On April 5, 1987, two spans of the New York State Thruway (1-90) bridge over the Schoharie Creek fell about 80 feet into a rain-swollen creek.

On July 25, 1989 NCDOT established the Scour Evaluation Program Select Committee to develop a scour evaluation program for NCDOT → All existing bridges over water and designing new bridge to resist scour. (screening process)

Program includes the following steps:

1. Initial Screening
2. Prioritization for Structure Scour Evaluation
3. Assessment
4. Detailed Study
5. Plan of Action

The FHWA requested the program development by March 31, 1991 (Initial Screening only)
**Introduction**

1. Approximately 500,000 highway bridges overwater in the US.

2. Over 100,000 have been identified as unknown foundations by National Bridge Inventory.

3. No “As-Built” information available and a large number of these bridges are non-federal-aid. Meaning, that they were identified by owners while screening their bridges for their scour vulnerability.

4. FHWA demanded each State to code these bridges using Item 113 “Scour Critical Bridges” base on the Coding Guide for Structure Inventory and Appraisal of the Nation’s Bridges.

   - Low Risk: 4, 5, 7-9
   - Potential: 6
   - Critical: 0-3
   - Unknown Foundations: U
   - Tidal Bridges: T
Search for pile driving records, as-built plans, bill of materials, general drawings.

Field Visit

Collect historical hydro. information, channel soundings, field observation, bridge photos

Is the foundation information available?

Yes

No additional testing required, some educational testing may required

No

Field testing is needed

NDT (Non Destructive Testing)

Generate UF Report

Scour Committee

Half-Inch Rod Soundings

Estimate Pile Embedment and determine the foundation type.

Drilling Investigations (Maybe needed)
Bridge Document Management System (Project Wise)

Search by county name and bridge number

1. Bridge Document Management System - Recent BIR and streambed sounding history charts
Bridge Document Management System (Project Wise)

- Bridge Location
- Substructure Type
- Span no.
- Sufficiency Rating
- Substructure Condition
- Year Built
- Year Rehab
- ADT
- Bridge Length
- Bridge Location
- Substructure Type
- Span no.
- Sufficiency Rating
- Substructure Condition
- Year Built
- Year Rehab
- ADT
- Bridge Length
Also, any stated information that will assist the scour committee to code the bridge.
BMU Headquarter (Files Room)

Field Office Visits

2. Headquarter BMU files room

3. Field offices visits
· The UF database is a Microsoft Access Database.

· The User can access the unknown or the known foundation reports through two buttons.
Unknown Bridge Foundation Database

Launch the database
NCDOT Program

Field Testing using NDT Methods
NCDOT - Unknown Foundation NDT

- Sonic Echo/Impulse Response (SE/IR)
- Bending Wave (BW)
- Ultra Seismic (US)
- Parallel Seismic (PS)
- Induction Field (IF)
- ½” ROD and Hammer (RH)
PIT Test

Non-Destructive Testing
- Pile Integrity Test (PIT)
- Parallel Seismic
- Borehole Sonic
- Borehole radar
- Sonic Echo

Typical Set Up For PIT Test
Wake County - Bridge 910201 – Bent 2 - Pile 4 (Side Strike)

FURTHER INFORMATION

Pile Length: 18.0 ft
Wave Speed: 15000.0 ft/s
Wavelet: 4.00 ft 1875 Hz
Gage 1 at: 0 ft
Gage 2 at: 2 ft

Two Velocity Record Shown with Pile Profile
Which way is correct to mount the accelerometer?

Duplin County- Br 300105

Duplin County- Br 300105
PIT Test - Side Strike

Timber Pile

Wedge

Accelerometer
Stream Bed Soundings

Duplin County - Bridge 300230
Stream Bed Soundings

Wake County – Bridge 910374

Interior Bent

End Bent

Wake County – Bridge 910374
Half-Inch Rod Soundings

Wake County - Br 910201

½ " Steel Rod

Wake County - Br 910248
Half-Inch Rod Soundings

Duplin County- Br 300230
Field Observations

Check the condition of the IB, EB Piles?

Check the condition of abutment wall?
Field Observations

Check condition of wing wall Piles?
Field Observations
Check if debris piled up on bents?

Wake County – Br 910201

Camden County – Br 140013
Field Observations

Any scour or scour repair noted?
Field Observations

Check whether the stream attack is straight, mild curve or sharp bent?
Field Observations

Check the condition of the bridge deck?

Check whether the THALWEG has shifted?

Wake County – Br 910186

Gates County – Br 360008
Test the pile either from the top or the side.
Using PIT
Get as much information as you can.

PIT Test

½” Steel rod

Ask the neighbors about flood history.
Water level during flood
½” Rod drive
2. Drilling Investigation – Solid Stem Auger

Using a drill rig to estimate the rock depth
2. Drilling Investigation – Solid Stem Auger

Wake County- Br 910374

Wake County- Br 91201
Which Bridge will be funded first?

Bridge with Unknown foundation

Dangerous Bridge

Collapsed Bridge - Scour
3. Find X
3. Find x.

Here it is: [Equation]

Did we ask the question correctly?
The Past

Where are we now with the UF program

- Plan of action is over 20 years. (We are doing the same things)
- Is current procedure feasible?
- Is current procedure manageable to complete the remaining bridges?
- Is it necessary to evaluate all of the bridges on the UF list?
- Is UF report requirement are necessary for the safety?

Why are we recoding the UF bridges (FHWA – Why?)

- Are we checking the safety of whole components of the bridge?
- Are we checking the structural integrity of the piles?
 Changes

- Sub-regional Bridges
- Division managed Bridges

What should we do? and where should we go with UFP

- Develop intelligent plan of action with manageable process to address the following factors:
  1. Bridge Deficiency Rating.
  2. Substructure condition Rating.
  4. Continues Bridge inspection program.

- Assemble an experience team to scan these bridges similar to sub-regional bridges process.
Asset Management

Condition of most critical components?

If it is foundation:

Condition and the integrity of the foundation

Pile Embedment (minimum)

Condition of Pile (Integrity)

Need to look at the integrity of the entire structure

Instrumentation to obtain load carrying capacity in order to determine posting requirement.
This is where we are now
With many questions

Welcome

We need to talk
The Future

Chart

Risk Based Management for Scour

The NCDOT Risk Based Management approach
NCHRP 24-25
QUESTIONS?