

A Brief History of the Scour Program in Indiana

Bill Dittrich

Bridge Inspection Area Engineer
Indiana Department of Transportation

February 15, 2016



History of Indiana's Scour Program



History of Indiana's Scour Program

■ 1987

- April: The collapse of the New York State Thruway Bridge over Schoharie Creek is caused by scour.



History of Indiana's Scour Program



History of Indiana's Scour Program



History of Indiana's Scour Program

■ 1988

- September: The FHWA issues a Technical Advisory – Scour at Bridges. This TA gave guidance for developing and implementing a scour evaluation program.



History of Indiana's Scour Program

■ 1989

- The Green (1988) Recording and Coding Guide came into use. It contained NBI Item #113, with codes of "0-9" and "N."
- INDOT started work to adapt its mainframe computer NBI data base to meet the changes in the Green Coding Guide.



History of Indiana's Scour Program

- INDOT started development of basic guidelines for screening and assessing bridges, basically following the guidelines provided by the FHWA.
- Most bridges in Indiana were coded as "6."



History of Indiana's Scour Program

- INDOT began assessing and assigning coding values for NBI Item #113, for INDOT Bridges, based on data provided by District Maintenance Directors, using their knowledge of past scour issues on particular bridges.



History of Indiana's Scour Program



History of Indiana's Scour Program

■ 1990

- INDOT began using a PARADOX program to record foundation and soil information along with the Item #113 coding.



History of Indiana's Scour Program

- Central Office Bridge Inspection Staff began reviewing each INDOT Bridge Inspection Report and used bridge plans, photos, and notes to determine an assessed scour coding for Item #113.



History of Indiana's Scour Program

■ 1991

- An FHWA Memo came out dated 07/1/1991 that gave a deadline of January 1997 for all states to complete scour evaluations.
- INDOT began to submit semi-annual reports to the FHWA to show progress on coding NBI Item #113.



History of Indiana's Scour Program

- INDOT developed further guidelines on how to code NBI Item #113, based on the foundation type and the soil the foundation was set on.



History of Indiana's Scour Program

■ 1993

- A Scour Memo was sent out to all counties instructing them on how to code Item #113. A target date of 05/30/1994 was given for submitting data to INDOT.



History of Indiana's Scour Program

DEC 27 1993



INDIANA DEPARTMENT OF TRANSPORTATION
206 North Senate Avenue
Room N755
Indianapolis, Indiana 46204-2249
(317) 232-5533 FAX: (317) 232-0238

EVAN BAYH, Governor
FREDERICK C. POOL, Comptroller

Writer's Direct Line:
317-232-5319

December 20, 1993

MEMORANDUM

TO: Board of County Commissioners of all Counties
and Consultants

FROM: Bruno F. Canzian, Manager
Local Transportation Section
Division of Planning

RE: National Bridge Inspection Program
Rating for Scour Vulnerability at County Bridges

Enclosed, please find detail information concerning the requirements for scour rating at county bridges. It is important you become familiar with the contents of this memorandum and the attachments. The objective is to avert potential failures which could result in structure collapse due to scour at bridge piers and abutments. The national effort, which includes all states, is designed to identify all bridges with scour potential so that corrective action can be taken in a timely manner.

In essence, a three step approach is recommended to identify bridges for scour vulnerability which includes 1.) Screening, 2.) Assessing and 3.) Calculations. Counties may wish to modify the rating procedures included herein and develop their own. It is important, however, all counties have at hand procedures which identify scour critical bridges within their jurisdictions and the appropriate countermeasures in place to ensure safety.

We believe the small effort involved is essential in order to avert a potential failure, minimize your liability and provide added safety to the traveling public. Be advised no additional funding is available for this initial activity, however, future scour calculations on high risk bridges will become part of, and be eligible for, your regular bridge inspection funding requests. A target date for completion of this activity is set for May 30, 1994 as described in the attachments. As always, thank you for your efforts and cooperation on this vital matter.

BC/bc

Printed on Recycled Paper • An Equal Opportunity Employer



History of Indiana's Scour Program

- Data was submitted to INDOT. This was usually a paper sheet with NBI Numbers, Feature Intersected, and a number handwritten next to the Feature Intersected with a number for Item #113.
- Most county data was coded as a "2," "5," or "8."



History of Indiana's Scour Program

■ 1994

- INDOT hosted training around the state on how to screen and assess bridges for scour, and how to code Item #113. This training was put on by INDOT's Hydraulics Unit.



History of Indiana's Scour Program

■ 1995

- The White (1995) Recording and Coding Guide came into use. It contained two new coding options for NBI Item #113: Codes "U" = Unknown Foundation and "T" = Over Tidal Waters.



History of Indiana's Scour Program

- INDOT started work to adapt its mainframe computer NBI database to meet the changes in the White Coding Guide. This took quite a while to accomplish.
- About 30 INDOT Bridges and several thousand County Bridges soon had their Item #113 coding changed to "U."



History of Indiana's Scour Program

■ 1996-2000

- All coding of "6" was eliminated from NBI Item #113, and INDOT was given approval to cease reporting semi-annual reports on the coding values of Item #113. This item was still reviewed as a part of the FHWA's annual review.



History of Indiana's Scour Program



History of Indiana's Scour Program

■ 1998

- INDOT, along with the FHWA, created a "Scour Committee," to review and perform scour calculations on +/- 400 INDOT Scour Critical bridges.



History of Indiana's Scour Program

- A consultant was hired to conduct field reviews and perform calculations and present the data to the committee for each bridge, which was then discussed and a consensus formed on a plan to address the scour issues for each bridge.



History of Indiana's Scour Program

earthtech
engineering and technology for the planet.

Bridge Scour Analysis Database for Replaced, Monitored & Rehabilitated Bridges

For Districts:
Interstates
Greenfield
Vincennes
LaPorte

Seymour
Crawfordsville
Ft. Wayne



Prepared for:
Indiana Department of Transportation
100 North Senate Avenue
Indiana Government Center North, Room N755
Indianapolis, Indiana 46204

Prepared by:
Earth Tech
6405 Castleway Court
Indianapolis, Indiana 46250

February 2002



History of Indiana's Scour Program

■ 2001

- INDOT moved its state NBI Bridge database off of the mainframe computer and into an ACCESS database. Scour items included in the PARADOX Scour File were included.



History of Indiana's Scour Program

■ 2005

- INDOT added Scour Plan of Actions (POAs) and Scour Monitoring Plan data fields into the ACCESS database.
- There were revisions to the Bridge Inspection Regulations – 23CFR.



History of Indiana's Scour Program

■ 2008

- The FHWA issued a memo on 01/04/2008, covering Scour and Scour Plan of Actions and Monitoring Plans. This memo gave a deadline of November 2009 for all states to have POAs developed and utilized.



History of Indiana's Scour Program

- The FHWA issued a memo on 01/09/2008, covering Unknown Foundation Plan of Actions and Monitoring Plans. This memo gave a deadline of November 2010 for all states to have POAs developed and utilized.



History of Indiana's Scour Program

- INDOT began using the InspectTech database to record scour, foundation and soils information, as well as the results and recommendations from INDOT's Scour Committee.



History of Indiana's Scour Program

- All INDOT Scour Critical Bridges and those with Unknown Foundations had a generic Plan of Action and Monitoring Plan developed. These plans were to be modified by District Inspectors as they conducted Routine Bridge Inspections.



History of Indiana's Scour Program



History of Indiana's Scour Program

■ 2009

- Indiana counties still had around 975 bridges coded as Scour Critical and around 1,100 bridges coded as having Unknown Foundations.



History of Indiana's Scour Program

<u>NBI SCOUR CODE</u>		<u># of County Bridges</u>
0	Bridge CLOSED, due to	0
1	Bridge CLOSED, due to	6
2	SCOUR CRITICAL	351
3	SCOUR CRITICAL	524
4	HIGH/MODERATE Risk for	812
5	MODERATE/LOW Risk for	5443
6	Code - No Longer	1
7	Designed Scour Counter measures in-	495
8	Low Risk for Scour	3,898
9	Little Chance of	9
U	Unknown Foundation Types	1133
T	Over Tidal	0
	<u># of Bridges over Waterways</u>	<u>12,672</u>
N	Not over Water	195



History of Indiana's Scour Program

- Special forms were created using an ACCESS database that contained all county bridges that were either Scour Critical or had Unknown Foundations. This database formed the basis for POAs and Monitoring Plans for each of these types of bridges.



History of Indiana's Scour Program

County Bridge Scour Form			
COUNTY#: 73	CO_NAME: Shelby	BRIDGE#: 00122	NBI#: 7300110
Facility Carried: CR 700S	Feature Intersected: THOMPSON Ditch		
Year Built: 1920	Year Reconstructed: 0000	EMERGENCY_ROUTE: <input type="checkbox"/>	
Average Daily Traffic: 00015	Year of ADT: 2008	Daily Truck Percent: 03	
DATE OF POA: #####	DATE POA UPDATED:	UPDATE_FREQ: 24	
113a: 3	113A_Scour_STATUS:	Scour Critical - Unstable	
113b: A	113B_Scour_FOUNDATION:	Concrete Spread Footing-no Piles	
60_RATING: 4	60#SUBSTR COND:	POOR-1/2" OPEN VERTICAL CRACKS	
61_RATING: 5	61#CHANL COND:	FAIR-NO PROTECTION	
	61#CHANL MATL:	NATURAL	
62_RATING: N	62#CULV COND:	N/A	
71_WATERWAY: 6	71#WATER ADEQ:	APPEARS BARELY ADEQUATE	
REASON FOR MONT:	ABUTMENTS 1 & 2 FOOTINGS EXPOSED WITH UNDERCUTTING AND SETTLEMENT CRACKS.		
TRIGGERS:	100 YEAR STORM EVENT (3"/HOUR OR 5.9"/24 HOURS) OR WATER LEVEL 1' BELOW BOTTOM OF GIRDERS.		
COUNTY CONTACT INFO:	COUNTY HIGHWAY SUPERINTENDENT-KEM ANDERSON OFFICE 317-392-6485 CELL 317-512-3829 INSPECTION CONSULTANT-USI CONSULTANTS-ROB COOP OFFICE 317-544-4996 CELL 317-370-1805		
COUNTER MEASURES RATING: N	NONE		
COUNTER MEASURES Observations:	REPLACEMENT OF STRUCTURE. UNTIL REPLACEMENT RIPRAP ABUTMENTS.		
COUNTER MEASURES NEEDED:			
DATE OF CROSS SECTION:			
CROSS SECTION COMMENTS:	CHANNEL WIDER THAN STRUCTURE. BANK EROSION BEHIND UPSTREAM WINGWALLS.		
Soil Information:	SANDY GRAVEL CHANNEL. AREA CONSISTS OF SILTY CLAY LOAM.		



History of Indiana's Scour Program

- Counties had until the end of 2009 to submit all these forms to be included in the new county portion of InspectTech, which was to go online in 2010.
- INDOT and all counties met the goal to have initial POAs for Scour Critical Bridges.



History of Indiana's Scour Program

- INDOT started letting a large number of scour countermeasure contracts using special funds, such as stimulus money.



History of Indiana's Scour Program

■ 2010

- Indiana County Bridge Inspection Consultants began using the InspectTech NBI database.



History of Indiana's Scour Program

- It was soon discovered that quite a bit of the POA and Monitoring data for Scour Critical Bridges, and Bridges with Unknown Foundations did not map correctly into InspectTech.
- This issue was addressed and corrected during the remainder of the year.



History of Indiana's Scour Program

- INDOT's new Bridge Inspection Manual was published in June 2010 with guidance on Scour Critical Bridges and Bridges with Unknown Foundations.



History of Indiana's Scour Program

- INDOT Counties met the FHWA deadline of November 2010 to either change Item #113 coding from a "U" to something else, or create a Monitoring POA. The majority of bridges had their coding changed to other valid codes.



History of Indiana's Scour Program

■ 2011

- The FHWA began annual reviews of 23 metrics on the Bridge Inspection Program. Metric #18 covers Inspection Procedures – Scour Critical Bridges.



History of Indiana's Scour Program

- On 12/16/2011, the FHWA notified INDOT that their review found that current practices for Scour Critical Bridges did not meet the requirements of 23CFR.



History of Indiana's Scour Program

- INDOT developed a Plan of Corrective Action (PCA) on this Metric, to determine how many Scour Critical Bridges in the state did not have a valid Scour POA, and then to ensure that one was developed and implemented. In addition, INDOT would develop policies for POAs for INDOT and local bridges.



History of Indiana's Scour Program

PCA – Procedures

Metric #18: Inspection Procedures – Scour Critical Bridges

FHWA notified INDOT on December 16, 2011 that the INDOT practice for scour critical bridges does not meet the requirements of 23 CFR 650.313.

GOAL

To develop and follow a plan of action (POA) for all scour critical bridges.

IMPLEMENTATION

Action Item: INDOT will determine and actively manage the number of Scour Critical Bridges (SCB) and bridges with unknown foundations that have Plans of Action.

Estimated completion date: August 31, 2012 (to determine number of SCBs without POA)

Estimated completion date: December 2012 (to complete POAs)

Implementation: INDOT will review the scour critical bridges to make certain each one has a POA and ensure all SCBs have a POA.

Action Item: INDOT will review its guidance documents related to Unknown Foundations, Scour Critical Bridges, and POAs to determine if they meet the intent of the NBIS and FHWA policy. Based on review of guidance documents, Inspection Manual may be revised.

Estimated completion date: August 31, 2012 (review documents)

Estimated completion date: December 2012 (revise documents)

Action Item: INDOT will determine what documentation exists for:

- Initial Scour Screening, Assessment, and Calculations that were performed in the mid 1990's
- Justification for changing the scour code (item 113) for long-standing SCBs and/or bridges with unknown foundations to non-scour critical.

Estimated completion date: August 31, 2012

Implementation: INDOT will develop guidance on the documentation required for all bridges and documentation required to change a bridge to non-scour critical.

Action Item: INDOT will develop policy, methodology, and documentation requirements to ensure POAs are implemented (i.e. bridges are being monitored or closed during triggering events, etc.).



History of Indiana's Scour Program

- Deadlines for this accomplishing this POA were 08/31/2012 and 12/31/2012.



History of Indiana's Scour Program

■ 2013

- On 12/18/2013, the FHWA notified INDOT that their review found that current practices for Scour Critical Bridges still did not meet the requirements of 23CFR.



History of Indiana's Scour Program

- INDOT developed a new Plan of Corrective Action (PCA) on this Metric, to develop new policies and conduct training on Scour POAs, specifically on the screening/assessment/calculations process. This work would cover a four-year period to end in July 2018.



History of Indiana's Scour Program

PCA – Procedures

Metric #18: Inspection Procedures – Scour Critical Bridges

FHWA notified INDOT on December 18, 2013 that the INDOT practice for scour critical bridges does not meet the requirements of 23 CFR 650.313.

GOAL

To ensure all bridges have been properly assessed for scour and a POA is developed and implemented for those bridges identified as scour critical.

IMPLEMENTATION

Background: As a result of the previous PCA approved for this Metric, INDOT has reviewed its documentation and polices that exists for:

- Initial scour screenings, assessments, and calculations that were performed in the mid-1990's
- POAs developed during the mid-2000's
- Justification for changing the scour code (item 113) for bridges with unknown foundations that were changed to non-scour critical during the late-2000's

Based on the findings from the review, INDOT determined:

- Initial scour screening, assessment, and calculations that were performed in the mid-1990's for LPA bridges are inadequate.
- Initial scour screening, assessment, and calculations that were performed in the early to mid-2000's for state bridges are adequate.
- POAs exist for all SCBs; however several limitations exist, including:
 - Triggering events are not easily identified and tracked
 - Limited documentation exists of monitoring efforts beyond routine inspection reports
- Limited documentation exists justifying changes made to the scour code (item 113) of bridges with unknown foundations that were changed to non-scour critical during the late-2000's. Per guidance from INDOT, LPA's were encouraged to use a risk-based approach and follow the FHWA memo issued in the late-2000's that encouraged the recoding of bridges with unknown foundations.

Revised PCA:

- INDOT will issue policy requiring LPA's to perform and document new scour screenings, assessments, and evaluations for all LPA bridges to determine an appropriate ratings for item 113.
- INDOT will issue new policy regarding developing, implementing, and updating scour POAs.
- INDOT will issue new policy regarding documenting POA monitoring efforts for LPA and State bridges



History of Indiana's Scour Program

■ 2015

- INDOT reviewed the Kansas DOT Scour Monitoring and Rating Program as a means to meet FHWA concerns. INDOT decided to develop a new process instead.



History of Indiana's Scour Program

- Keith Hoernschemeyer of the FHWA reviewed the scour policies and assessment processes of various DOTs, and helped to write a new draft policy for INDOT.



History of Indiana's Scour Program

INDIANA DEPARTMENT OF TRANSPORTATION BRIDGE SCOUR EVALUATION PROCEDURES FOR LOCAL PUBLIC AGENCIES

INTRODUCTION

Several catastrophic bridge failures resulting from scour led to the development and initiation of the national bridge scour evaluation program in 1988. That program required each state to develop procedures to ensure each bridge over a waterway, whether existing or under design, was evaluated as to its vulnerability to scour in order to determine the prudent measures to be taken for its protection. INDOT's initial approach to this program for existing bridges was published in 1995. The approach was recently reviewed and due to inadequacies and limitations in the program, INDOT determined those evaluations were no longer acceptable. In addition, documents for many of the scour evaluations conducted during the initial program are no longer maintained in each bridge's bridge file. Therefore, the primary purpose of these revised scour evaluation procedures is: (1) to apply a risk-based approach to scour evaluations and the development and implementation of Plans of Action (POAs); and (2) to ensure those efforts are properly documented in each bridge file. The result of this effort will be that each bridge will be assigned a Scour Critical Evaluation Rating (Item 113) based on the following bridge scour evaluation procedures. Those bridges identified as scour critical or coded as U (unknown foundation) will require a Plan of Action (POA) to be developed and implemented.

The expected outcome of this process is to determine an accurate scour rating for each bridge based on existing documents, field conditions, and engineer judgement, or determine what documents are needed for an accurate scour rating. This process is to be completed utilizing an appropriate combination of office and field reviews. It is anticipated that the office reviews would include review of the online bridge files from INDOT and interviews with County staff. It may also include review of historical bridge files not available online from INDOT. It is anticipated the field reviews would be accomplished concurrently during an NBIS routine bridge inspection. The "Scour Evaluator" is responsible for the overall scour evaluation and is required to sign the forms. The "Scour Evaluator" must be a Professional Engineer that is a certified NBIS Team Leader in Indiana. It is preferred that these scour evaluation procedures be conducted by a multi-disciplinary team knowledgeable in hydraulic, geotechnical, bridge design, and bridge inspection procedures.

INITIAL SCREENING PROCESS

Screen each bridge utilizing the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES form in [Appendix A](#). Bridges with multiple foundations should analyze the worst case. Answer each question and assign NA or a Scour Critical Evaluation Rating (Item 113) per the form. Sign and date the form; then upload the completed form to INDOT's electronic bridge file. If the assigned Scour Critical Evaluation Rating (Item 113) from the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES equals N, 9, or 8; the INDOT Scour Evaluation Procedure is complete for that bridge. If the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES equals NA, the Scour Critical



History of Indiana's Scour Program

- INDOT and the Indiana ACEC Bridge Inspection Committee reviewed, tested, and commented on the draft developed by Hoernschemeyer and a final workable version was created.



History of Indiana's Scour Program



History of Indiana's Scour Program



History of Indiana's Scour Program



History of Indiana's Scour Program

Thank You

