

# Underwater Bridge Inspection

## Planning, Experiences & Considerations

ABCD Northeast Ohio Chapter



# Bridge Inspection Qualification Requirements

- INSPECTION CRITERIA
- CLIMBING
- UNDERWATER
  - FHWA/NBIS
  - DTL - FHWA UW INSPECTION
  - INSPECTOR – FHWA EQUIV. COURSE AND NATIONAL DIVE CERTIFICATION



# MISCONCEPTIONS



# UNDERWATER ENVIRONMENT



## Underwater Environment

- Weather



## Underwater Environment

### □ Current



# Underwater Environment

- Obstacles



# Underwater Environment

- Equipment



# Underwater Environment

## □ Equipment








# Underwater Environment

- Equipment



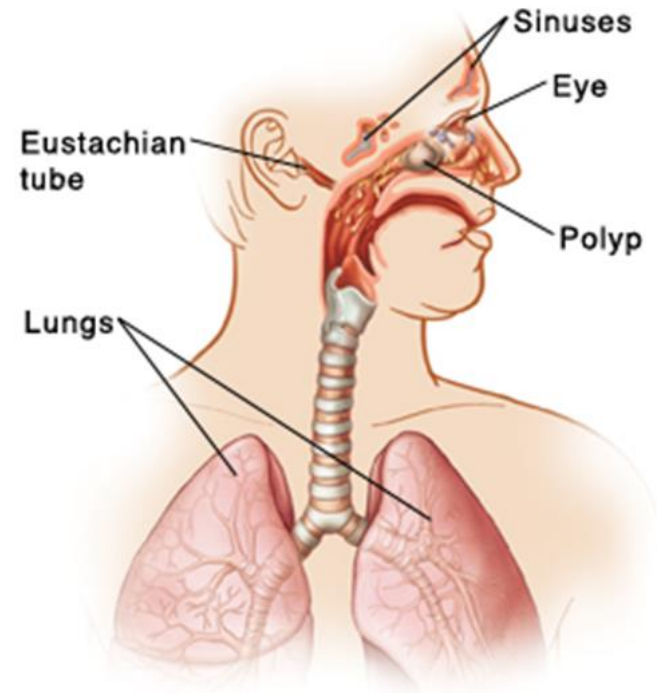
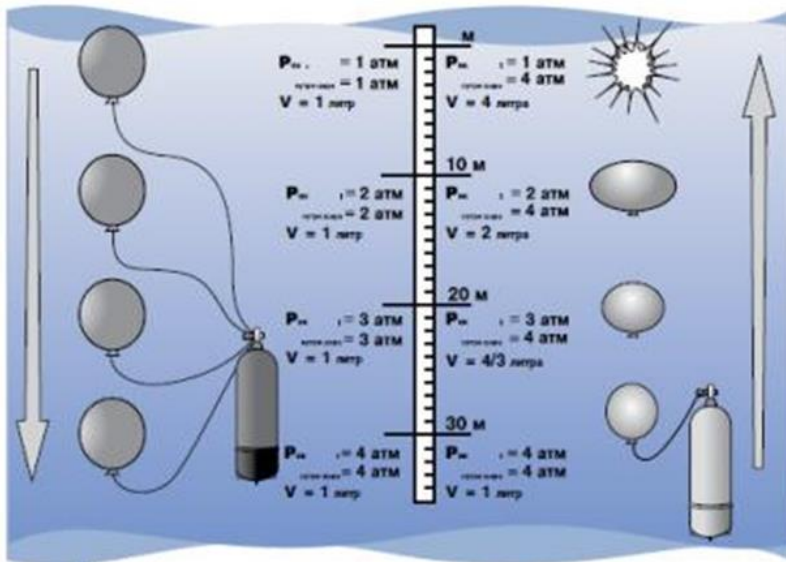
## Underwater Environment

- Pressure
  - $PV = nRT$
  - 1 atm (bar) = sea level
  - 10 m (33 ft) underwater = 1 atm
- $PV = nRT$ 
  - $P \times 2 = V / 2$
  - $P \times 3 = V / 3$
  - $P \times 4 = V / 4$

Depth	ATM	Air Volume	
0 m	1	1	
10m	2	1/2	
20m	3	1/3	
30m	4	1/4	
40m	5	1/5	

# Underwater Environment

- Squeeze
  - Air voids
  - Equalize
  - Lungs



## Underwater Environment

- Air
  - Oxygen
  - Nitrogen
  - Nitrogen Narcosis
  - Decompression Sickness



# UNDERWATER INSPECTION



# Underwater Inspection

- Clearing



## Underwater Inspection

- Clearing



# Underwater Inspection

- Clearing



Before

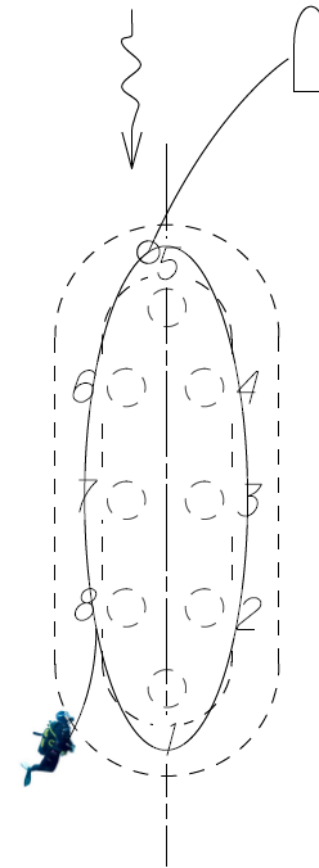


After



# Underwater Inspection

- Current



PIER PLAN

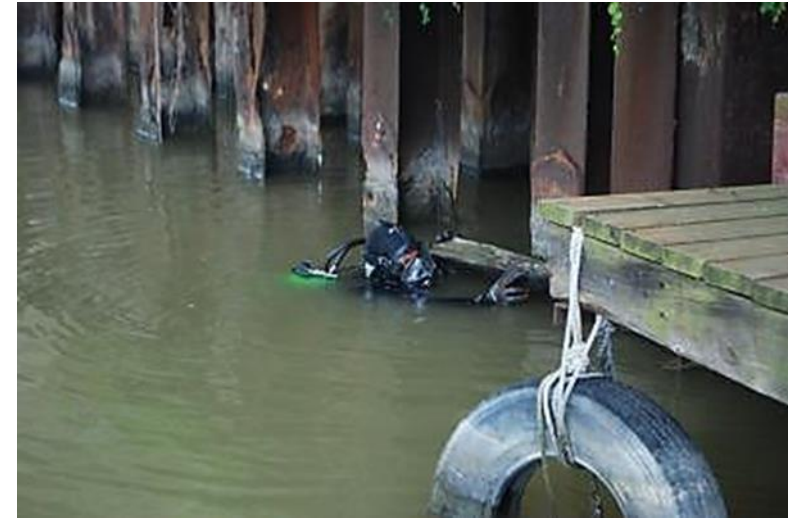
# Underwater Inspection

- Current



# Underwater Inspection

## □ Scour – Piers and Bulkheads



# Underwater Inspection

## □ Report


**Washington County Engineer's Office**  
County Road 60 & Water Street over Muskingum River  
(WAS-C0060-0625)  
Underwater Inspection Report

*Submitted to:*  
**Washington County Engineer's Office**  
103 Westview Avenue  
Marietta, Ohio 45750

*Prepared by:*  
**Barr & Prevost**  
2800 Corporate Exchange Dr.  
Suite 240  
Columbus, Ohio 43231

**November 16, 2013**

**BARR & PREVOST**  
ENGINEERING | TESTING | SURVEYING




*County Road 60 & Water Street over Muskingum River* *Washington County Bridge Inspections  
Barr & Prevost*

**WAS-C0060-0625, County Road 60 & Water Street over Muskingum River**

**Bridge Information:**

- *Bridge No.:* WAS-C0060-0625
- *Structure File Number:* 8433127
- *Facility Owner:* Washington County
- *Facility Carries:* County Road 60 & Water Street
- *Waterway:* Muskingum River
- *Completed by:* Barr & Prevost
- *Inspection Date:* November 16, 2013
- *Inspection personnel:* Julia David – Registered P.E., Level II Bridge Inspector, FHWA Underwater Inspection Certified  
Michael Ohanian – Level II Bridge Inspector, FHWA Underwater Inspection Certified  
Steven Hart – Field Survey Party Chief  
Mike Davis – Field Survey Party Rodman



**Picture 1 - County Road 60 & Water Street over Muskingum River**

1

# Underwater Inspection

## □ Report

County Road 60 & Water Street  
over Muskingum River

Washington County Bridge Inspections  
Barr & Prevost

### Items to Note Pertaining to this Site:

- *Scour susceptible substructure units:* Pier 1, Pier 2, Pier 3, Pier 3A and Pier 5
- *Average water depth:* Pier 1 – 8 ft, Pier 2 – 11 ft, Pier 3 – 14 ft, Pier 3A – 17 ft and Pier 5 – 10 ft
- *Channel description:* The Muskingum River flows
- *Estimated stream velocity:* less than 2.5 fps
- *Water visibility:* less than 1 inch
- *Weather:* 51°, Rainy (11/16/2013)
- *Existing scour protection:* Rip rap (Dumped Rock or Rock)



Picture 2 - Pier 3 & Pier 3A

2

County Road 60 & Water Street  
over Muskingum River

Washington County Bridge Inspections  
Barr & Prevost



Picture 3 - Pier 3, Pier 3A and Pier 5

### Inspection Procedure

The substructure units that were susceptible to scour were inspected by a team comprising of: Registered P.E. Level II Bridge Inspector, Level II Bridge Inspector, field survey party chief and a field survey party rodman. Scour inspection was facilitated by surveying the channel bottom around the pier foundations and the submerged portions of the substructure units were inspected by a FHWA underwater inspection certified scuba diver using tactile methods and probing.

In general, the procedure involved surveying elevations upstream and downstream of the bridge for approximately 50 ft. A 'grid' pattern was utilized for obtaining bottom of river elevations along the face of the foundations and at quarter points between spans. The baseline datum was established using the existing plan elevation for Pier 4 at the north fascia girder beam seat. The data points collected were downloaded and a digital terrain (contour) model of the river bottom around the piers that would be susceptible to scour was prepared, see the Site Plan sheet included. This contour model will provide a baseline for future scour inspections.

In addition to the 'grid' elevation data points, the top of pier elevations were surveyed for comparison to the existing plan elevations to see if the piers have settled. If the difference in

3

# Underwater Inspection

## Report

County Road 60 & Water Street  
over Muskingum River

Washington County Bridge Inspections  
Barr & Prevost

elevations is excessive this can be an indication of pier instability due to scour undermining the pier foundation.

### Findings

No undermining or scouring of Pier 2 was detected. The northeast corner of the footing of Pier 1 is exposed 3 ft along the north and east sides of the pier to a depth of 2 ft. Pier 3 and Pier 3A sit on the same footing/pile cap. The upstream face of the footing under the columns of Pier 3A is exposed 2 ft on northeast corner and extends to be 2 ft below the bottom of the footing at the northwest corner of the footing (see detail provided). The footing of Pier 5 is exposed on the west side of the footing. It varies from 3" on the downstream side to 3 ft at the southwest corner to 2 ft at the northwest corner and 1 ft on the north side. No undermining of the footing of Pier 5 was detected. The concrete on the submerged portions of the piers is in good condition.

Table 1 below tabulates the bearing seat elevations between the existing plans and field survey elevations collected at the time of the inspection. As indicated in the table, the differences in elevations from the plans and the survey are minor and do not indicate undermining or instability.

Table 1 – Pier Plan Versus Surveyed Elevations

Location	Existing Plan Elevations (ft)	Surveyed Elevation (ft)	Elevation Difference from Existing (ft)
Pier 2	629.59	629.38	-0.21
Pier 3	634.31	634.18	-0.13
Pier 3A	637.67	637.28	-0.39
Pier 4 (Benchmark)	633.76	633.82	0.06
Pier 5	634.81	634.58	-0.23
Pier 6	628.64	628.40	-0.24

Table 2 tabulates the Bridge Inspection Report items that will need to be updated as a result of this inspection. Table 3 tabulates the Bridge Inventory items that will need to be updated as a result of this inspection.

Table 2 – Bridge Inspection Ratings

Substructure	
33. Abutments	1
35. Piers	1
40. Scour	3 2
42. Substructure Summary	6

County Road 60 & Water Street  
over Muskingum River

Washington County Bridge Inspections  
Barr & Prevost

Channel		
51. Alignment		1
52. Protection	(Rip Rap)	1
53. Waterway Adequacy		1
54. Channel Summary		8

Table 3 – Bridge Inventory Items

Item No.	Description	Code	Note
75	Channel Protection	Y	Rip Rap (Dumped Rock or Rock)
189	Underwater Inspection	Y	Bridge to be inspected by diving
		60	5 year frequency
		111713	November 16, 2013

### Recommendations

The scour susceptible substructure units for this bridge consist of Pier 1, Pier 2, Pier 3, Pier 3A and Pier 5. It is recommended that rock channel protection be placed around the Pier 3 and Pier 3A and that this bridge be monitored for scouring and undermining on the five year underwater inspection cycle.

Inspector Signature:

*Julia A. David*

Julia A. David, PE (OH# 69738)

Date:

12/23/2013

Reviewer Signature:

*James E. Prevost*

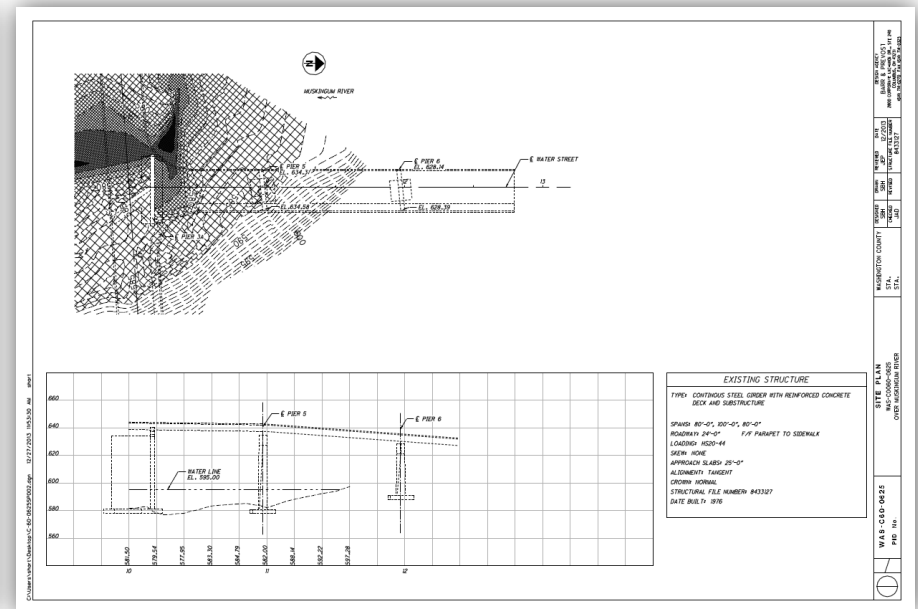
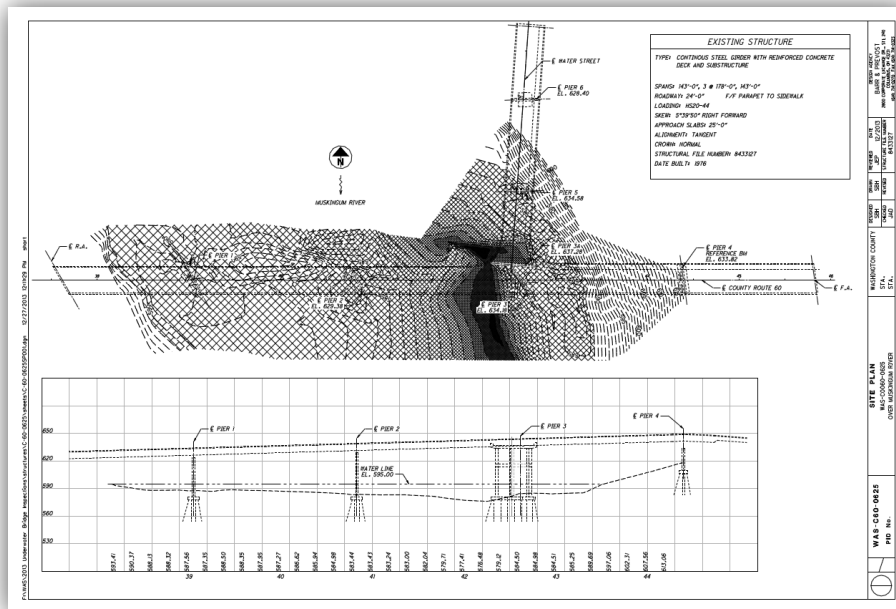
James E. Prevost, PE (OH# 64055)

Date:

12/26/2013

# Underwater Inspection

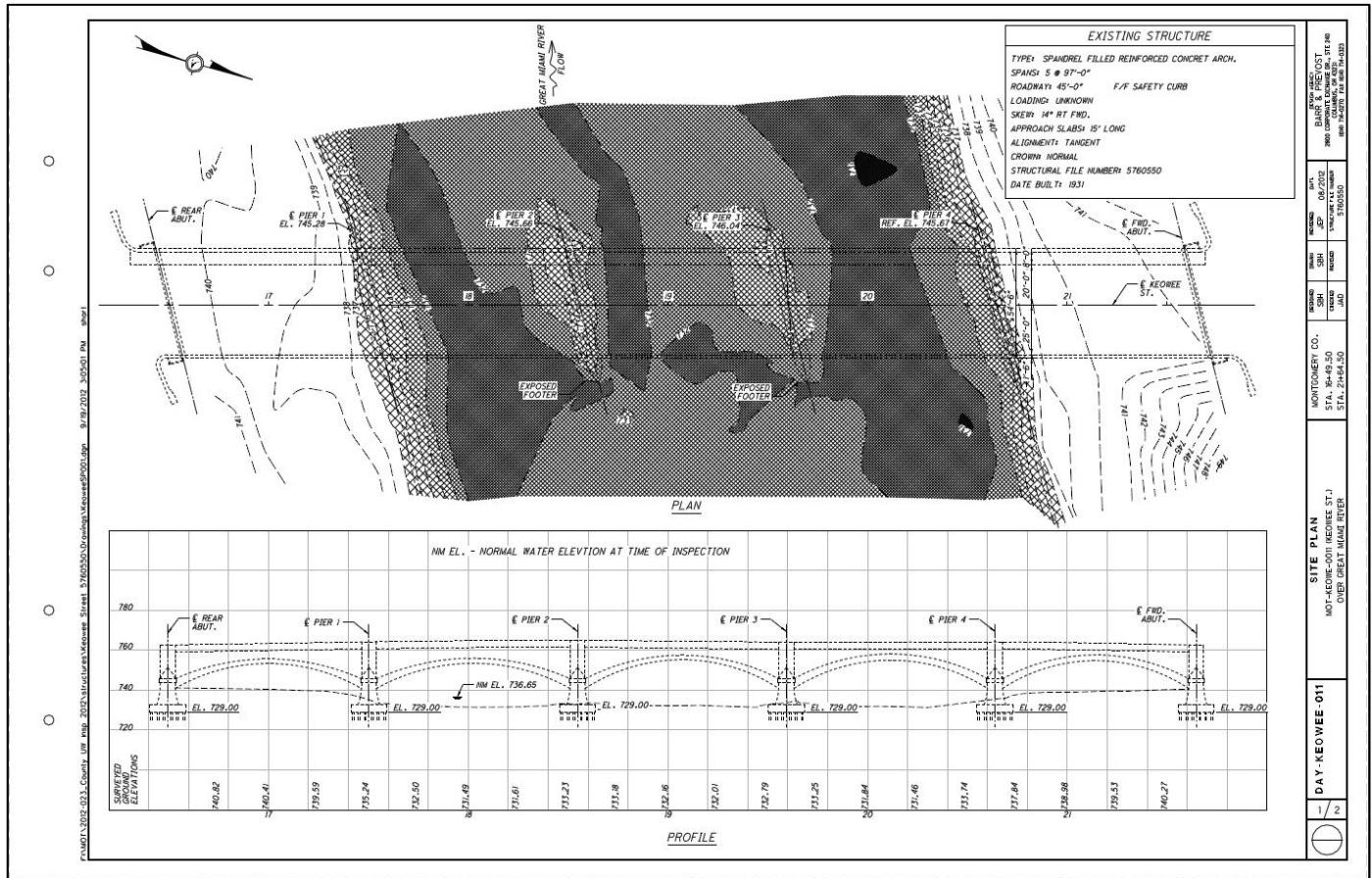
## □ Report





# Underwater Inspection

□ Report



# Underwater Inspection

□ Report

