

**ACTIONS TO ADDRESS  
BRIDGES WITH UNKNOWN  
FOUNDATIONS FOR SCOUR**

**by**

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# FHWA SCOUR DEADLINES

All bridges coded 6 or T have to be evaluated by <u>November 2008</u>	X
All bridges coded 0, 1, 2, or 3 will need Plans of Action developed by <u>November 2008</u>	X
All Plans of Action will need to be implemented by <u>April 2009</u>	X
All bridges that are coded “U” (i.e. have an unknown foundation) will need: a) to be evaluated for scour, recoded, and if required a Plan of Action developed and implemented; or b) if a bridge remains coded “U” then it will need a Plan of Action developed and implemented for it; by <u>November 2010</u>	In Progress

# TxDOT Bridge Statistics

- Number of Bridges over water – 43,193
- Number of Bridges with unknown foundations – 8,523
- On-System Bridges –
  - Total over water – 26,022 (~ 60%)
  - Number of bridges with unknown foundations – 128 (< 2%)
- Off-System Bridges
  - Total over water – 17,171 (~ 40%)
  - Number of bridges with unknown foundations - 8,395 (> 98%)

# BRIDGES WITH UNKNOWN FOUNDATIONS



How is TxDOT going to be able to meet the FHWA deadline?

# BRIDGES WITH UNKNOWN FOUNDATIONS

TxDOT Bridge Division has submitted a plan to the FHWA and received approval

# TxDOT's Plan for Evaluating Bridges with Unknown Foundations for Scour

1. Use existing foundation records and analyze the bridges for scour
2. Infer the foundation depth and analyze the bridge for scour
3. Use a risk based analysis for scour

# Inference Methods

- Twin structures with plans only for one of the bridges – infer that the foundation length and type were the same for the adjacent structure
- Several bridges within a short distance of the bridge were built at the same time and are of the same type – infer that foundation length and type were the same for the unknown structure
- Reverse Engineering – try to infer the soil stratigraphy and bridge loading to estimate the foundation lengths

# Risk Analysis

- Applied mostly to Off-System Bridges
- Based on NCHRP Web Document 107: Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations
- Utilizes data in the Bridge Inspection Database

# Risk Analysis

- Data in the Bridge Inspection Database is used to determine the annual probability of scour failure of a structure.
- Annual probability of scour failure is compared to the minimum performance level for the structure to determine if the risk is acceptable for the given data.

# Risk Analysis

- This has been applied to Off-System Bridges
- ~ 86% of the Off-System Bridges with unknown foundations were determined to be low-risk based on the analysis

# Item 113 Coding

- Bridges with known foundations will be recoded according to the scour analysis
- Bridges with unknown foundations may be recoded based on a risk analysis or using an inference method for the foundation length and a scour analysis.
- Some may be scour critical and require Plans of Action to be written for them by the District.

# Bridges with Unknown Foundations

- If the Scour Coding (Item 113) for a bridge has been changed, TxDOT does not want to lose the fact that some of them may still have unknown foundations.
- To prevent this the Bridge Division has devised new coding for Item 113.1

# TxDOT's Item 113.1 Use for Bridges with Unknown Foundations

## Bridges Coded U in Item 113

Code	Description
P	Plan of action has been written and implemented (known foundations)
<b>Bridges with Unknown Foundations</b>	
A	Bridge foundation is unknown. Screening indicates low risk of scour. Item 113 coded a 5.
B	Bridge foundation is unknown. Screening indicates that bridge is scour critical. Item 113 coded 2 or 3. Plan of Action is in place.
C	Bridge foundation is unknown. Screening indicates that bridge is scour critical. Item 113 coded 2 or 3. No Plan of Action in place
D	Bridge foundation is unknown. Bridge is closed to traffic or has failed. Item 113 coded 0 or 1. Plan of Action in place.
E	Bridge foundation is unknown. Bridge is closed to traffic or has failed. Item 113 coded 0 or 1. No Plan of Action in place.

## WHAT IMPACT WILL THIS HAVE ON EACH DISTRICT?

- The coding for Items 113 and 113.1 may be changed for various structures by the Bridge Division.
- Each District will be notified of the changes and will need to place documentation in the Bridge Inspection Folder
- Each District may be required to write Plans of Action for their scour critical bridges

# PLAN OF ACTION

- **Used for Scour Critical bridges**
- **Includes bridges coded 0, 1, 2, or 3 for Item 113**
- **Provide guidance for Inspectors and Engineers that can be implemented before, during, and after flood events to protect the traveling public.**

# ELEMENTS OF A PLAN OF ACTION

- Background Information
- Inspection information
- Closure options and instructions
- Countermeasure alternatives and schedule
- Other information

# PLAN OF ACTION

- Bridge Division has forms for the District to complete



1. BRIDGE INFORMATION				
Br. Str. No.	Owner	County	Location	Facility Carried
Plan of Action Completed By:			Date Plan of Action was Completed:	

2. NBI CODING INFORMATION	
Inspection date	Most Recent
Item 113 Scour	
Item 60 Substructure	
Item 61 Channel & Channel Protection	
Item 71 Waterway Adequacy	

3. SCOUR VULNERABILITY RATING	
Source of Scour Critical Evaluation Rating (Item 113): (check all that apply)	
<input type="checkbox"/> Calculated Scour	<input type="checkbox"/> Site Observation
<input type="checkbox"/> Other:	
Scour Evaluation Summary:	
Most Scour Susceptible Bent(s):	
Calculated Scour Depth:    feet	Maximum Allowable Scour Depth:    feet
Other Information:	
Scour History:	
Location, Extent & Depth of previous scour:	
Other Information:	
Foundation Type: <input type="checkbox"/> Drilled Shafts <input type="checkbox"/> Footing on Drilled Shafts <input type="checkbox"/> Piling <input type="checkbox"/> Footing on Piling <input type="checkbox"/> Spread Footing <input type="checkbox"/> Unknown	
Foundation Material: <input type="checkbox"/> Non-Cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Rock   Other	



4. MONITORING PLAN	
Monitoring Plan Summary:	
Monitoring Authority:	
Monitoring:	
<input type="checkbox"/> Regular Inspection Program of ____ mo.	w/channel profiles
Items to Watch:	
<input type="checkbox"/> Increased Inspection Interval of ____ mo.	<input type="checkbox"/> w/channel profiles
Items to Watch:	
<input type="checkbox"/> Underwater Inspection Program	Frequency ____ mo.
Items to Watch:	
<input type="checkbox"/> Other Monitoring Program	
Type:	
<input type="checkbox"/> Visual	
<input type="checkbox"/> Other:	
Flood monitoring required:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Flood monitoring event defined by:	
<input type="checkbox"/> Discharge over	
<input type="checkbox"/> Stage	
<input type="checkbox"/> Elev. measured from	
Frequency of flood monitoring:	<input type="checkbox"/> 1 hr. <input type="checkbox"/> 3 hr. <input type="checkbox"/> 6 hrs. <input type="checkbox"/> Other
Scour trigger elevation:	
Action required if scour trigger elevation is detected:	



5. COUNTERMEASURE RECOMMENDATION	
Proposed Countermeasures:	
<input type="checkbox"/> Countermeasures Not Required	
<input type="checkbox"/> Install Scour Countermeasures:	Estimated Date of Installation
Type	
<input type="checkbox"/> Abutment Protection Riprap	
<input type="checkbox"/> Pier Protection Riprap	
<input type="checkbox"/> Channel Improvements	
<input type="checkbox"/> Substructure Modification	
<input type="checkbox"/> Other	
6. COUNTERMEASURE IMPLEMENTATION	
A. Countermeasure Implementation Project Type:	
<input type="checkbox"/> Proposed Construction Project	
Lead Agency	
<input type="checkbox"/> Maintenance Project	
Lead Agency	
B. Completed Countermeasures:	
Type	Date of Completion

WHERE SHOULD A PLAN OF ACTION BE PLACED?

WHAT NEEDS TO BE DONE WITH A PLAN OF ACTION?



# PLAN OF ACTION

*WHERE SHOULD A PLAN  
OF ACTION BE PLACED?*

**Should be placed in the Bridge  
Inspection folder for the bridge**



## TxDOT BRIDGE SCOUR PLAN OF ACTION FOR BRIDGES WITH ITEM 113 CODED "3"

4. MONITORING PLAN	
Monitoring Plan Summary:	
Monitoring Authority:	
Monitoring:	
<input type="checkbox"/> Regular Inspection Program of ____ mo. w/channel profiles Items to Watch:	
<input type="checkbox"/> Increased Inspection Interval of ____ mo. <input type="checkbox"/> w/channel profiles Items to Watch:	
<input type="checkbox"/> Underwater Inspection Program Items to Watch:	Frequency ____ mo.
<input type="checkbox"/> Other Monitoring Program	
Type: <input type="checkbox"/> Visual	
<input type="checkbox"/> Other:	
Flood monitoring required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Flood monitoring event defined by:	
<input type="checkbox"/> Discharge over	
<input type="checkbox"/> Stage	
<input type="checkbox"/> Elev. measured from	
Frequency of flood monitoring: <input type="checkbox"/> 1 hr. <input type="checkbox"/> 3 hr. <input type="checkbox"/> 6 hrs. <input type="checkbox"/> Other	
Scour trigger elevation:	
Action required if scour trigger elevation is detected:	

# PLAN OF ACTION

## WHAT NEEDS TO BE DONE WITH A PLAN OF ACTION?

- Items that require action need to be acted on and documented
- Documentation of any action item needs to be included in the Bridge Inspection folder

# Example of Monitoring Documentation

Bridge Structure Number:					
Scour threshold indicated in Plan of Action:				Action required if scour threshold is obtained:	
Date	Name of Inspector	Flood Event	Monitoring Method	Observations	Actions Required

this form would be placed in the Bridge Inspection Folder



# SUMMARY

1. The Bridge Division has a plan in place for addressing bridges with unknown foundations for scour, which has been approved by the FHWA.
2. The coding for Items 113 and 113.1 may be changed for various structures. The Districts will be notified of which structures have undergone a code change.
3. Districts may be required to write Plans of Action for their scour critical bridges, which need to be placed in the Bridge Inspection Folder.

**QUESTIONS?**