to ~~stream currents~~ water flows. Where conditions dictate a need to construct the top of a footing to an elevation above the streambed, attention shall be given to the scour potential of the design.

C2.6.4.4.2

Revise the 4th Paragraph as follows:

Total scour is calculated based upon the cumulative effects of the long-term degradation scour, general (contraction) scour and local scour due to the base flood. Figure C1 shows degradation, contraction, and local pier scour depth for a typical spread footing foundation. The life expectancy of the bridge should be considered in determining the total degradation or aggradation of the waterway. Long-term scour is based on an assumed 75-year design life for new construction projects. The recommended procedure for determining the total scour depth at bridge foundations is as follows:

- Service life for a new construction project is assumed to be 75-years.

Other bullets remain the same as AASHTO

Add after the 4th Paragraph as follows:

Foundations should be designed to withstand the conditions of scour. In general, this will result in deep foundations. Figure C2.6.4.4.2-2 shows a typical deep foundation.

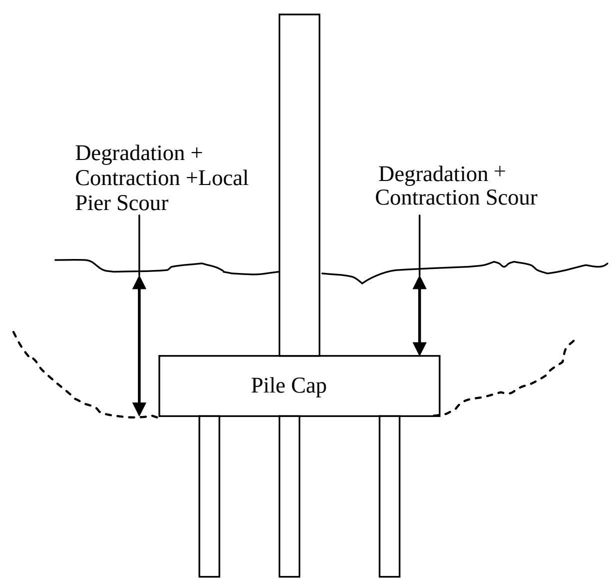

Figure C2.6.4.4.2-2 Deep Foundation Location

2.6.4.4.2

Revise the 6th Paragraph as follows:

The stability of abutments in areas of turbulent flow shall be thoroughly investigated. Exposed embankment slopes should be protected with appropriate ~~scour~~ countermeasures. Abutments shall be designed to be stable for permanent loads and hydraulic forces assuming the loss of approach fill. Deep foundations may be necessary.

C2.6.4.4.2

Revise the 6th Paragraph as follows:

Foundations should be designed to withstand the conditions of scour ~~for~~ from the Q_{100} base ~~design flood and the check~~ flood. In general, this will result in deep foundations. However, environmental concerns may preclude locating the footing below the anticipated scour ~~level~~ elevation. Figure C2 shows degradation, local contraction and local pier scour for a typical deep foundation. The design of the foundations of existing bridges that are being rehabilitated, should consider appropriate countermeasures ~~underpinning if scour indicates the need. Riprap and other scour countermeasures may be appropriate if underpinning is not cost effective~~.