Plan of Action for Scour Critical Bridges

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by:

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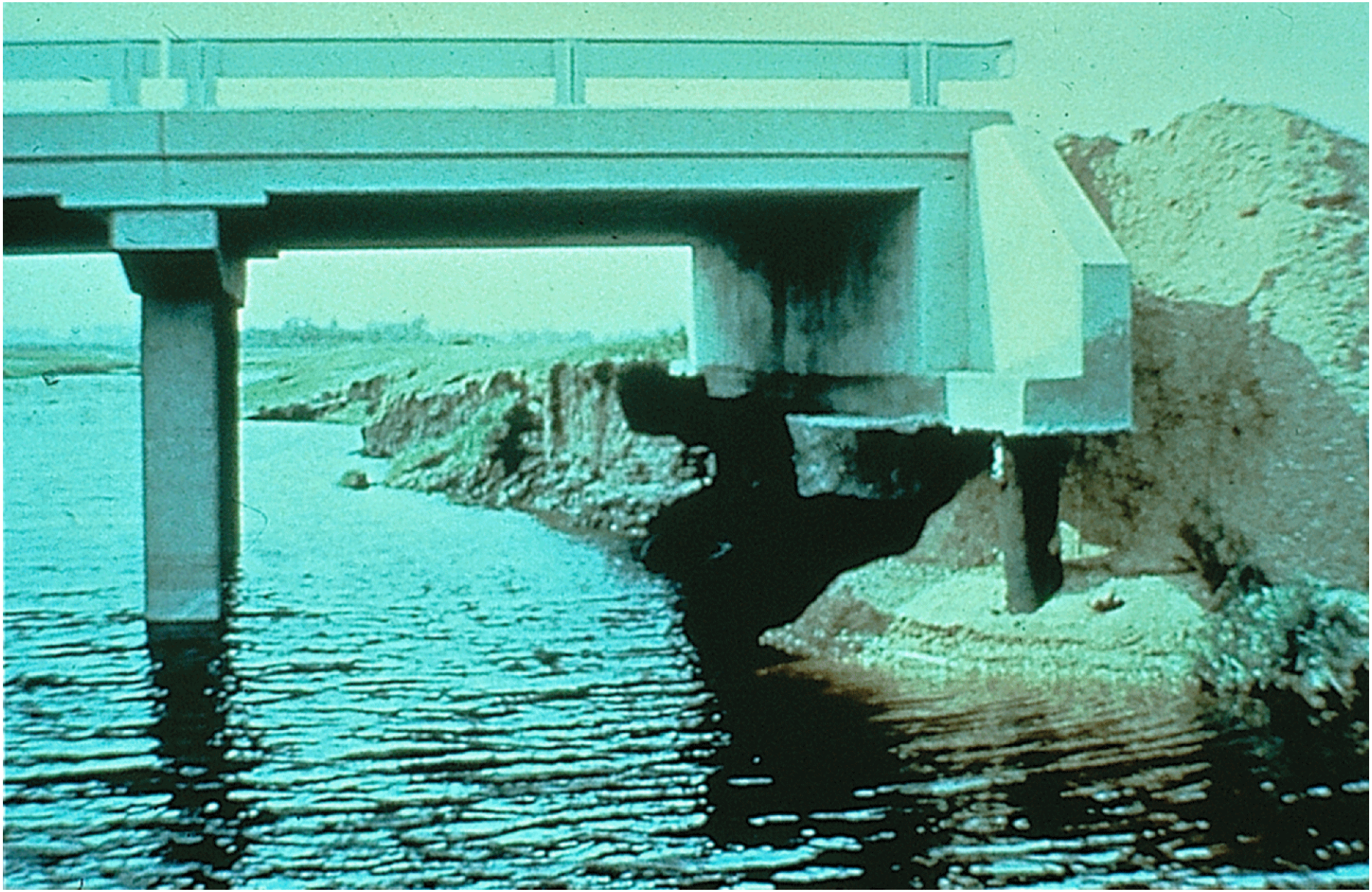
Scour Critical Bridge

A Scour Critical bridge is one with foundation elements determined to be unstable for the calculated and/or observed stream stability/scour conditions.

- 26,472 on a National basis
  - 5,496 within the Midwestern States

Includes the Following Rating Factors from the NBI Coding Guide Item 113:

Rating	Description
3	Assessed or calculated condition
2	Comparison of calculated and observed condition
1	Comparison of calculated and observed; failure is imminent
0	Bridge failed and is closed



A Plan of Action (POA) ***should*** be Developed for Each Existing Bridge Found to be Scour Critical

Per FHWA guidance contained in Technical Advisory T 5140.23, "Evaluating Scour at Bridges" dated October 28, 1991

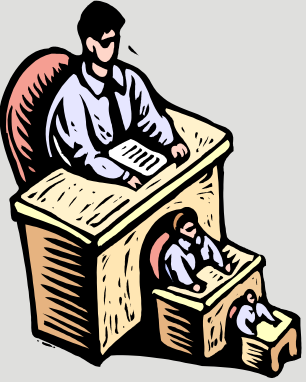
Why is it Needed?

Provide guidance for Inspectors and Engineers that can be implemented before, during, and after flood events to protect the traveling public

- HEC 18, Evaluating Scour at Bridges (Fourth Edition)
- HEC 20, Stream Stability at Highway Structures (Third Edition)
- HEC 23, Bridge Scour and Stream Instability Countermeasures (Second Edition)

Elements of the POA

- Management Strategies
- Inspection Strategies
- Closure Instructions
- Countermeasure Alternatives and Schedule
- Other Information



Management Strategies

- Location of Bridge
- Bridge Identification
- Type of Foundation and Foundation Material
- Source of Scour Critical Rating
- Importance of Roadway to the Transportation Network
  - ADT, Access Route to Emergency Facilities, Evacuation Route, Detour
- Programmed for Replacement (may suggest a risk- based analysis)

Inspection Strategies

- Type and Frequency of Inspection
  - Normal frequency is 2 years for superstructure and visual or probing underwater where applicable
  - 5 years for general underwater inspection
- Need for continuous Monitoring
  - When to start?
  - When to stop?
- What Constitutes a Scour Critical condition?
- Instructions for Action when the Scour Critical Condition is Reached

DETOUR

Closure Instructions

- Can be Load Restrictions, Lane Closure or Complete Bridge Closure
- Criteria for Closure should be Established by Scour Team based on one or more of:
  - Observed scour, movement of riprap, monitoring bed movement, water level, discharge, rainfall, flood forecasting, debris build-ups
- Identify Authority for Closing and Reopening a Bridge
  - Communication and coordination

Countermeasure Alternatives

- Alternatives Considered
  - More intense monitoring can be one of the alternatives
- Preferred Alternative
- Engineering Feasibility
- Schedule for Timely Design and Construction

Other Information

- Author and sign–off on POA
- Media Alert Instructions
- Sources of Emergency Repair Riprap
- Detour Instructions

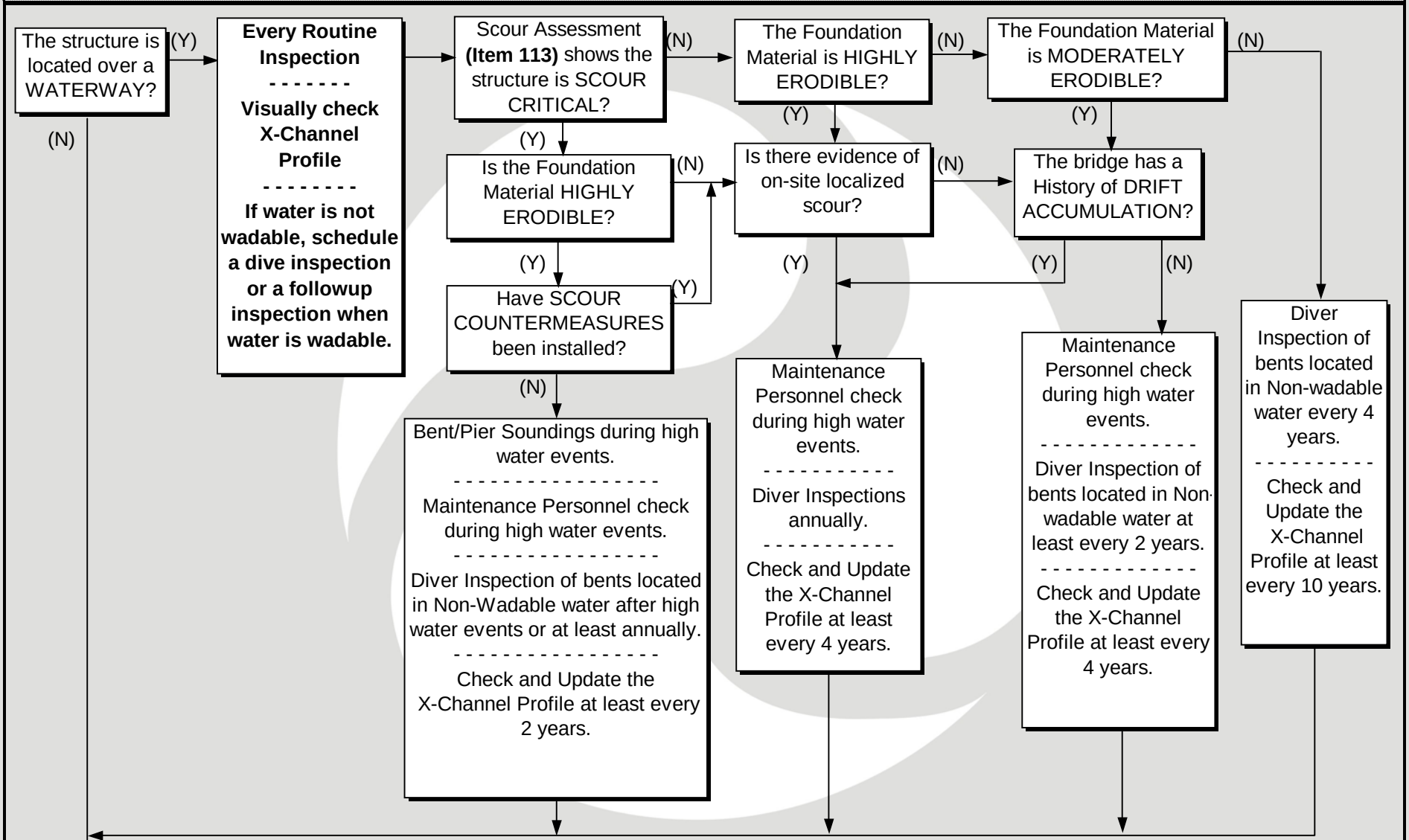
Generic POA

- **Bridge Identification: _____; Location of Bridge: ____; Year Built: ____; Replacement Plans (if scheduled):_____ Foundation Type: _____ Foundation Soils Types: _____**
- **ADT: _____; Service to Emergency Facilities or Evacuation (Y/N): _____**
- **Sources of scour critical rating (Assessment, Analysis, and/or Observation): _____**
- **Comments about rating (e.g., analysis did not account for erosion resistant material; emergency riprap placed after last flood, etc.): _____**
- **Inspection and Monitoring:**
  - **Increase inspection frequency: _____**
  - **Types (Probing, diving, inspection of banklines): _____**
  - **Special Inspection Criteria (after bankfull events, during major events): _____**
- **Monitoring Type (Fixed instrumentation, Portable instrumentation): _____**
- **Criteria for monitoring: _____**
- **Closure Plans (Limit loads; Lane closure; Full closure): _____**
- **Criteria for Closure (Discharge; Floodwater Elevation; Flood Forecast; Scour Soundings): _____ _____**
- **Authorization for Closure (Bridge Maintenance engineer; Inspector; Police; Statewide Bridge Closure Procedure): _____**
- **Detour Route: _____**
- **Criteria for reopening bridge: _____**
- **Countermeasures considered: (1) _____; Cost: $ _____**
  (2)_____ ; Cost: $ _____
  (3)_____ ; Cost: $ _____
- **Countermeasure Recommended: _____; Status: _____**
- **Author(s) of POA:_____; Date: _____**
- **Concurrences on POA: _____, _____, _____**

POA Examples from DOT's

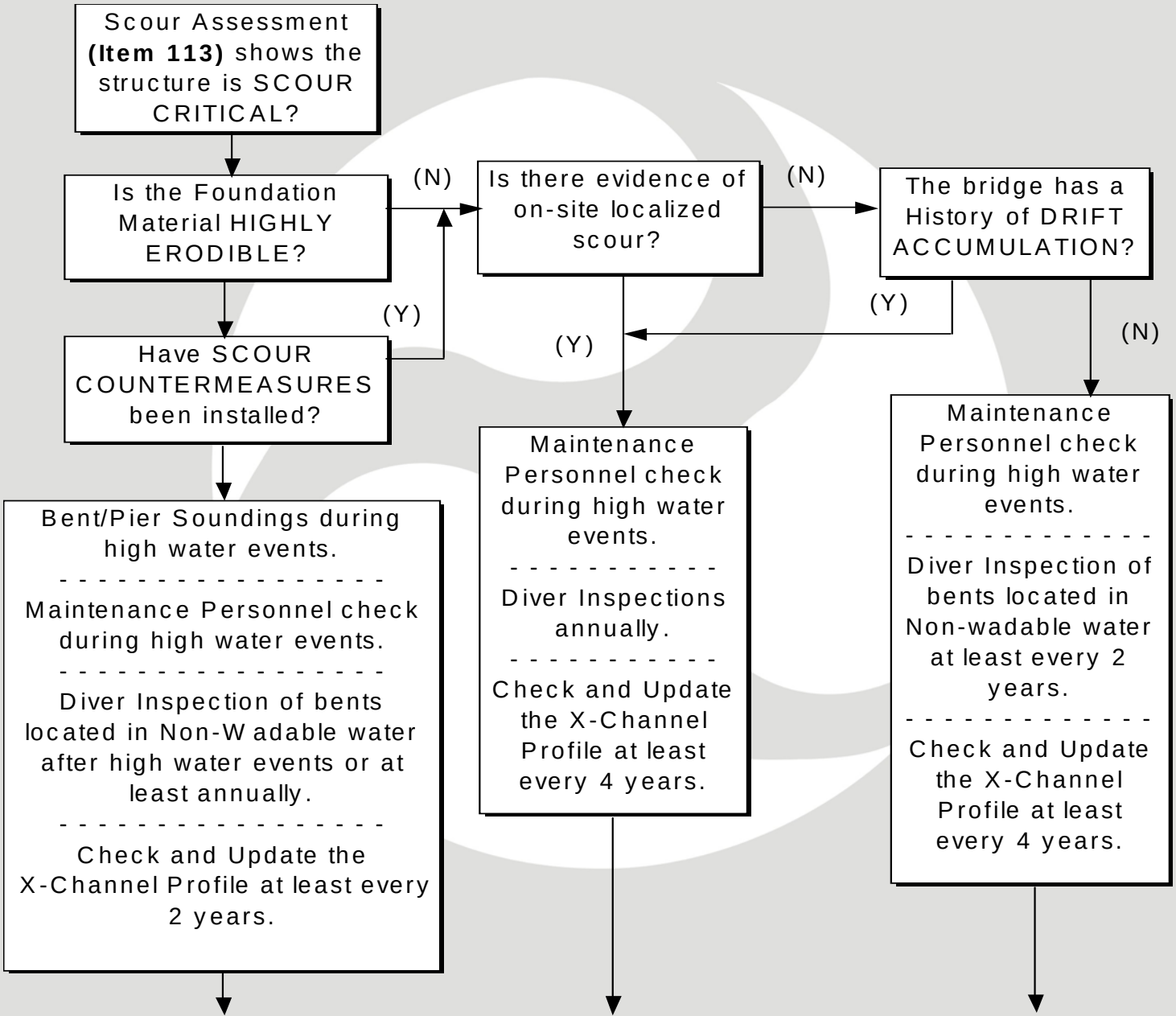
- Oregon
  - Dave Bryson
- Florida
  - Rick Renna
  - Seta Koroitamudu
- Maryland
  - Andy Kosicki
  - Stan Davis

UNDERWATER MONITORING GUIDELINE
OREGON DEPARTMENT OF TRANSPORTATION
(January 1, 1998)



NOTE: An acceptable scour countermeasure are those features that are Engineered in accordance with HEC-18 and 20. Such features include Rock Riprap, Guide Banks, Channel Improvements, Structural Scour Countermeasures, Overflow spans and/or structures, or Monitoring and Instrumentation.

Oregon DOT Plan of Action for Scour Critical Bridges



I-84 Bridges over the Snake River near Ontario, Oregon

Oregon Snake River
POA Example

- Determined to be Scour Critical, Code 3. Scour has been observed to shale layer.
- Foundation material is Shale that is continuously wet.
- Annual Underwater Inspection; Murky Water; All Inspection by Feel.
- Re-Evaluation by Annandale procedure might elevate Item 113 to Code 5.

SR 44 Bridge over St. John's River
District 5, Florida

SR 44 Bridge over St. John's River POA Example

- Bridge Number: 110063
- Location: SR 44 over St. John's River
- Foundation: Pile
- Scour Mode: Riverine
- Status:
  - Phase I: Data Collection and Qualitative Analysis → Final
  - Phase II: Hydrologic Assessment for Scour Analysis → Final
  - Phase III: Geotechnical & Structural Scour Assessment → Final
  - Phase IV: Recommended Plan of Action → Final
- Scour Rating: 3 → Critical

SR 44 Bridge over St. John's River POA Example (Continuation)

- POA Summary
  - To mitigate active scour, riprap was recently installed from Bent 5 to the West Side of bascule Pier 1.
  - Although a temporary scour countermeasure, the riprap in conjunction with a monitoring program may be an effective permanent scour countermeasure.
  - Should the monitoring program find significant degradation below the elevation of the riprap lined channel, a structural based countermeasure may be warranted.

SR 44 Bridge over St. John's River POA Example (Continuation)

- Countermeasure Alternatives
  - Alternatives — Cost
    1. Permanent Monitoring Program/ Portable Instrument — $313 per monitoring event
    2. Permanent Monitoring Program/ Fixed Instrument — $18,500
    3. Install Crutch Bents — Not feasible, riprap in vicinity

SR 44 Bridge over St. John's River POA Example (Continuation)

- Closure Plan
  - If a scour condition develops, it may be necessary to close the bridge.
  - If bridge closures, immediate implement District 5 bridge closure plan for state bridges.

SR 44 Bridge over St. John's River POA Example (Continuation)

- Plan Developer
  - Ayres Associates, Brian A. Acken, P.E., 01/30/98
- Consultant Recommendation
  - Alternative #1
- Action taken by FDOT
  - Routine monitoring/riprap already in place
- Work Program
  - 238328 (2-98); Project file 8

Training

- NHI 135048, *Countermeasure Design for Bridge Scour and Stream Instability*
  - Based on HEC-23
  - Plan of Action
  - Design Guidelines

Summary

- POAs should be develop and implemented for bridges identified scour critical for the safety of public users
  - FHWA hydraulics engineers are available upon request to assist DOTs in developing POAs

Questions?

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