

Scour Critical Bridges in California

What is required of Bridge Owners

February 4, 2016

*Webinar is being recorded to provide training access to those not able to attend.

Agenda

- Intro – FHWA/Sarah Skeen (5 min)
- National Bridge Inspection Program Requirements for Scour Critical Bridges – FHWA/Sarah Skeen (20 min)
- Caltrans Local Bridge Program Assistance for Scour – Linda Newton and Eileen Crawford (10 min)
- Caltrans Scour Critical Bridge Program Assistance – Kevin Keady and Charles Ineichen (10 min)
- Technical Assistance Questions – FHWA/Scott Hogan, Cynthia Nurmi, and Dave Henderson (35 min)
- Close-out and Future Webinars – FHWA/Sarah Skeen (10 min)

Why is Scour monitored as part of the NBIP?

- The most common cause of bridge failures is from floods scouring bed material from around bridge foundations. Scour is the engineering term for the erosion caused by water of the soil surrounding a bridge foundation (piers and abutments). (pg 1-1, *Evaluating Scour at Bridges- 5th Edition*, FHWA 2012)
- Owners are responsible for the risk of bridge failure due to scour.

What is a Scour Critical Bridge according to the NBIP?

- Bridges evaluated as scour critical, those that are scour vulnerable, tidal, or have unknown foundations.

Criteria used:

- NBI Item 113 < 3, or 6, U, T
 - NBI Items are defined in the NBI Coding Guide
 - www.fhwa.dot.gov/bridge/mtguide.pdf

NBI Coding Guide – Item 113

Item 113 - Scour Critical Bridges 1 digit Use a single-digit code as indicated below to identify the current status of the bridge regarding its vulnerability to scour. Scour analyses shall be made by hydraulic/geotechnical/structural engineers. Details on conducting a scour analysis are included in the FHWA Technical Advisory 5140.23 titled, "Evaluating Scour at Bridges." Whenever a rating factor of 4 or below is determined for this item, the rating factor for Item 60 - Substructure may need to be revised to reflect the severity of actual scour and resultant damage to the bridge. A scour critical bridge is one with abutment or pier foundations which are rated as unstable due to (1) observed scour at the bridge site or (2) a scour potential as determined from a scour evaluation study.

Code Description

N - Bridge not over waterway.

U - Bridge with "unknown" foundation that has not been evaluated for scour. Since risk cannot be determined, flag for monitoring during flood events and, if appropriate, closure.

T - Bridge over "tidal" waters that has not been evaluated for scour, but considered low risk. Bridge will be monitored with regular inspection cycle and with appropriate underwater inspections. ("Unknown" foundations in "tidal" waters should be coded U.)

9 - Bridge foundations (including piles) on dry land well above flood water elevations.

8 - Bridge foundations determined to be stable for assessed or calculated scour conditions; calculated scour is above top of footing.

7 - Countermeasures have been installed to correct a previously existing problem with scour. Bridge is no longer scour critical.

6 - Scour calculation/evaluation has not been made. (Use only to describe case where bridge has not yet been evaluated for scour potential.)

5 - Bridge foundations determined to be stable for calculated scour conditions; scour within limits of footing or piles.

4 - Bridge foundations determined to be stable for calculated scour conditions; field review indicates action is required to protect exposed foundations from effects of additional erosion and corrosion.

3 - Bridge is scour critical; bridge foundations determined to be unstable for calculated scour conditions: - Scour within limits of footing or piles. (Example B) - Scour below spread-footing base or pile tips.

2 - Bridge is scour critical; field review indicates that extensive scour has occurred at bridge foundations. Immediate action is required to provide scour countermeasures.

1 - Bridge is scour critical; field review indicates that failure of piers/abutments is imminent. Bridge is closed to traffic.

0 - Bridge is scour critical. Bridge has failed and is closed to traffic.

Requirements for Scour Critical Bridges

- National Bridge Inspection Standards (NBIS) regulation, 23 CFR 650.313.e.3
 - “(3) *Bridges that are scour critical. Prepare a plan of action to monitor known and potential deficiencies and to address critical findings. Monitor bridges that are scour critical in accordance with the plan.*”
- Address critical findings
 - High risk consequence of failure, bridge is candidate for replacement, structural, or hydraulic countermeasure and monitor until bridge can be recoded
 - Low risk consequence of failure bridge is candidate for long term monitoring

NBI Program Reviews

- FHWA reviews each State's program
- 23 metrics are evaluated
 - Identify requirements in 23 CFR 650 Subpart C
 - <http://www.fhwa.dot.gov/bridge/nbip/metrics.pdf>
 - Some metrics evaluate the actions of bridge owners
 - For this presentation looking at
 - Metric 18 -Scour Critical Bridges

Metric #18: Inspection procedures – Scour Critical Bridges

rev 4/1/13

NBIS Reference: 23 CFR 650.313 (e) Bridges that are scour critical

Criteria

- Bridges over water have a documented evaluation of scour vulnerability.
- Bridges that are scour critical have a scour plan of action (POA) prepared to monitor known and potential deficiencies and to address scour critical findings.
- Bridges that are scour critical are monitored in accordance with the POA.

Population: Bridges for the entire State, or selected geographic/owner subset, that are scour critical, scour vulnerable, tidal, or have unknown foundations.

Compliance Levels

Compliance (C): All of the following must be met for C:

- All bridges over water have a documented scour evaluation.
- All bridges that are scour critical, scour vulnerable, or have unknown foundations have a scour POA prepared to monitor and/or address critical findings.
- All bridges are monitored in accordance with the POA, as appropriate.

Substantial Compliance (SC): All of the following must be met for SC:

- All bridges over water have a documented scour evaluation.
- All bridges that are scour critical, scour vulnerable, or have unknown foundations have a scour POA prepared to monitor and/or address critical findings, but up to 20% of the sampled bridges have POA deficiencies lessening their effectiveness.
- All bridges are monitored in accordance with the POA, as appropriate, but minor deficiencies in documentation may exist.

Non-Compliance (NC): One or more SC criteria are not met.

Conditional Compliance (CC): Adhering to FHWA approved plan of corrective action (PCA).

Minimum Assessment (Min-AL): Perform all of the following:

- Monitor PCA if in effect.
- Review Metric 18 ART Report (MAR18) to resolve all unevaluated bridges.
- Assess based on previous review results and the reviewer’s knowledge and awareness of the State’s identification of scour critical bridges, the status of POAs, and monitoring in accordance with the POAs.

Intermediate Assessment (Int-AL): In addition to the Min-AL:

- Randomly sample using Intermediate criteria.
- Review sample scour critical bridge files to verify that a scour evaluation exists and POAs are developed and implemented.
- If a recent potential triggering event(s) has occurred to a sample bridge, review files to verify that monitoring occurred in accordance with POA.
- Include site visits of some sample bridges in the field review sample for Metric 12 and 22.

In-Depth Assessment (InD-AL): In addition to the Int-AL:

- Randomly sample using In-depth criteria.
- Verify through interviews and site visits to some of the sampled scour critical bridges that monitoring procedures and POAs have been implemented.

CA Review of Scour Critical Bridges

- Reviewed metric each year
 - Intermediate level in 2013
 - In-depth level in 2014
 - 5 additional bridges in 2015
 - Expected to continue
- Sampling bridges is random
- Inviting local bridge owners to attend field visit
 - Interview on POA implementation

Annual Review Results

- Result is the M18 is in substantial compliance
- Substantial Compliance requires an Improvement Plan
 - Training for local bridge owners
 - Guidance and technical resources to provide guidance
 - Caltrans Local HBP supports addressing scour critical bridges

POA Reviews – Best Practices

- Owners are monitoring scour critical bridges during storm events
- Some owners:
 - Have their own bridge maintenance crews
 - Documenting their monitoring efforts
 - Annually, during/after storm events, etc.
 - Monitoring of scour at their bridge over time.
 - Use weather service information to monitor flow.
 - Addressing unknown foundations
 - Look for bridge records and sending them to Caltrans
 - Hiring engineers to do additional technical studies
 - Installing engineered designed scour countermeasures

POA Reviews - Improvements

- Clearly define monitoring needed for bridges
- Align monitoring in POA with practice
- Update POAs when changes occur
- Complete the POA template provide by Caltrans
- Include how to address critical findings in your POAs
- Don't install non-engineered scour countermeasures

POA Reviews - Conclusions

- Owner is responsible for the bridge
 - Including the risk of failure due to scour
- Annual review of POA content should be part of the storm season preparation
- Monitoring during and after storm events
 - Staff should have copies of POA for their bridges
 - Monitoring should be clear and easy to understand

Technical Resources

- FHWA
 - Technical Publications
 - www.fhwa.dot.gov/engineering/hydraulics/scourtech/
 - All Hydraulics: https://www.fhwa.dot.gov/engineering/hydraulics/library_listing.cfm
 - Hydraulic Software
 - <https://www.fhwa.dot.gov/engineering/hydraulics/software.cfm>
 - Training
 - www.nhi.fhwa.dot.gov/home.aspx
 - Search for scour
 - <http://www.fhwa.dot.gov/federal-aidessentials/catmod.cfm?id=111>
 - Technical Assistance/Guidance - Resource Center
 - <http://www.fhwa.dot.gov/resourcecenter/teams/hydraulics/>
 - Scott Hogan (scott.hogan@dot.gov)
 - Cynthia Nurmi (Cynthia.Nurmi@dot.gov)
 - FHWA-HQ Bridge Scour Engineer - Dave Henderson (Dave.Henderson@dot.gov)
- Caltrans
 - State Specific Policy, Forms, etc.
 - <http://www.dot.ca.gov/hq/structur/strmaint/scour.htm>
 - Local Bridge Program
 - <http://www.dot.ca.gov/hq/LocalPrograms/hbrr99/hbrr99a.htm>
 - POA training links along with other program areas
 - Technical Guidance - Charles Ineichen (charles.ineichen@dot.ca.gov)