Underwater Bridge Inspection
Underwater Bridge Inspection

- Brian Schroeder, PE, CWI, ITL
  - Ayres Associates

- Evan Currie, PE, ITL
  - Great Lake Engineering Group
Underwater Bridge Inspection

- Managing
- Assigning
- Reviewing
- Assisting/witnessing
Managing

Underwater Bridge Inspection
Managing

• Plans
• Previous reports
• When to dive
• Dive team
• Underwater
Plans

- Most important
  - What is underwater

- Readily available
  - Bridge’s file
  - Owner’s database
    - Wisconsin DOT
      - Plans and reports online
      - B-38-0021
Previous Reports

• All applicable
  – Underwater inspection
  – Routine inspection
  – Structure inventory & appraisal

• Electronic files
  – MBIS/MBRS
  – Owner’s database
When To Dive

- National Bridge Inspection Standards (NBIS)
  - “...cannot be inspected visually at low water by wading or probing...”

- General site conditions
  - Water depth > 4 feet
  - Swift current
  - Obstructions
Dive Team

• Trained divers
  – NBIS
    • Comprehensive or underwater bridge inspection course
  – MDOT
    • Three years’ diving and reporting experience
    • Trained on equipment used
    • Underwater bridge inspection course
  – MIOSHA
    • “…assigned tasks in accordance with member’s experience or training…”
Dive Team

- Inspection Team Leader
  - NBIS
    - Five ways
    - Combination of education and years of experience
  - MIOSHA
    - Designated employee in charge
Dive Team

• Inspection Team Leader
  – MDOT
    • Three years’ diving and reporting experience
    • Trained on equipment used
    • Inspection courses (National Highway Institute)
      – Safety Inspection of In-Service Bridges
      – Bridge Inspection Refresher
      – Underwater Bridge Inspection
      – Engineering Concepts for Bridge Inspectors (non PEs)
Underwater

- Diving equipment
  - SCUBA
  - Surface supplied air
- Exposure suits
  - Dry suit
  - Wet suit
  - Coveralls
Underwater

- Diving equipment - SCUBA
Underwater

- Diving equipment – surface supplied air
Underwater

- Support equipment
  - Boat
  - Decompression chamber
  - Crane
Underwater

• Access
Underwater

- Access
Underwater

- Bridge size
Underwater

- Bridge size
Underwater

- Mackinac Bridge
  - Piers
  - Trestle bridge
  - Riprap
Mackinac Bridge - piers
Underwater

- Mackinac Bridge - piers
Underwater

- Mackinac Bridge - piers
Underwater

- Mackinac Bridge - piers
Underwater

- Mackinac Bridge - trestle
Underwater

- Mackinac Bridge - riprap
Underwater

• Mackinac Bridge
  – Typical findings
    • Concrete overspill
    • Exposed H-pile
    • Exposed aggregate
Underwater

- Mackinac Bridge – exposed aggregate
Underwater

- Lift Bridge
  - Access
  - Scour
  - Pier design
Underwater

- Lift Bridge - access
• Lift Bridge – scour
Underwater

- Lift Bridge – scour and pier design
Underwater

- Lift Bridge – pier design
Underwater

• Other Structures – dolphins
Managing

- Plans
- Previous reports
- When to dive
- Dive team
- Underwater
Assigning Bridges

- Previously inspected
- Newly constructed
- Special access
Previously Inspected

- Frequency
  - 60 months
  - Same month as previous
  - Required for FHWA metrics

- Borderline structures
  - Dive again
  - Respective costs
    - Water depth
    - Quantity of substructure units
Newly Constructed

- Construction contract
  - Initial underwater inspection
- Timing
  - Prior to bridge opening
  - Before contract leaves site
- Report
  - Punch list
Newly Constructed

• Punch list
  – Recommendations from initial dive
  – Contractor addresses list before released

• Post-punch list
  – Another dive
  – Specific to punch list
  – Respective cost
Newly Constructed

- 03023-B04, M-89 over Kalamazoo River
Newly Constructed

- 03023-B04, M-89 over Kalamazoo River
Special Access

- GCRC 2703, Silver Road over Lobdell Lake
  - Upstream profile
Special Access

- GCRC 2703, Silver Road over Lobdell Lake
- Downstream profile

Date: 11.10.2011
Special Access

- GCRC 2703, Silver Road over Lobdell Lake
Special Access

- GCRC 2703, Silver Road over Lobdell Lake
  - Access
    - Upstream gates opened
    - Surface-supplied air
  - Inspection types
    - Underwater
    - Routine
  - Dive every 24 months
Assigning Bridges

- Previously inspected
- Newly constructed
- Special access
Report Review

Underwater Bridge Inspection
Report Review

- General Appearance
- Complete Statements
- History
- Exercise
General Appearance

- Bound appropriately
- Minimal contents
  - Table of contents
  - Photo Log
  - MBIS Report
  - Sounding / Notes Plan
  - Streambed Profiles
General Appearance

• Other Information
  – Hydrographic Survey
    • Current depths
    • Change in depth
  – Underwater video
    • Timeline
  – Other?

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>04:11 – 05:48</td>
<td>North side spillway</td>
</tr>
<tr>
<td>04:35 – 05:35</td>
<td>Typical concrete condition below water</td>
</tr>
<tr>
<td>05:36 – 05:48</td>
<td>Log located on channel bottom</td>
</tr>
</tbody>
</table>
Complete Statements

• Correct grammar
• Consistency
  – Abbreviations
  – Dimensions
• Make sense
  – 39102-B01, M-89 Over Gull Creek
  – Recommendation: recheck softness of concrete piles in next underwater inspection
Complete Statements

- 39102-B01, M-89 Over Gull Creek
Complete Statements

- 39102-B01, M-89 Over Gull Creek
History

• Deficiencies
  – Previous vs. current
  – Identify new deficiencies

• Recommendations
  – Action taken on previous?
  – New recommendations with reasoning
History

• Streambed profiles
  – Longest history possible
  – Simple (spreadsheet)
  – Detailed (CADD)
History

- Streambed profiles
Exercise

- Fill in the blank
- Handouts
  - Groups A and B
- Mingle
- Complete reports
  - Fill in the blanks
Report Review

- General Appearance
- Complete Statements
- History
- Exercise
Assist / Witness

Underwater Bridge Inspection
Assist / Witness

- Safety
- Field Schedule
- Optimize opportunity
Safety

• Coordination
  – Other staff
  – Dive team
  – Location
  – Time

• Identify training
  – First Aid / CPR
  – Diver
  – Boat operator
Safety

• Make yourself comfortable
  – Afraid of water
    = no boat
  – Appropriate clothing
Safety

• Not in harm’s way
  – Where to sit in the boat
  – Proximity to equipment
Safety

• Not in harm’s way
Safety

• Personal Protective Equipment
  – Life vest
  – Hard hat
  – Safety glasses
  – Steel-toed footwear
Field Schedule

- **Window of time**
  - Sun up to sun down
  - Part of a day

- **Number of bridges**
  - 1 bridge for many days
  - Multiple bridges in 1 day
Optimize Opportunity

- Underwater photos/video
  - Obtain
  - Review
- Assist with field report
  - Fill in notes
  - Take measurements
- Ask questions!