

Quincy North Bay Bridge Inspection

Prepared for:

Klingner & Associates

Quincy, IL

Prepared by:



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Inspection Dates: October 7, 8, 2014

QUINCY NORTH BAY BRIDGE INSPECTION, QUINCY, IL
REPORT TO: KLINGNER & ASSOCIATES
INSPECTION PERFORMED ON
OCTOBER 7 & 8, 2014

Introduction

Mainstream Commercial Divers, Inc. (MCDI), Murray, KY, was contracted by Klingner & Associates, Quincy, IL, to perform a routine underwater bridge inspection and provide soundings around the in-water piers of the North Bay Bridge located over Quincy Bay in Adams County, Quincy, IL.

The bridge was originally built in 1898 as a railroad bridge. The bridge was built with five stone piers and two stone abutments, with four timber pile bents added later (see photos #1, #2, #3, #4). The west abutment was in the dry and therefore was not inspected. The topside conditions of the timber pile bents had already been determined to be in poor condition by Klingner & Associates and prior to the last inspection, MCDI was told not to perform a substructure inspection on them.

The water elevation at the time of the inspection was 470.52' above mean sea level (NAVD 88) on the Mississippi River gauge at Quincy, IL.

Methods

A qualified three-man dive team provided by MCDI performed a Level-1 and partial Level-2 visual and tactile inspection of the underwater elements of the bridge piers as described in the Bridge Inspector's Reference Manual (December 2006). Surface supplied diving equipment with voice communications was utilized to conduct the inspection. A tactile inspection was required for portions of the inspection due to the poor visibility below the water surface. The diver used a probe rod in an attempt to identify the extents of each pier foundation. The diver also investigated for scour holes or voids under or near the pier foundation and identified the river bottom material around the bridge piers. Soundings were taken around the bridge piers in ten foot increments out 50' from the edge of the piers (see drawing 1). A stadia rod was utilized where the water was shallow enough, and a depth finder mounted on the boat was utilized when it was not. The inspection and readings were taken in accessible locations around the piers, but were restricted in areas due to a significant buildup of timber debris on the east side of the bridge (see photos # 3, #5, #6, #7,). The purpose of the inspection was to inspect the underwater portions of the bridge piers and exposed portions of their foundations. However, if in the course of this inspection the inspector noticed any significant defects in the pier or pier caps above water, it was noted in this report.

Inspection and Soundings

Pier #21 – Upper Bay Bridge (See Photo #8)

At the time of the inspection, Pier 21 was in 3' to 8' of water. The diver began the inspection on the west face of the pier. There was 3' of water along the edge of the pier. The diver inspected all of the underwater horizontal and vertical joints, looked for cracked or missing blocks, and attempted to locate a footing. No cracked or missing blocks were observed and the mortar appeared to be in good condition with very little mortar missing.

The diver used a 4' probe to probe around the base of the pier to try to locate a footing. The diver was able to probe around the west side of the pier without hitting anything solid. However, on the east side of the pier he reported a consistent probe depth of approximately 3' to 4' alongside the pier, which was possibly a footing. The substrate was primarily a soft, sand-silt mix.

Pier # 22 - Upper Bay Bridge (See Photo #9)

At the time of the inspection, pier 22 was in 11' to 21' of water. Pier 22 was of the same design as pier 21 except that it had two rub rails (fenders) that appeared to be made of railroad track steel. The first rub rail was at the water's edge and the second rub rail was approximately 3' below the water's surface. Each rub rail was constructed in two sections and then anchored to the blocks (see Photo #9).

The diver began the inspection on the west face and worked in a counter-clockwise direction around the pier. The diver inspected all of the underwater horizontal and vertical joints, looked for cracked or missing blocks, and looked for a footing. On the west face, the first three rows down from the water surface had a section of mortar missing along the horizontal joint, approximately 8" long, 3" deep, with a 1/2" wide gap. On the bottom row from the northwest miter, there was mortar loss on a horizontal joint over an 18" area, 6" deep, with a 3/4" wide gap. Near the center of the west face, there was a vertical joint with missing mortar, approximately 14" long, 12" deep, and 1/2" wide gap. This level of mortar loss was typical for all six faces of pier 22. There was a light layer (less than 1/16") of algae growth on the entire surface, a portion of which the diver wiped off for a more thorough inspection.

Localized scour has caused part of a timber crib foundation composed of horizontally positioned timbers and vertical timber piles, located beneath the masonry pier, to become undermined (see drawing 2). The pier had a stone footing (ledge) approximately 8" wider than the pier and composed of one course of stone, which was supported by the timber crib work and timber piles. The 8" wide stone ledge was evident around a majority of the base of the pier. The timber crib supporting the masonry pier was approximately 15' wide. The crib was founded on timber piles; however, the diver could not determine how the piles tied into the crib. The west side of the crib was undermined for approximately 10' starting from the southwest corner, and another 4' of the crib was exposed before the river bottom covered the top of the crib. Along the east side, 3' of the crib was undermined, and another 5' was exposed before the river bottom covered the top of the crib. The diver took a depth reading on top of the timber crib and recorded 13' of water, 17' on the bottom of the crib, and 20' on the river bottom below the downstream pier nose. The

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diver found three vertical timber piles exposed. The diver noted that the condition of the timber elements were soft and decaying. The diver easily penetrated a timber pile with the tip of his dive knife approximately 3/4".

Pier # 23 - Upper Bay Bridge (See Photo #10)

At the time of the inspection, pier 23 was in 5' to 10' of water. Pier 23 was a six sided hexagonal shaped pier that supported the movable span. The diver began his inspection on the south side of the pier. The diver inspected all of the horizontal and vertical joints, looked for cracked or missing blocks, and looked for a footing. The inspection crew observed that on the south face, above the water surface, there were three cracked blocks. The worst of these cracks was located on the pier cap on the southwest face. The horizontal crack on the southwest face ran the length of the block and was approximately 2-1/2" wide (see photos #11, #12). The second crack was located on the third row down from the aforementioned block (see photo #13). The third crack was located on the downstream adjacent block and ran vertical for the entire height of the block (see Photo #14). There was a section of the pier cap that appeared to be broken away on the northwest face (see Photos #15, #16).

When the diver inspected the upstream face he found three blocks that appeared to have some possible impact damage. The first block was on the northeast face, at the water's surface, toward the downstream end of the face. The damage was approximately 36" long, 13" tall, and 7" deep at the deepest point (see photo #17 and video). The second block was also at the water's edge, on the northeast face, closer to the north. The damage was 25" long, 15" tall, and 4" deep at the deepest point (see photo #18 and video). The third damaged block was also at the water's edge, on the northwest face, near the north edge of the face. The damage was 12" long, 8" tall, and 4" deep at the deepest point (see Photo #19). There was a light layer of algae growth on the entire surface, a portion of which the diver wiped off for a more thorough inspection.

The diver observed typical mortar conditions which consisted of sections with 2" to 3" of mortar loss, approximately 1/2" deep. The diver was able to probe 3' to 4' around the pier, except for the upstream side, which had a rip-rap substrate. The diver found approximately 12 blocks, which appeared to be used during the construction of the pier, randomly lying on the downstream side of the pier.

Pier # 24 - Upper Bay Bridge (See Photo #20)

At the time of the inspection, pier 24 was in 10' to 12' of water. Pier 24 was of the same design as pier 21 and pier 22.

The diver began his inspection on the south side of the pier. The diver inspected all of the horizontal and vertical joints, looked for cracked or missing blocks, and looked for a footing. On the downstream face, the first horizontal mortar joint from the surface running from the southwest miter to the nose was missing mortar, approximately 12" deep with a 3/8" gap. There was a section of block missing on the southwest miter. The area was 3" long, 6" wide, and 2" deep. The east face had typical mortar loss. The center of the upstream nose, two blocks below the water surface, was missing a section of stone approximately 3" long, 3" wide, and 2" deep.

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The diver found a section of exposed footing (stone ledge step out) on the southwest corner, with no undermining found. Approximately 18" to 20" of the ledge was exposed. The ledge was followed for 4' to the west before it became covered up by the river bottom. The ledge was followed for 11' to the north before it became covered up by the river bottom. The west ledge was found using a probe rod on the west side of the pier. The diver probed down an average of 12" to 18" before hitting the ledge. The substrate consisted of a soft infill. There was a light layer of algae growth on the entire surface.

Pier # 25 - Upper Bay Bridge (See Photo #21)

At the time of the inspection, pier 25 was in 8' to 11' of water. Heavy timber debris was noted on the upstream side of the pier. Pier 25 was of the same design as pier 21, pier 22, and pier 24.

The diver began his inspection on the south side of the pier. The diver inspected all of the horizontal and vertical joints, looked for cracked or missing blocks, and looked for a footing. The majority of the joints showed very little loss of mortar, and what loss had occurred was primarily on the upstream side. Where loss had occurred, the missing mortar was approximately 1/2" wide and 2"-3" deep on the north face. However, the south face had a little more erosion of the joints starting at the water's edge and extending downward. The widest area of mortar loss was located on the south face, approximately 6" above the water surface, and was approximately 3" wide, 12" long, and 3" deep (see Photo #22). The diver was not able to inspect all of the joints and was unable to check all the way around the pier for a footing due to heavy timber debris primarily on the north, east, and west sides (see photo #21). The diver was only able to inspect 10' down the east side of the pier, and 6' down the west side of the pier. The downstream side of the pier was completely accessible. In the areas that the diver could inspect, the joints appeared to be in good condition.

The diver was not able to locate a footing in the areas that were exposed. The diver attempted to probe around the pier, but was unable to due to a rip-rap and timber substrate. The substrate around the pier was rip-rap and sand on the downstream side and timber debris on the north, east, and west sides. There was a light algae growth on the pier.

East Abutment

On the day of the inspection, the west face was the only portion of the abutment that was in the water. There was very heavy timber and brush debris accumulated in front of the west face (see photo #23). Due to the amount of debris and the fact that the water depth was 3' or less, the diver waded along the west face looking for cracks, missing blocks, and scour holes.

To conduct the inspection, the diver entered the water from the bank on the downstream side and worked his way upstream. The diver inspected all of the horizontal and vertical joints, looked for cracked or missing blocks, and looked for a footing. The pier cap of the abutment appeared to have a damaged block toward the center of the pier (see photo #24). No associated damage was observed underwater.

The diver attempted to probe for a footing and was unable to locate one. The substrate was primarily timber debris with patches of silt amongst the timber debris.

Conclusion

While onsite, MCDI personnel informed Klingner personnel (Ryan Phelps, P.E.) of the rough dimensions of the scour hole under the pier. The scour is a significant concern and we feel should be addressed immediately, as well as the timber debris that is built up around the east abutment. We believe that the timber debris may be putting a significant strain on the uninspected timber bents and could be constricting flow causing the scouring at Pier 22. We were told in the field not to inspect the timber bents, and later told by Klingner that the timber bents are not touching or supporting the bridge structure. The scour hole wasn't present during the 2009 inspection and the timber debris has gotten significantly worse since the 2009 inspection. Further Level III inspection including penetration of the scour hole could be performed in order to obtain better dimensions of the scour and attempt to identify the number and location of the vertical piles if desired for engineering analysis.

[End of Report]

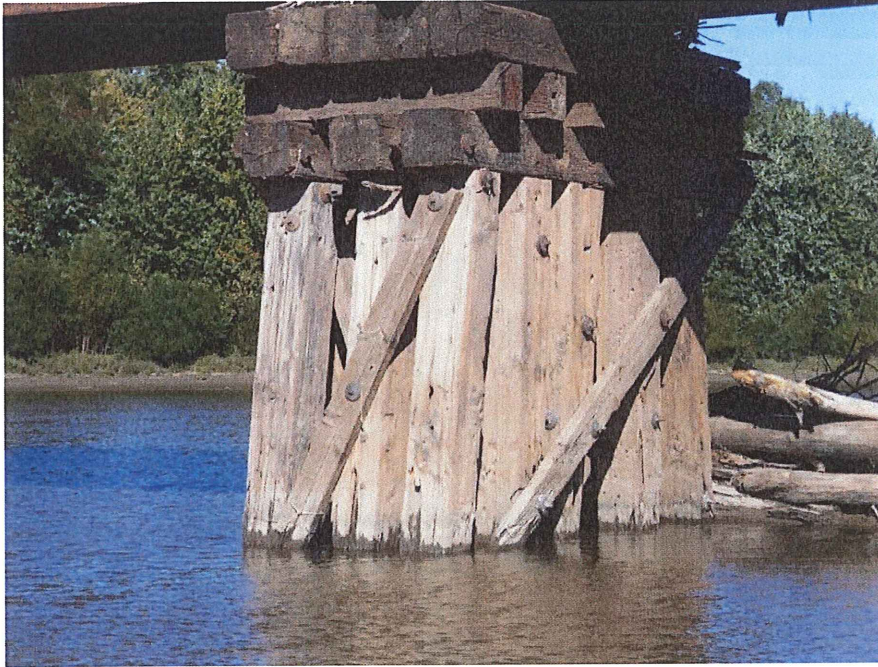


Photo #1: Timber Pile Bent



Photo #2: Timber Pile Bent



Photo #3: Timber Pile Bent/ Timber Debris Buildup

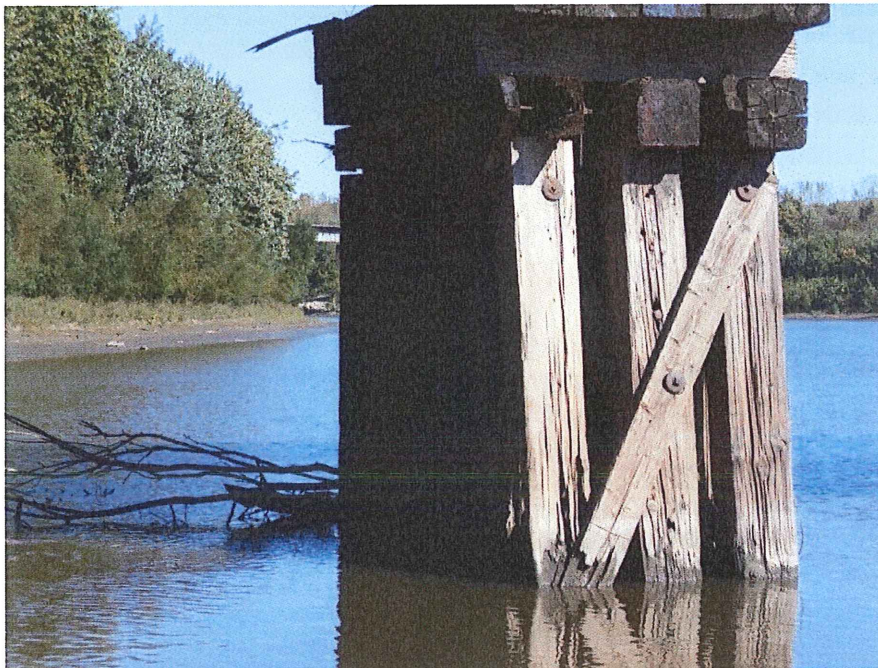


Photo #4: Timber Pile Bent

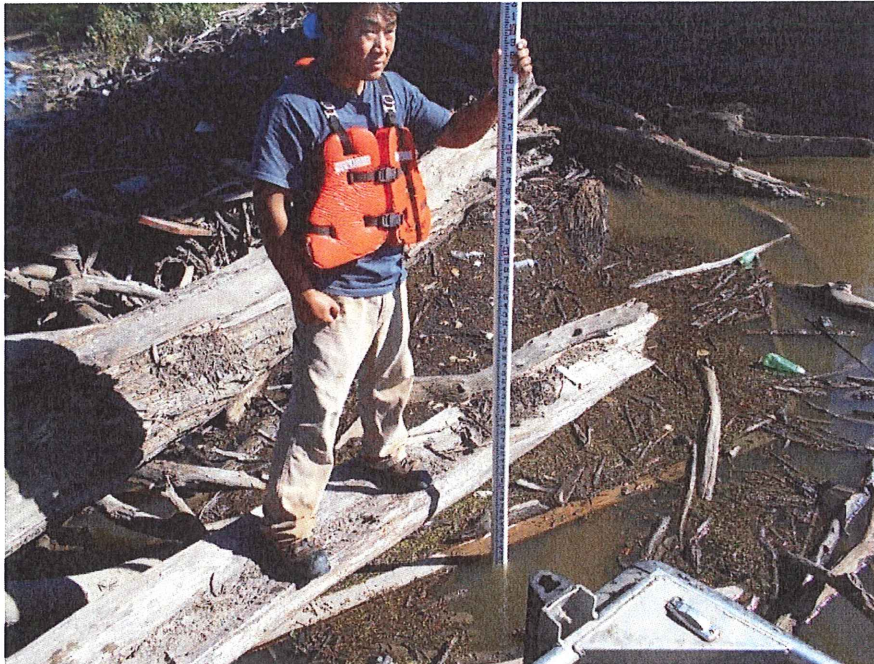


Photo #5: Timber Debris Buildup



Photo #6: Timber Debris Buildup



Photo #7: Timber Debris Buildup

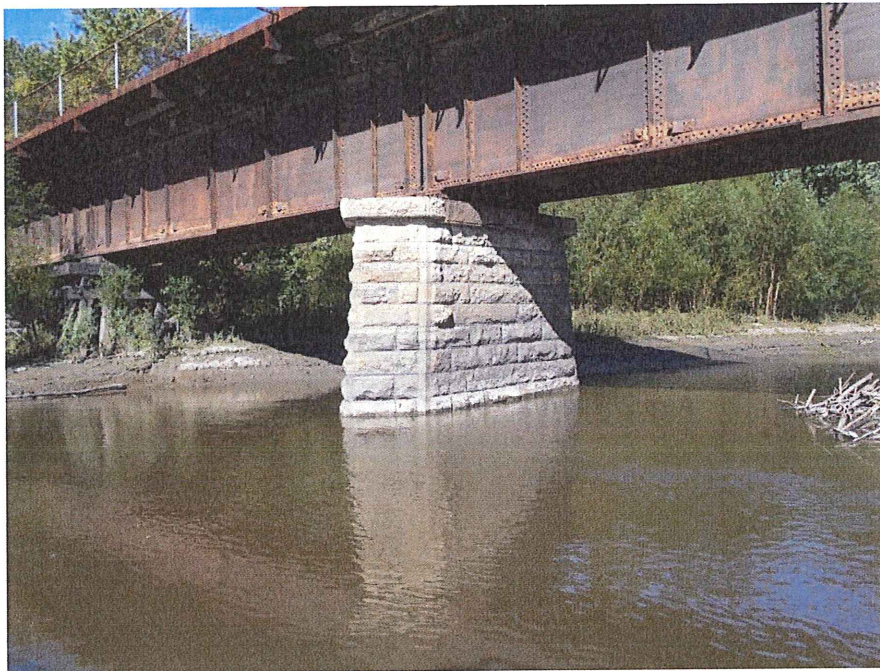


Photo #8: Pier #21

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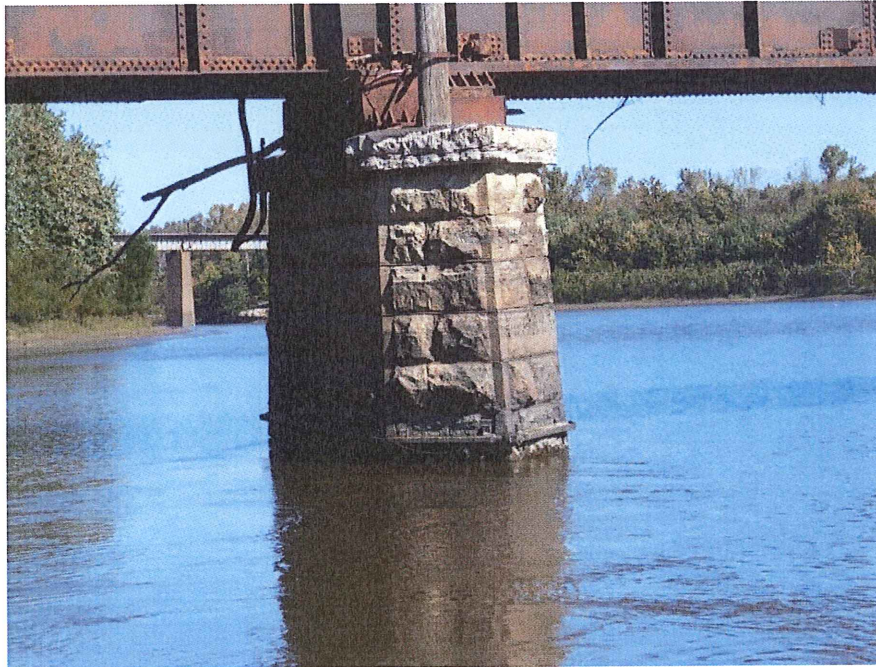


Photo #9: Pier #22

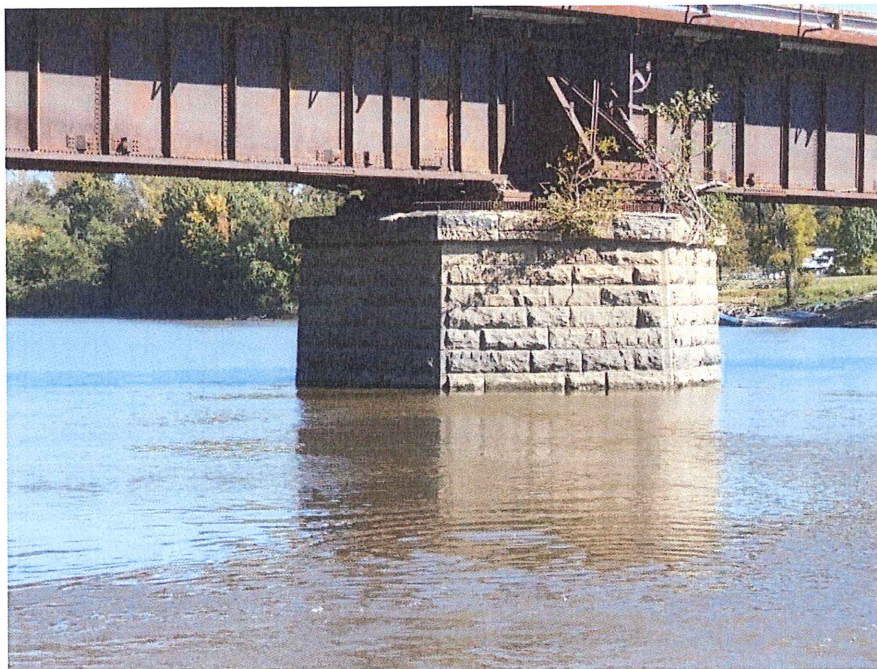


Photo #10: Pier #23



Photo #11: Horizontal Crack on the Southwest Face of Pier #23

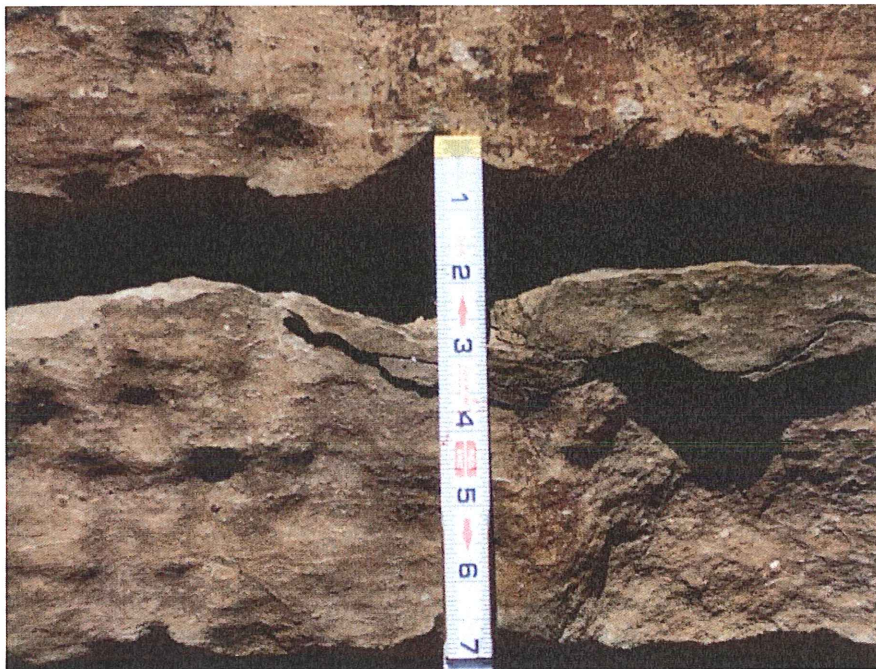


Photo #12: Horizontal Crack on the Southwest Face of Pier #23



Photo #13: A Second Crack on the Southwest Face on Pier #23



Photo #14: A Third Crack on the Southwest Face on Pier #23



Photo #15: Broken Section of a Pier Cap on Pier #23



Photo #16: Broken Section of a Pier Cap on Pier #23



Photo #17: Damaged Area on Pier #23



Photo #18: Damaged Area on Pier #23



Photo #19: Damaged Area on Pier #24



Photo #20: Pier #24

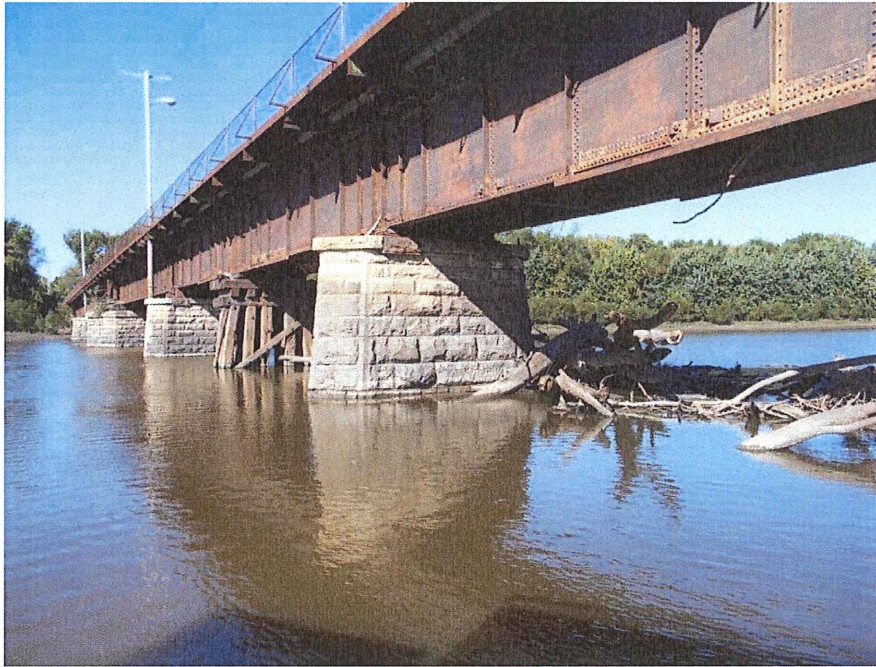


Photo #21: Pier #25

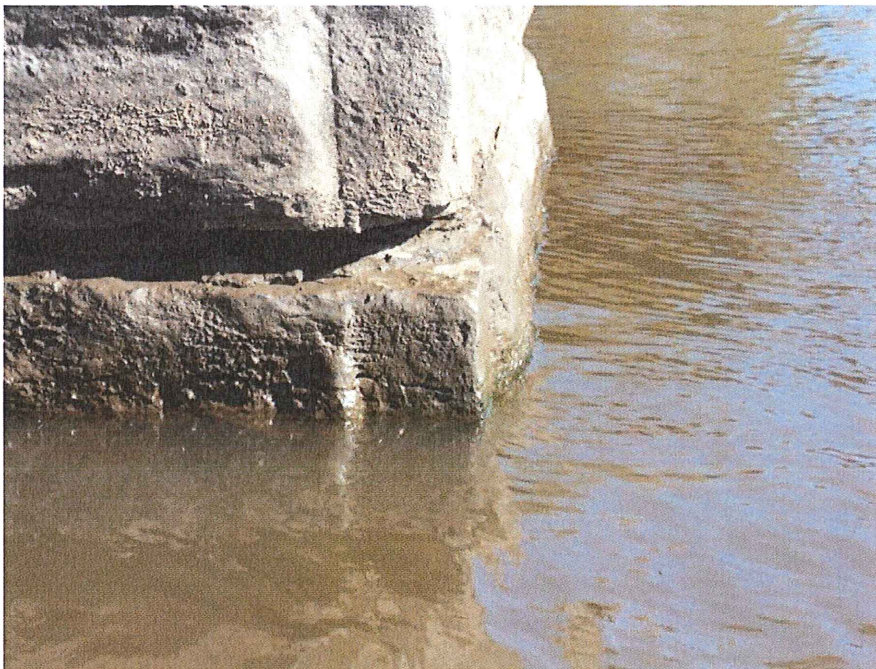


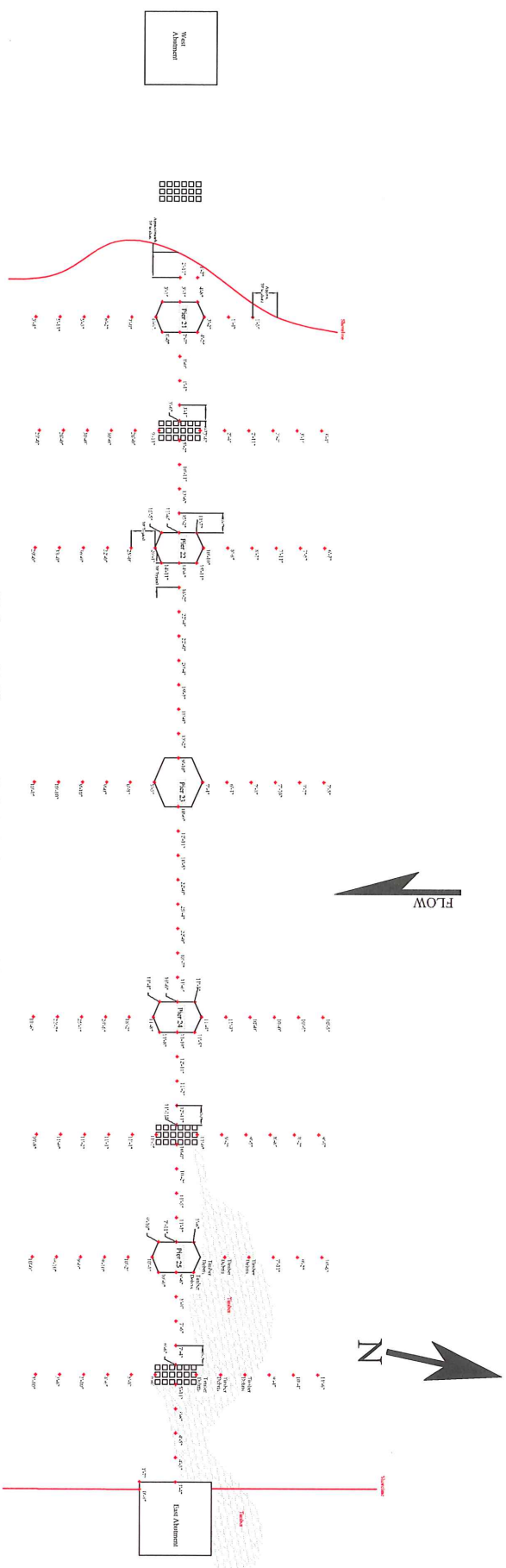
Photo #22: Missing Mortar on Pier #25



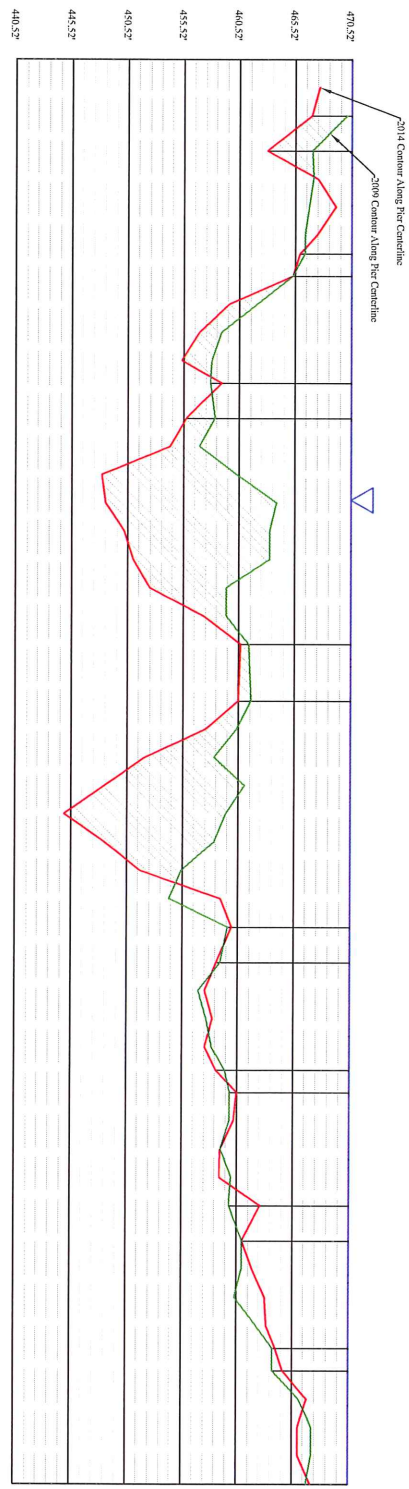
Photo #23: East Abutment and Timber Debris



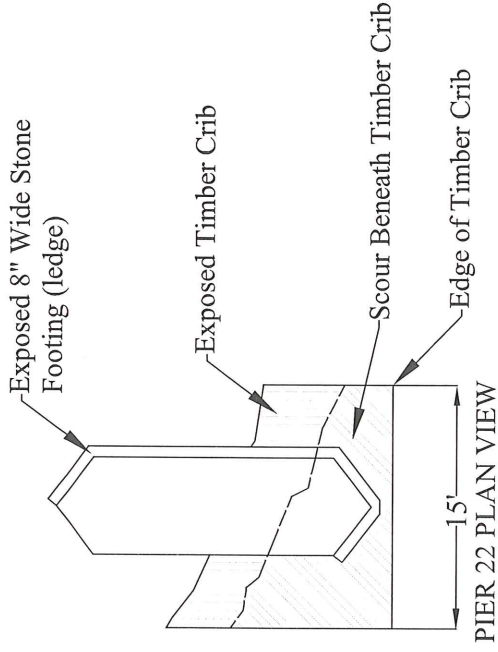
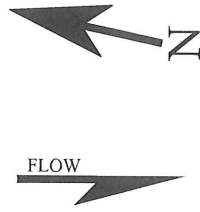
Photo #24: East Abutment and Timber Debris



Plan View of 2014 Soundings



Profile of Channel Bottom Elevation
2009 and 2014 Comparison



NOTES:

- Number and location of timber piles may not be accurate.
- Diver identified pilings by hand and felt what was believed to be additional pilings inside the scour hole with a probe rod.
- All dimensions are approximate as estimated by divers. Measurements were taken from the outside of the crib. Actual volume and shape of scour under the crib is unknown.
- Scour hole is believed to be caused by constriction of flow by timber debris in the area.

