NCHRP 20-68A
“US Domestic Scan Program”

Domestic Scan 15-02

Bridge Scour Risk Management

Richard Marz, P.E.

Chief Structures Maintenance Engineer

Wisconsin DOT

Domestic Scan 15-02
"Bridge Scour Risk Management"

- This scan was conducted as a part of NCHRP Project 20-68A, the U.S. Domestic Scan program

- The program was requested by the American Association of State Highway and Transportation Officials (AASHTO), with funding provided through the National Cooperative Highway Research Program (NCHRP)

NCHRP 20-68A
U. S. Domestic Scan Program

- The Program is a multi year project conducting 3-4 scans per year.
- Each scan is selected by AASHTO and the NCHRP 20-68A Project Panel.
- Each scan addresses a single technical topic of broad interest to many state departments of transportation and other agencies.
- The purpose of each scan and of Project 20-68A as a whole is to accelerate beneficial innovation by:
  - facilitating information sharing and technology exchange among the states and other transportation agencies;
  - identifying actionable items of common interest .

NCHRP Panel's General Guidance to the Scan Team (cont.)

"The scan team will focus on practices for ***inspection, monitoring, countermeasure selection and placement,*** *and* ***risk management*** *for scour-critical and scour-susceptible bridges individually and in networks of varying sizes."*

NCHRP Panel's Anticipated Outcomes

"By documenting and sharing successful practices the scan team will produce a valuable resource for use by bridge owners, state and local bridge inspectors, bridge designers and bridge management staff in ***reducing the risk*** *to the travelling public due to flooding and scour."*

Scan Team

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Bridge Management Engineer

Michigan DOT

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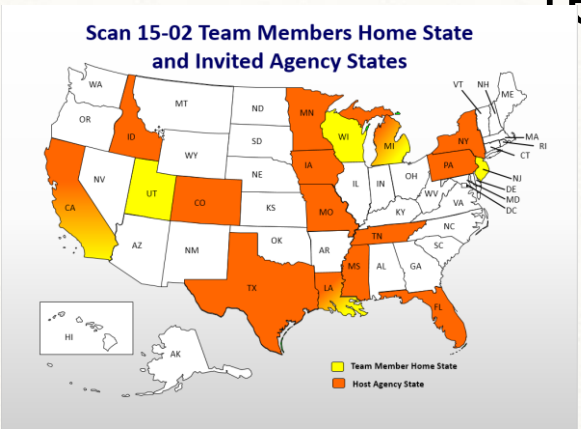
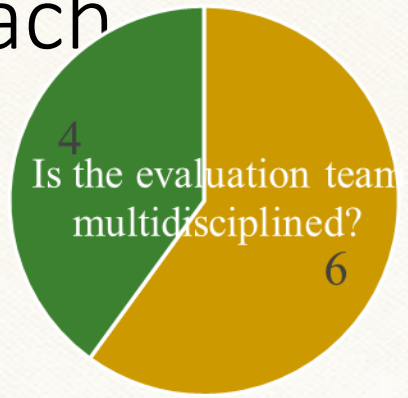
Team's Approach



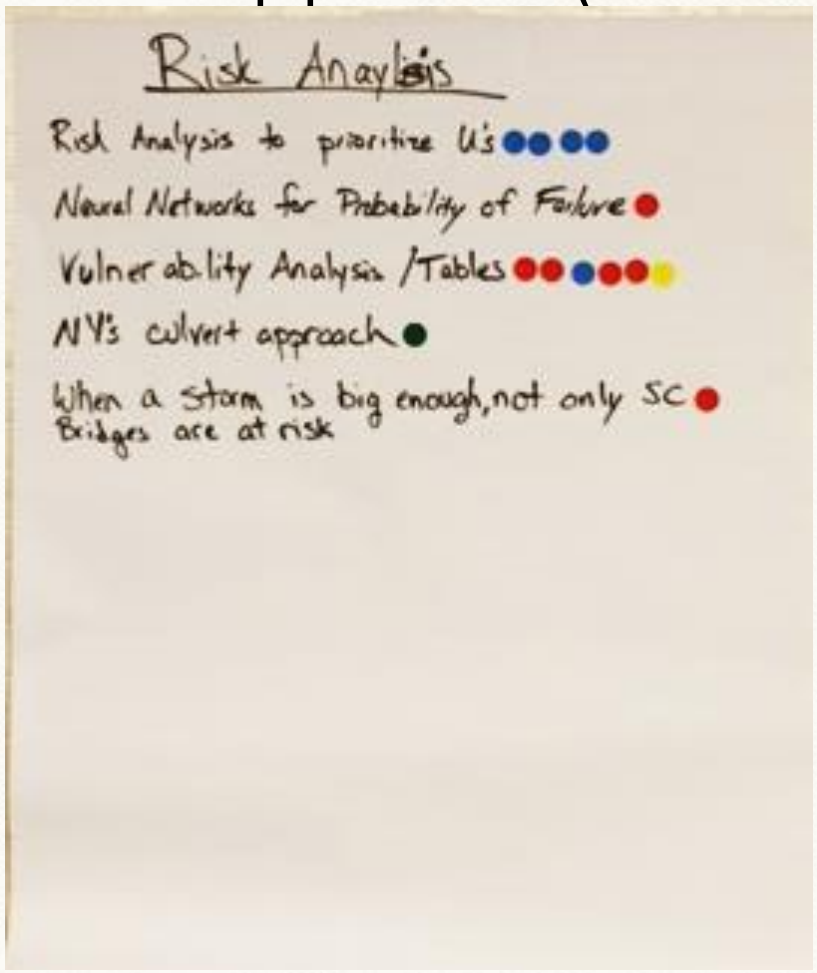
Desk Scan, Literature Search, Identify Agencies and prepare questions.



Combine Responses

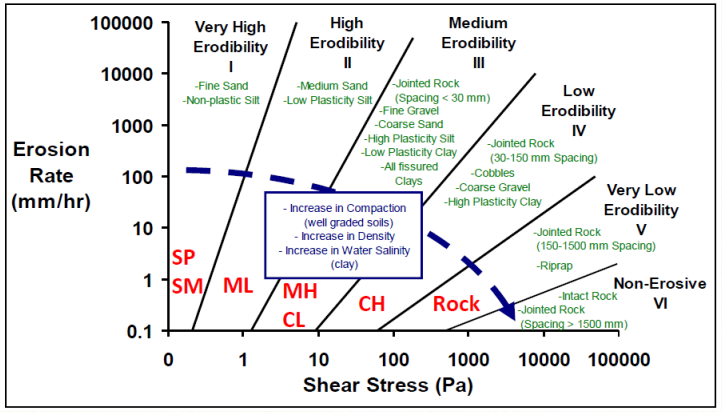
Host Workshop

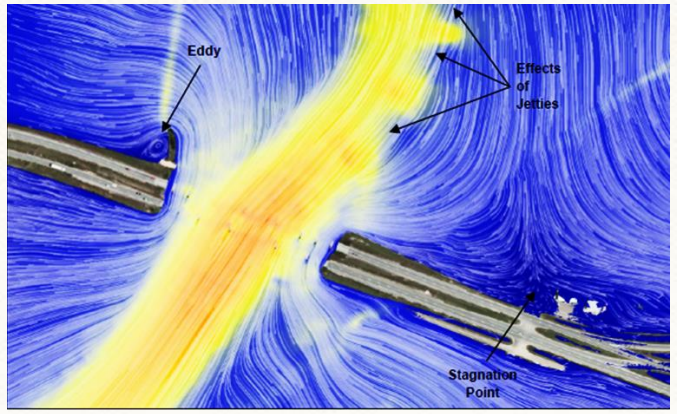
Team's Approach(Continued)



Topic 1: General Procedures and Risk Analysis

- States need to form scour committees with interdisciplinary capabilities (i.e., Engineers from Geotechnical, Structural, and Hydraulics areas)





Topic 1: General Procedures and Risk Analysis

- Due to limited resources, States should consider using Risk Analysis to prioritize how to best apply their limited resources rather than using vulnerability analysis to identify scour critical bridges.

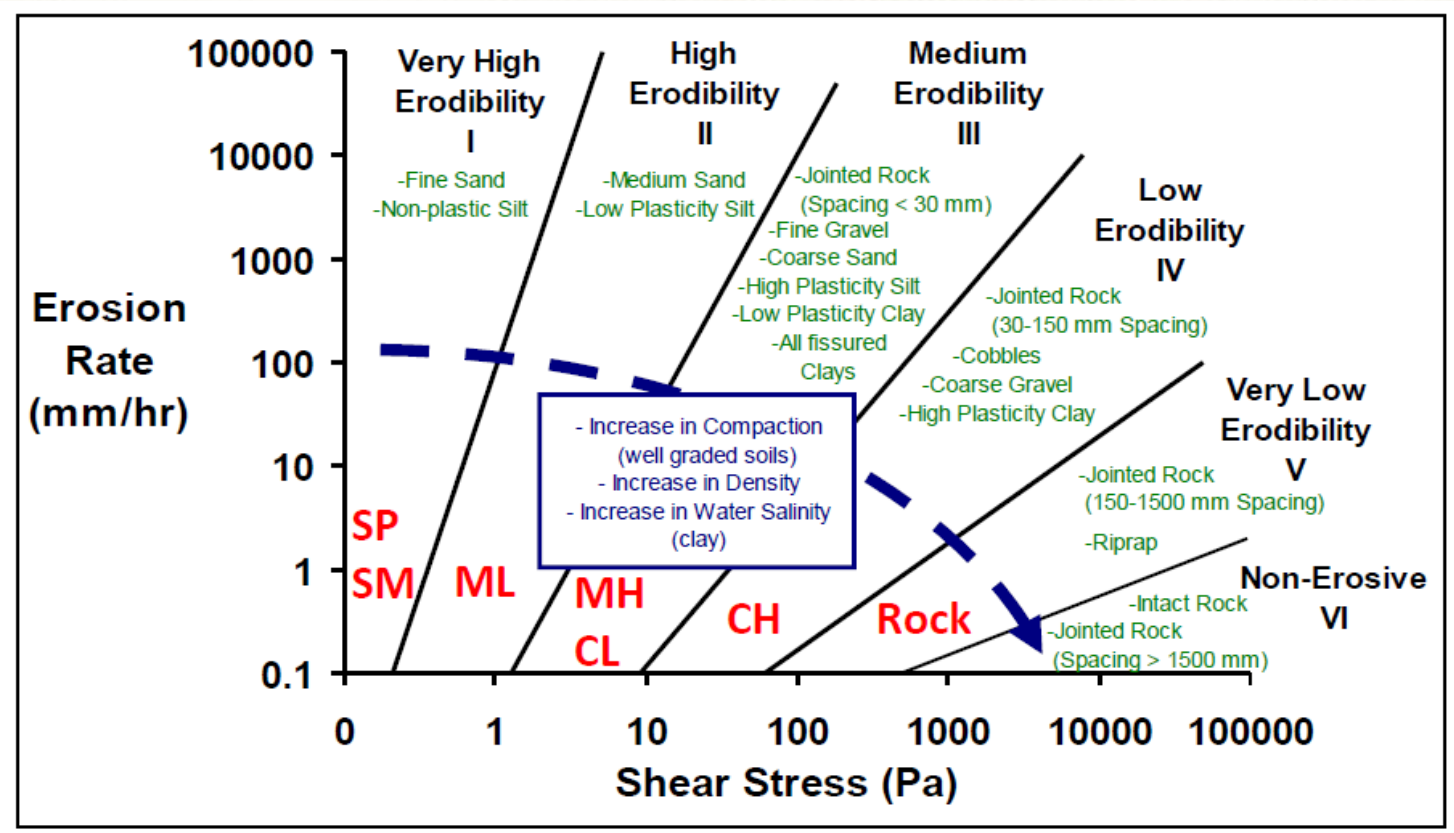
Criteria	Rehabilitation	Replacement
Construction Cost	Lower Initial Cost = $18,790,000	Higher Initial Cost = $ 43,392,000
Life Cycle Costs	Net Present Value = $ 27,266,671 Equiv. Uniform Annual Cost = $ 1,123,598	Net Present Value = $ 47,616,837 Equiv. Uniform Annual Cost = $ 1,962,183
Functionality	Remains the same	Wider roadway deck promotes safety & accommodates center channelization lane for left turns
Long Term Reliability	Substructures would be 130 years old before bridge is replaced Additional future scour countermeasures likely required	New bridge built to current codes and requirements Scour resistant Substructure
Risk	Greater potential for unforeseen issues with major structural repairs Higher likelihood for possible issues with 80-year old substructures	Fewer unknowns with all-new construction Ability to fully considerer potential issues in new design
Constructability	Specialized & complex repairs for track and tread replacements Jacking and shoring leaves Major work during winter	Typical Movable Bridge Construction
Construction Disruption	9-Month Roadway Closure	21-Month Roadway Closure

Topic 1: General Procedures and Risk Analysis

- Scour is a nation-wide threat. AASHTO should create a multidisciplinary task force that would develop guidelines and specifications for scour mitigation design and to serve as a clearing house for new innovations.

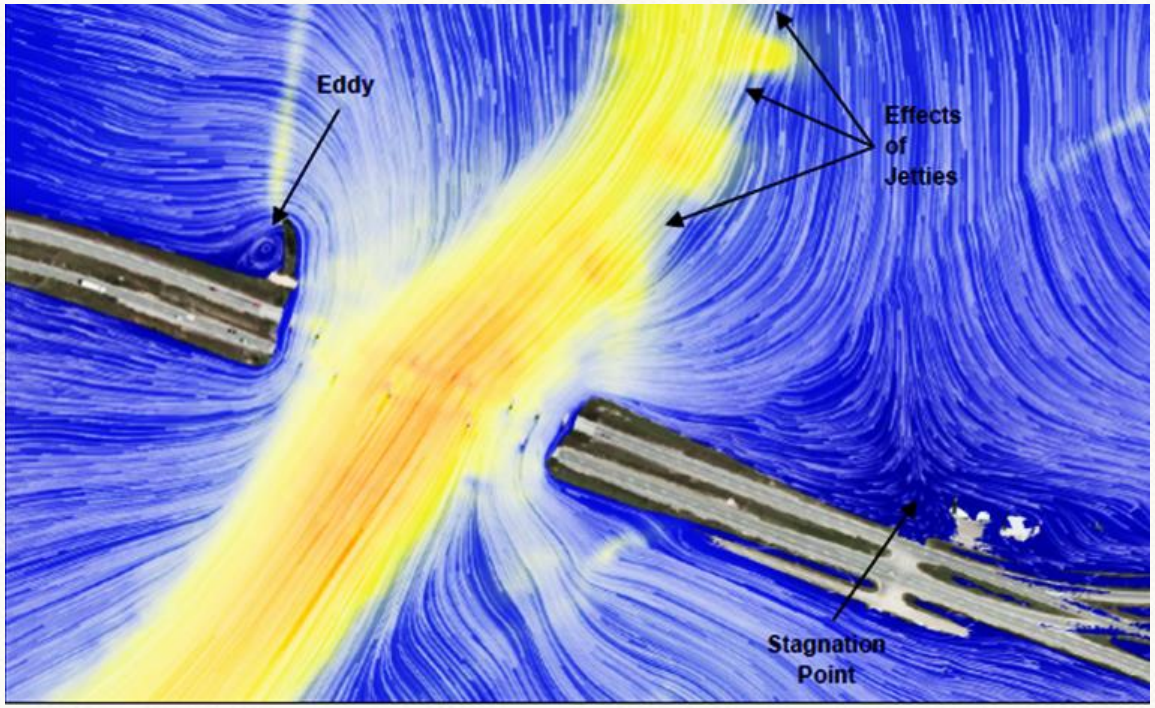
Topic 2: Scour Modeling and Analysis

- Materials testing for cohesive soils or rocks can performed for more accurate results



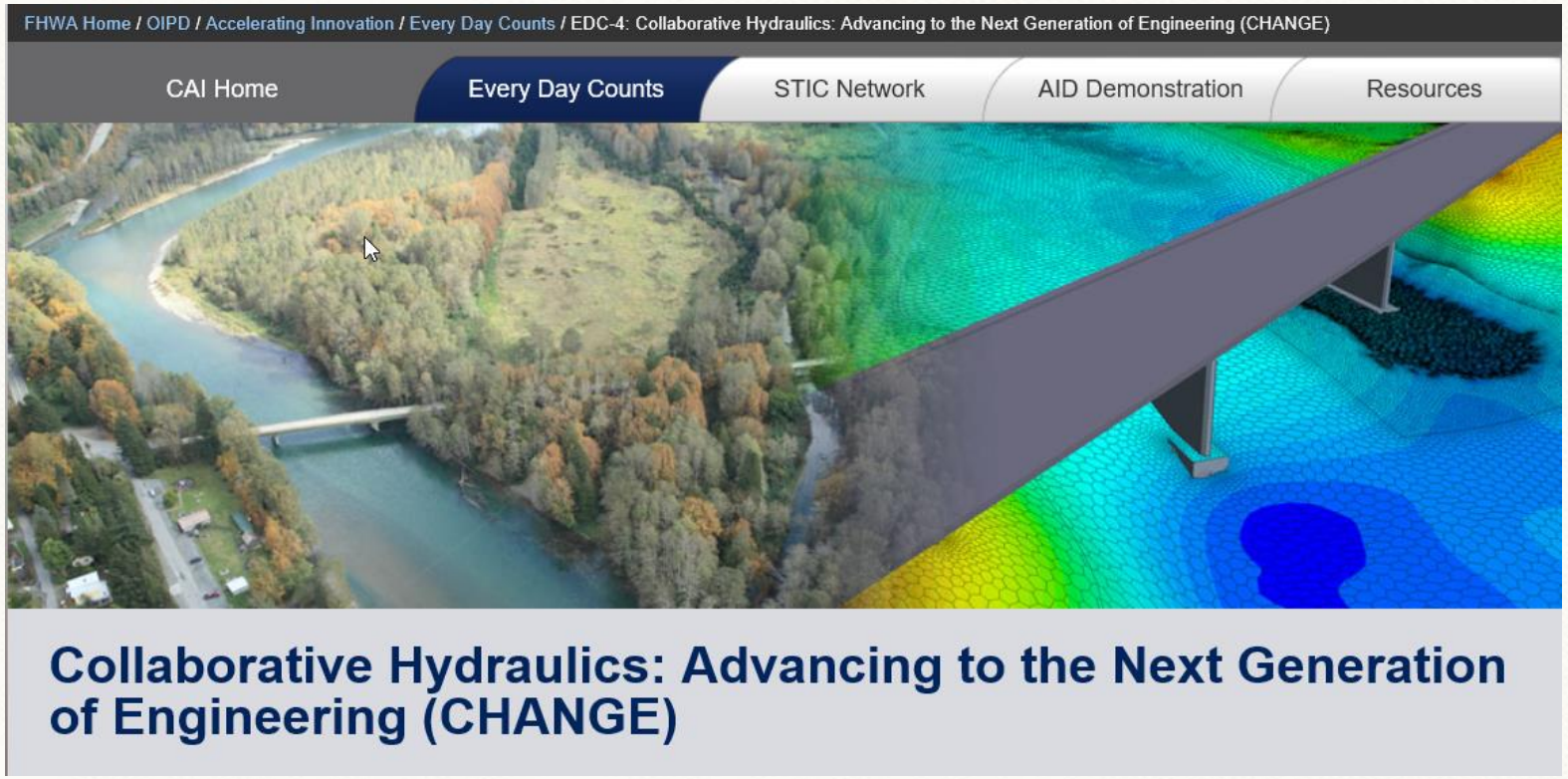
Topic 2: Scour Modeling and Analysis

- States are recommended to use 2D/3D models that are shown to be very useful in advanced cases. There is a need to identify the conditions or parameters when the 2D models can be applied.



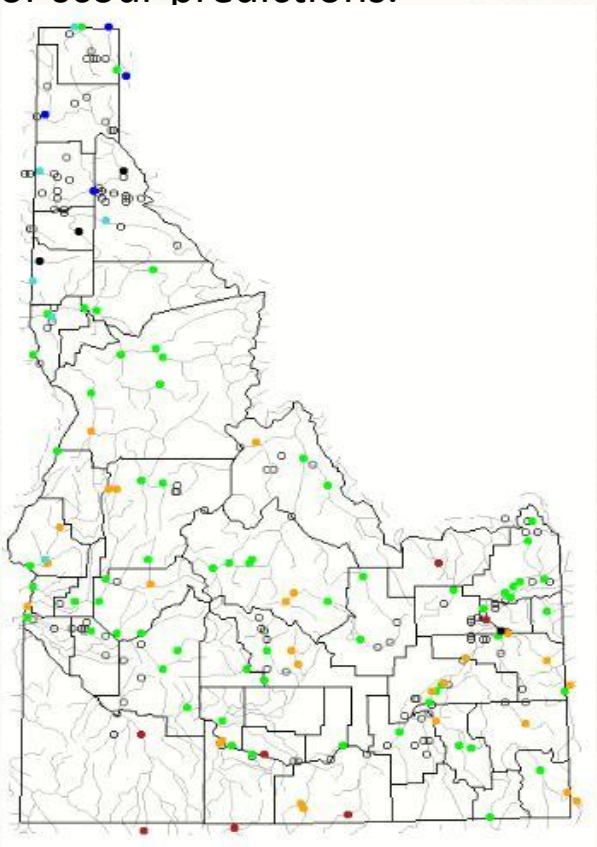
Topic 2: Scour Modeling and Analysis

- Encourage States and other agencies, involved with 2D modeling, to participate in NHI courses and other training workshops.

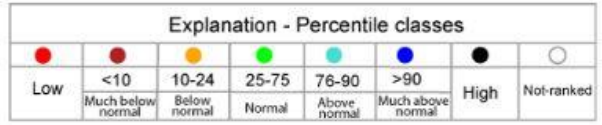


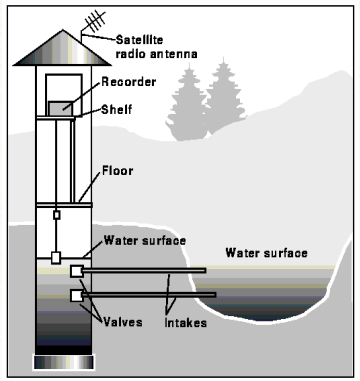
Topic 3: Monitoring and Field Inspection of Scour Critical Bridges

- States should establish collaborative partnerships with USGS and other agencies to facilitate sustainable data collection for scour predictions.



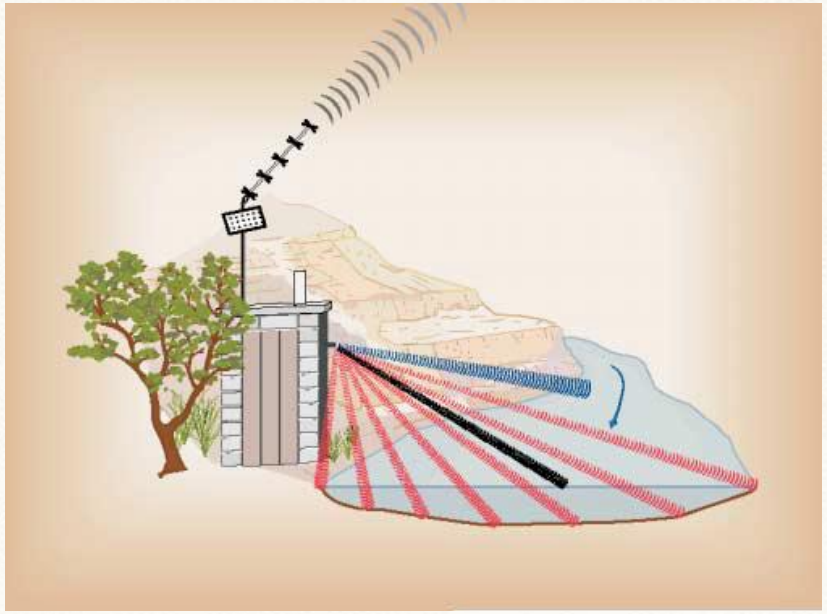
USGS
science for a changing world

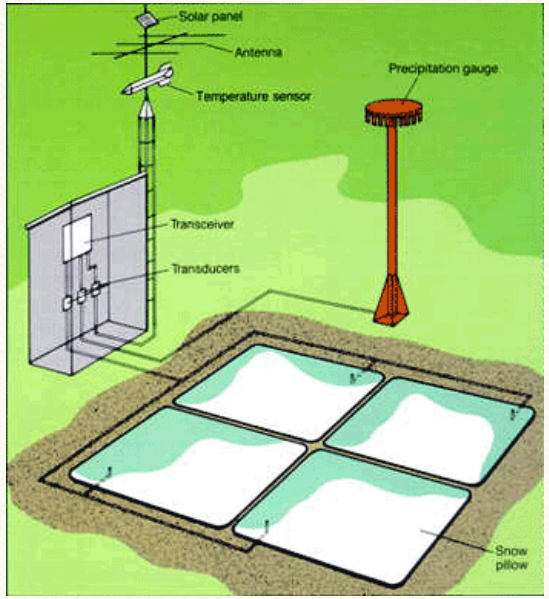




Topic 3: Monitoring and Field Inspection of Scour Critical Bridges

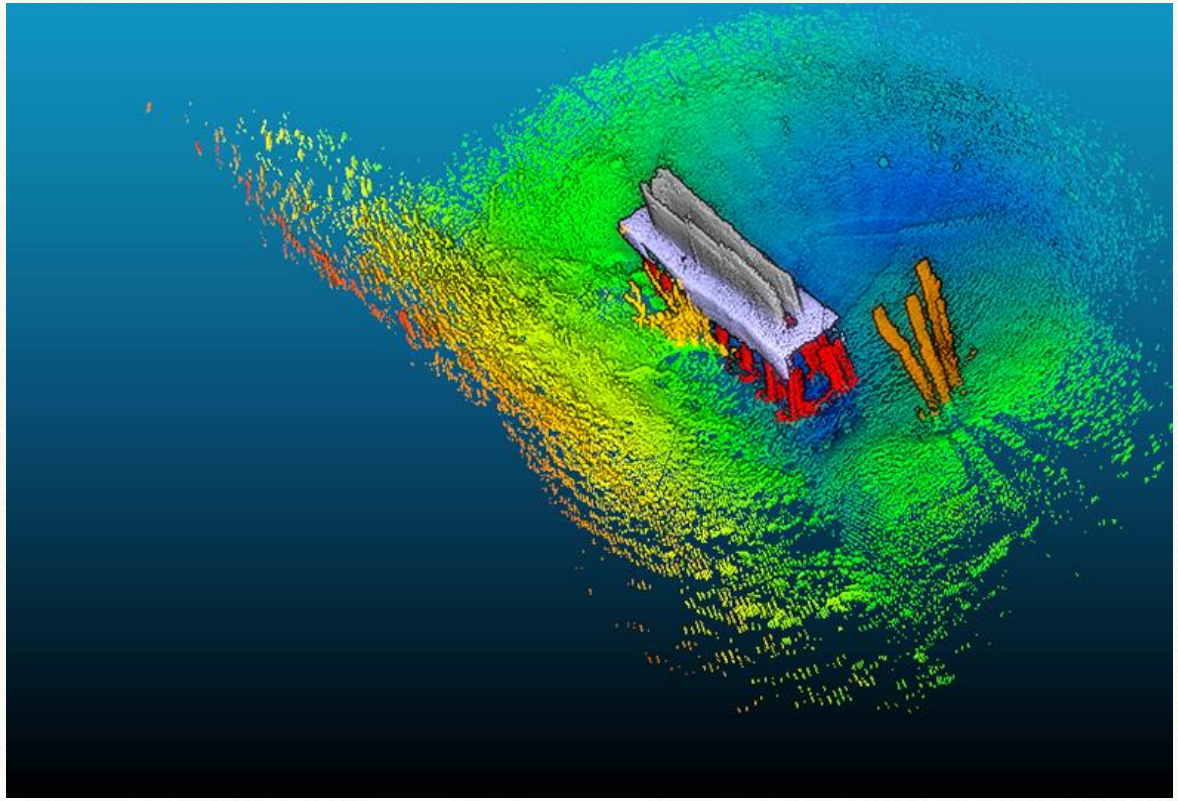
- AASHTO and FHWA should establish partnerships with USGS and other agencies for innovative applications to advance the State-of-Art of flooding on highway infrastructure.





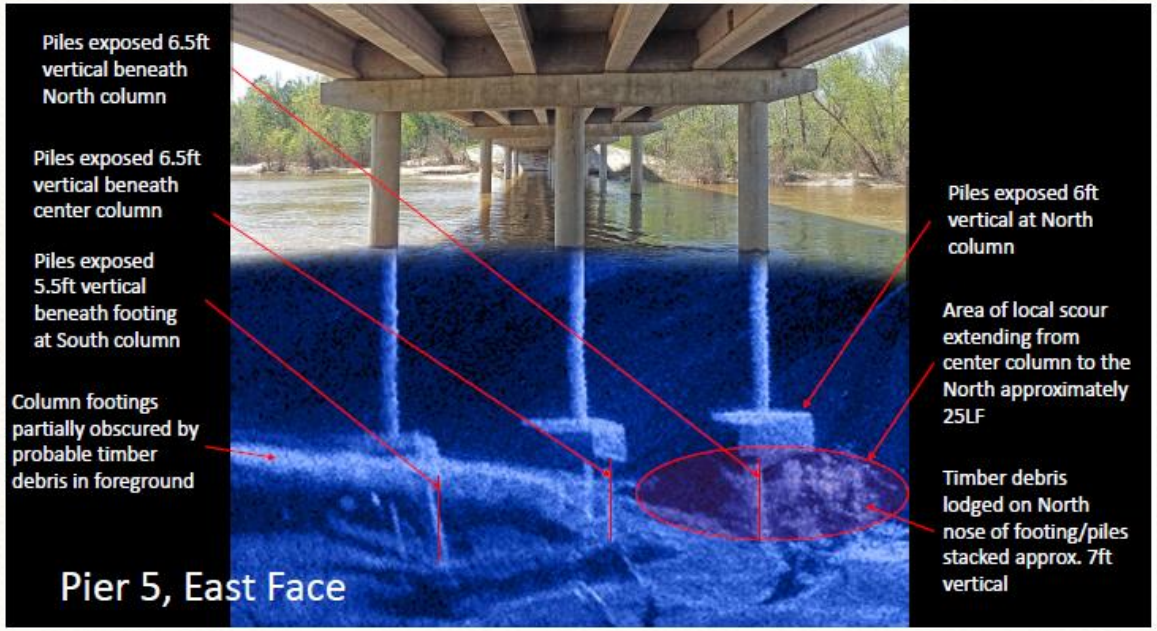
Topic 3: Monitoring and Field Inspection of Scour Critical Bridges

- States should work proactively with FHWA for use and acceptance of advanced technologies for under water inspection (e.g., sonar) to improve data collection and divers' safety.



Topic 3: Monitoring and Field Inspection of Scour Critical Bridges

- Continued and future research is needed to enhance the capabilities of various systems to measure real-time scour. Moreover, communication and dissemination of various research projects is needed to raise awareness of accomplishments.



Topic 4: Design, Construction, and Sustainability of Countermeasures

- States should have procedures for inspecting countermeasures during construction and routine inspections.

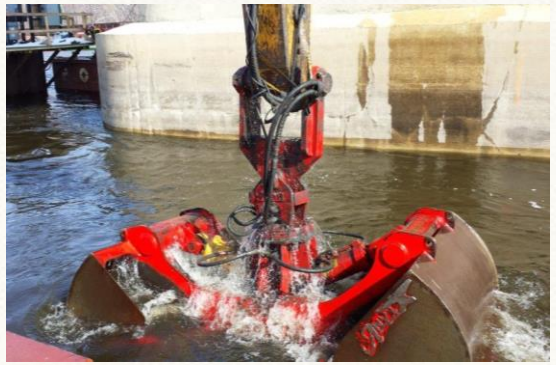
Michigan Bridge Element Inspection Manual

CS TABLE 10 – SCOUR PROTECTION

Defects	Condition State 1 GOOD	Condition State 2 FAIR	Condition State 3 POOR	Condition State 4 SEVERE
Scour or Erosion	None.	Countermeasure is substantially effective. Scour or Erosion exists without undermining.	Countermeasure device has limited effectiveness Erosion may be evident with undermining of countermeasure.	The channel protection device or scour countermeasure are unstable, missing or no longer effective.
Material Defect (scaling, abrasion, spalling, corrosion, cracking, splitting and decay)	Insignificant or minor defects.	Countermeasure device is substantially effective. Extensive minor to isolated advanced defects.	Scour countermeasures have limited effectiveness. Extensive advanced to major defects.	
Damage (unraveling, displacement, separation, and sagging)	Insignificant or minor damage.	Countermeasure device is substantially effective. Extensive minor to isolated advanced damage.	Scour countermeasures have limited effectiveness. Extensive advanced to major damage.	

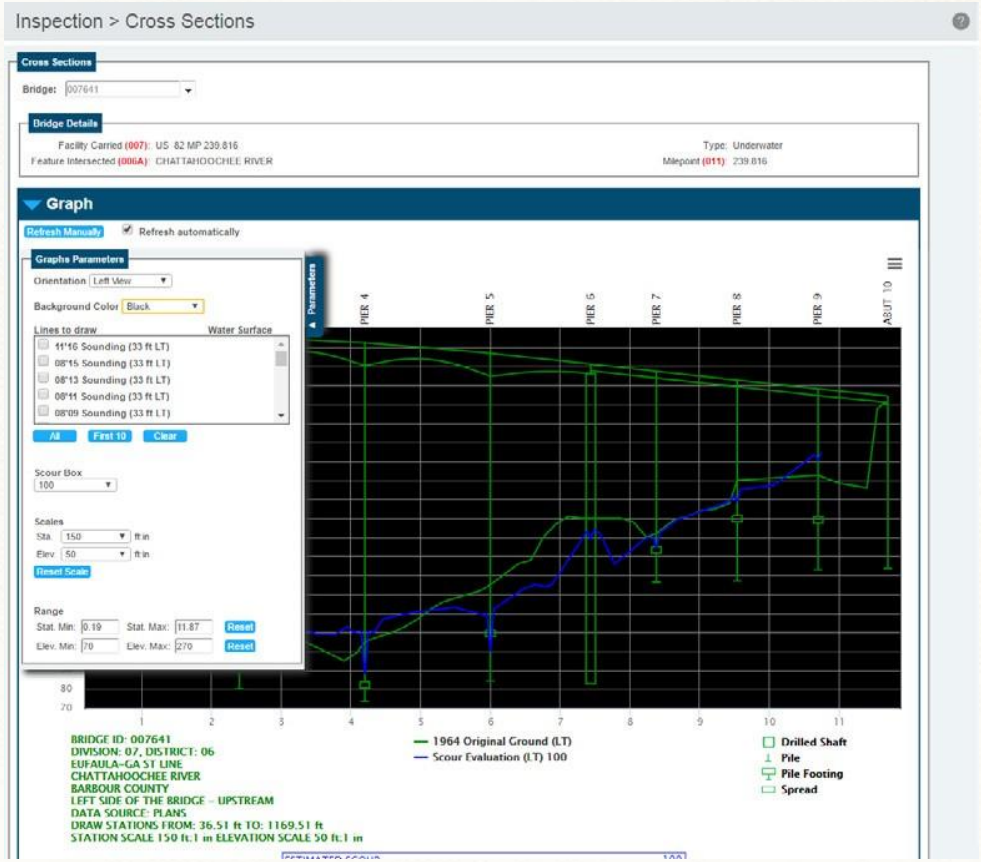
Topic 4: Design, Construction, and Sustainability of Countermeasures

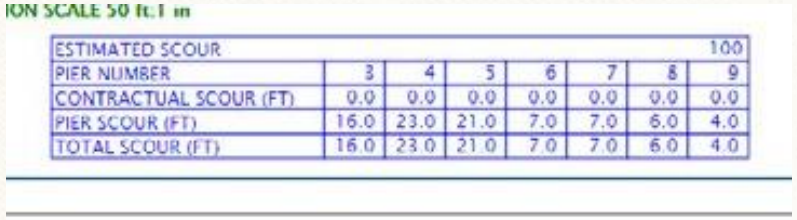
- AASHTO should establish a body to help disseminate the information related to the performance of various types of countermeasures.



Topic 5: Plan of Action (POA)

- It is recommended that States consider additional information (e.g., cross section, whether the bridges on the detour route are scour critical, etc.) to enhance their POA which could be useful to the stakeholders.



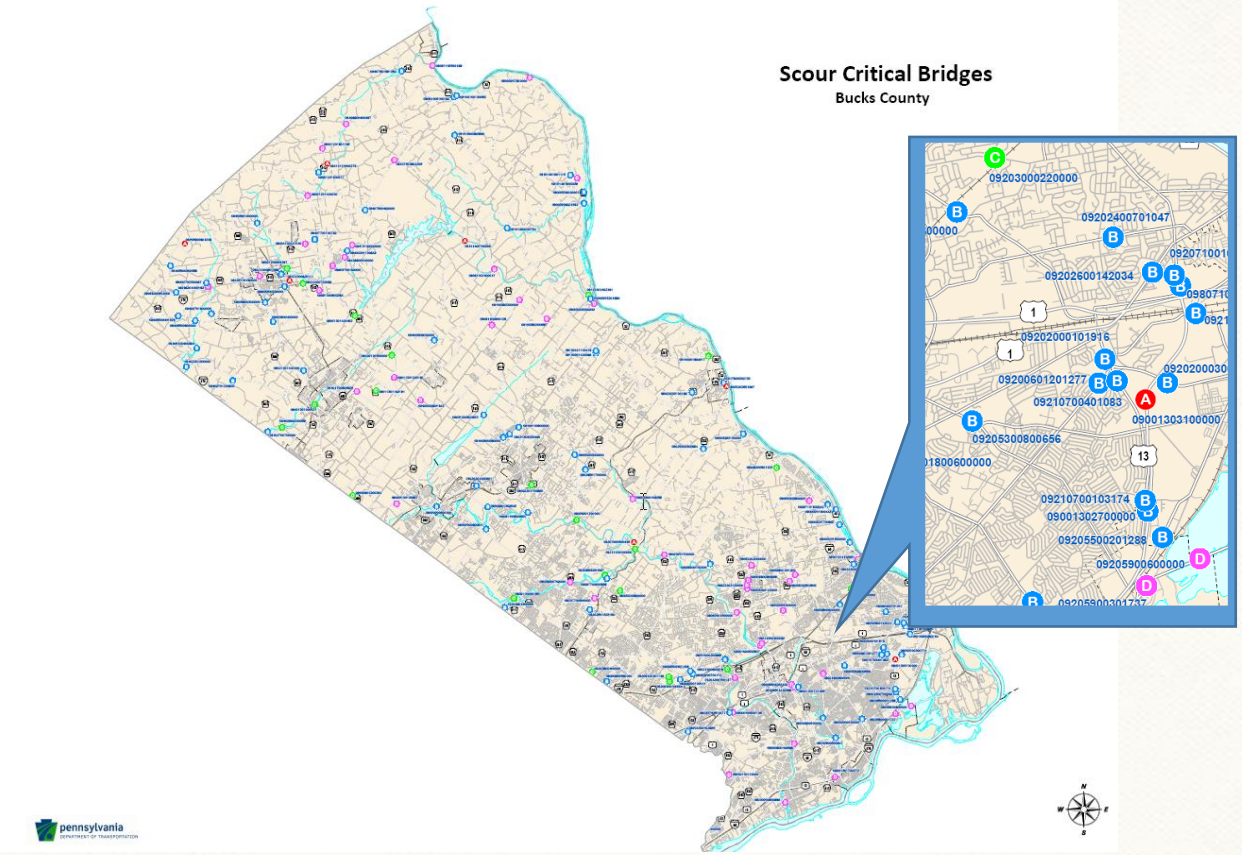


ION SCALE 50 ft.I in

ESTIMATED SCOUR							100
PIER NUMBER	3	4	5	6	7	8	9
CONTRACTUAL SCOUR (FT)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PIER SCOUR (FT)	16.0	23.0	21.0	7.0	7.0	6.0	4.0
TOTAL SCOUR (FT)	16.0	23.0	21.0	7.0	7.0	6.0	4.0

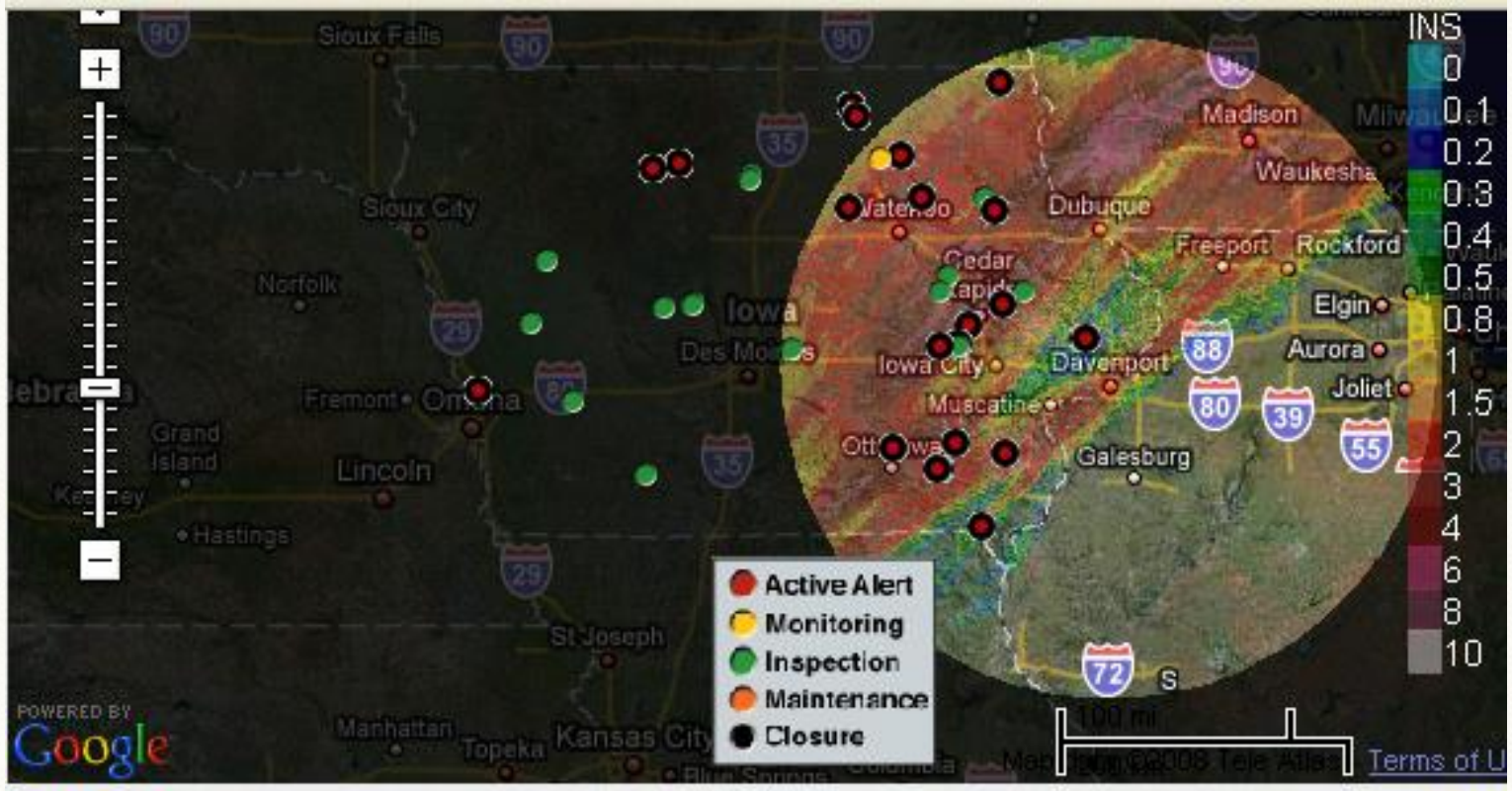
Topic 5: Plan of Action (POA)

- States are recommended to develop emergency protocols for widespread flood events.



Topic 5: Plan of Action (POA)

- States should create risk-based prioritization for implementing POA during flood events, which could be based on specific triggers for specific bridges.



Final Report and other material will be made available on the web at

www.domesticscan.org

2018

National Team Wish List

- Multi-disciplinary – Structural, Hydraulic and Geotechnical Subject Matter Experts
- National Coordination with other agencies such as FHWA, USGS
- Clearinghouse for research and new testing procedures
- Place to share countermeasure successes and failures
- Body to advance state of the art when scour manuals and speed the implementation of innovations nationally

Thank you for your consideration and for the states that participated in the scan!