



Section 5

Unknown Foundations

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- Scour Evaluation Guide
Chapter 6: Unknown Foundations



- An “unknown foundation” is any foundation with unknown composition, gross dimensions, or embedment.

<https://ftp.txdot.gov/pub/txdot-info/library/pubs/bus/bridge/scour-guide.pdf>



- Simple spans on concrete substructure
- Built in 1959
- Founded on H-piles
- Channel bed exhibits up to 1.5 ft of scour

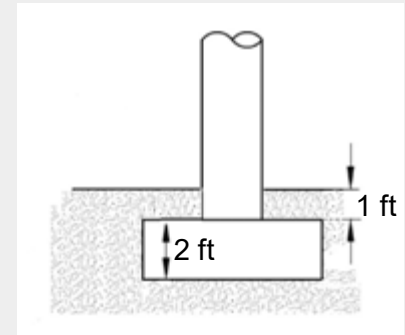
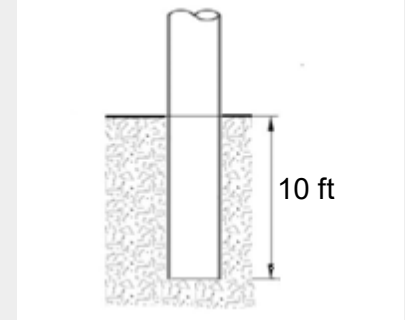
- As built plan set not available
- Pile embedment unknown

- Item 113.2 = U



- Retrieve as built plans, pile driving records, or other relevant bridge data
 - Microfilm records are now available as pdf files
 - Contacting local agencies might be all it takes for off system bridges

- Assumptions
 - 10 ft as built embedment for verified deep foundation
 - 1 ft embedment and 2 ft thickness for spread footing
- Inferences
 - Embedment can be inferred from similar bridges with known foundations
 - Provide justification for inferred foundation depth





Test methods to determine subsurface bridge foundation characteristics

Foundation depth, type, geometry, materials, or integrity

Surface NDE

- Sonic echo/Impulse response
- Bending wave
- Ultra seismic

Borehole NDE

- Parallel seismic
- Induction field
- Borehole radar



- Methods to address unknown foundations
 - Data collection
 - Assumptions/Inferences
 - Non-destructive evaluations (NDE)



- Estimate the annual probability of failure (P_a) due to bridge scour using condition ratings from the NBI database (e.g., Items 60, 61, and 71)
- Minimum performance level (MPL) based on NBI Item 26
- Define risk categories by comparing P_a to MPL

Low Risk

$$P_a / \text{MPL} < 1$$

Medium Risk

$$1 \leq P_a / \text{MPL} \leq 2.5$$


High Risk

$$P_a / \text{MPL} > 2.5$$



High-risk does not necessarily mean scour critical.



 **Bridge Scour Risk Screening
for Unknown Foundations**

PSN: 09007830100
FACILITY CARRIED: FM 194
FEATURE CROSSED: BRUSHY CREEK
ASSESSOR: _____
DATE OF ASSESSMENT: _____

Instructions
Complete the shaded cells. If the requested value is unknown or coded blank, leave the cell blank.
This form does not serve as documentation of a scour evaluation.

NBI Coding Information

Item	Description	Current Coding
28	Functional Classification	4
60	Substructure	6
61	Channel and Channel Protection	7
71	Waterway Adequacy	3

Risk Assessment Parameters

High Priority Route?	No
Overlapping Frequency	Slight
Annual Exceedance Probability (P _a)	0.000 250
Maximum Performance Level (MPL)	0.000 500
P _a / MPL	0.5

Bridge Scour Risk Category = LOW

If Risk Category = "Low" and "Medium"

- Use Scour Summary Sheet (Form 2605) with scoured foundation subelement suggested in Evaluation Guide Chp 6.3 and SVA (Form 537) serve as scour evaluation.

If Risk Category = "High", either or both of the following approaches may need to use with Scour Summary Sheet (Form 2605) and SVA (Form 537) to serve as a complete scour evaluation.

- NDE
- POA as scour critical bridge at a minimum of using Form 2604 as Item 113=3

DO NOT DISCLOSE - INFORMATION CONFIDENTIAL UNDER THE TEXAS HIGHLIGHT SECURITY ACT AND SECTION 21 USC SECTION 8536. SAFETY SENSITIVE INFORMATION

Scour evaluation spreadsheet

- [Bridge Scour Tabulations](#)
- [TxDOT Scour Analysis Spreadsheet](#)
- [Risk Screening for Unknown Foundations](#)

<https://crossroads/divisions/brg/sections/file-operations-section/scour-forms-and-guidance.html>



This form is no longer used directly to code Item 113



NBI Coding Information

Item	Description	Current Coding
26	Functional Classification	4
60	Substructure	6
61	Channel and Channel Protection	7
71	Waterway Adequacy	7

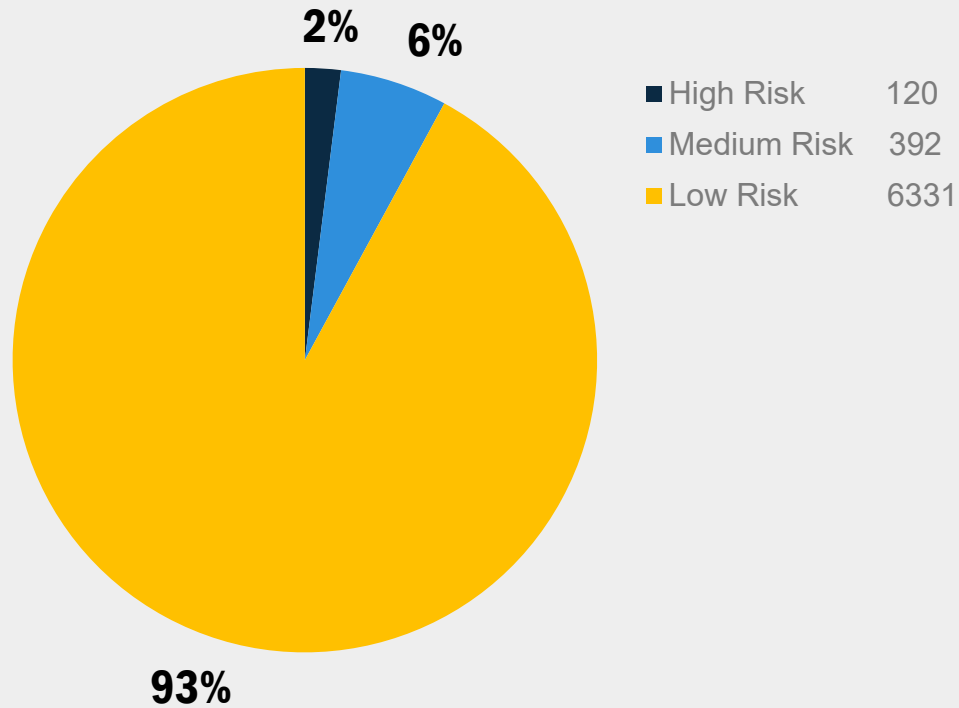
Risk Assessment Parameters

High-Priority Route?	No
Overtopping Frequency	Slight
Annual Exceedance Probability (P_a)	0.000 250
Minimum Performance Level (MPL)	0.000 500
P_a / MPL	0.5

Bridge Scour Risk Category = **LOW**



Unknown Foundations (Item 113.2=U)*



* Query ran on February 2024



- Methods to address unknown foundations
 - Data collection
 - Assumptions/Inferences
 - Non-destructive evaluations (NDE)

- Risk categories based on risk-based assessment
 - Low risk
 - Medium risk
 - High risk



Low Risk

- Data collection
- Infer data according to scour evaluation guide
- Assumptions based on supporting documents

Medium Risk

- Data collection
- Infer data according to scour evaluation guide
- Assumptions based on supporting documents
- NDE is an option if necessary

High Risk

- Data collection
- NDE is the only option to infer data

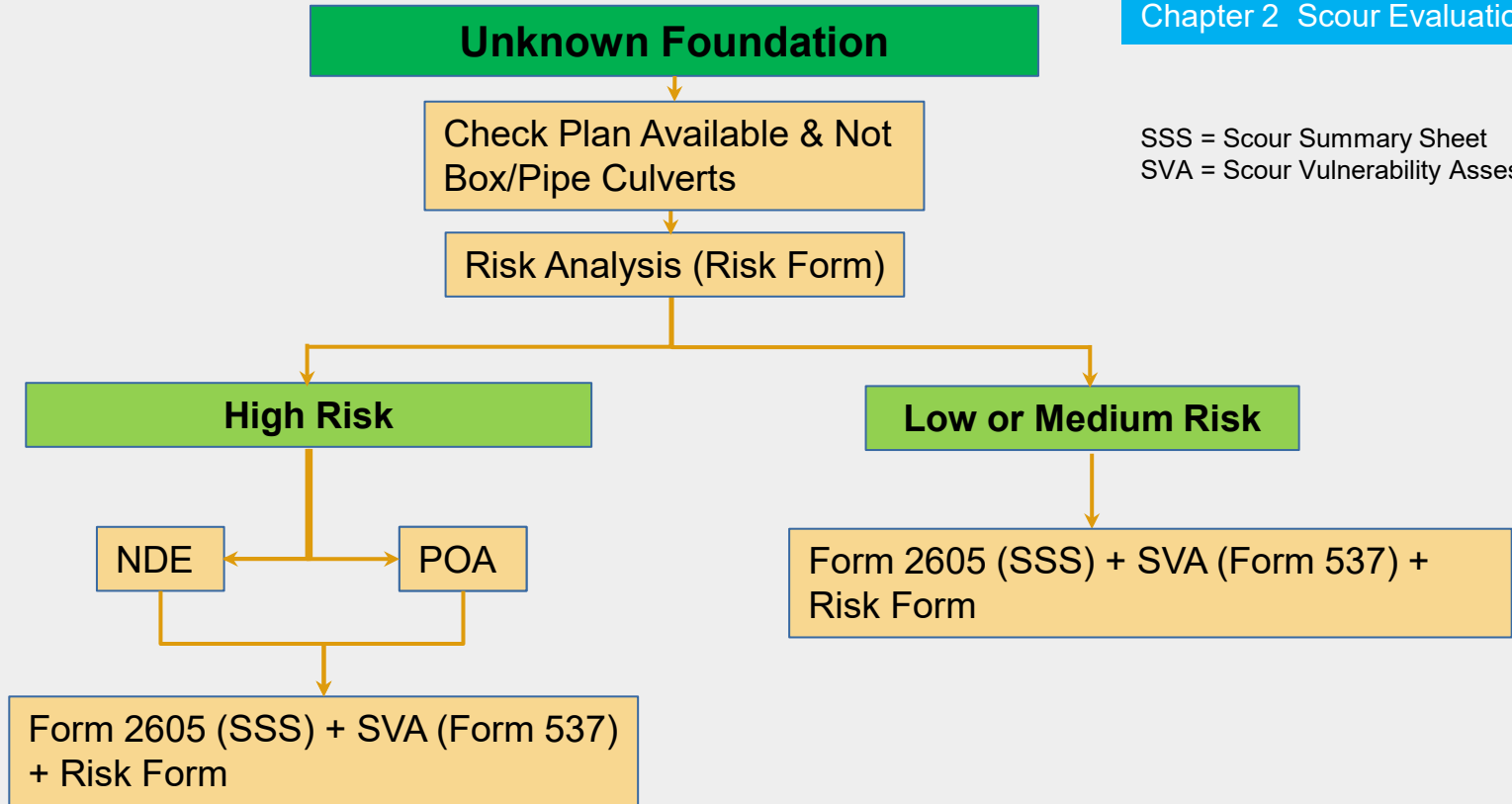
(consider as scour critical)

- POA

- Scour Vulnerability Assessment (Form 537 w/attached risk assessment form)
- Scour Summary Sheet (Form 2605)



- If scour evaluation cannot be performed after risk-based assessment (e.g., high-risk bridges), a POA needs to be developed
- POA for high-risk unknown foundation is similar to scour critical POA
 - Form 2604 or Form 2624
- POA should include
 - Monitoring more frequently
 - In-depth foundation investigation
 - Design and construction of a new bridge or countermeasure



SSS = Scour Summary Sheet
SVA = Scour Vulnerability Assessment

Item 113=U, Item 113.2=U and updated Item 113.2=U



Item 113 = U, unknown foundation and lacking scour evaluation and/or documentation

Previous version of scour forms

Item 113.2 = Blank → known foundation

U → unknown foundation

Updated scour forms

Item 113.2 = Blank → known foundation

U → unknown foundation lacking scour evaluation

A → assumed foundation approach performed

NDE → non-destructive evaluation performed

BRG will bulk change Item 113.2 from U to A on AssetWise for the bridges with unknown foundations that have scour evaluation/documentation



Possible scour coding after data collection

Recommended Scour Coding(s)

NBI CODINGS		
Item	Description	Coding
Item 113	Scour Critical Bridges	8
Item 113.1	Scour Plans of Action	
Item 113.2	Unknown Foundations	



Current scour coding

Recommended Scour Coding(s)

NBI CODINGS		
Item	Description	Coding
Item 113	Scour Critical Bridges	6
Item 113.1	Scour Plans of Action	
Item 113.2	Unknown Foundations	U



Possible scour coding after scour evaluation

Recommended Scour Coding(s)

NBI CODINGS		
Item	Description	Coding
Item 113	Scour Critical Bridges	8
Item 113.1	Scour Plans of Action	
Item 113.2	Unknown Foundations	A





THANK YOU!

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