



MARINE INDUSTRIAL CONSTRUCTION, LLC

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Underwater Investigation

KELLOGG CREEK BRIDGE

22142

Milwaukee, OR.

2/10/2016

Inspection Performed for:



HARTCROWSER

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Associate Geotechnical Engineer

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Performed by:

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On Wednesday, February 10th, 2016 Marine Industrial Construction, LLC. (MIC) performed an underwater, Level I*, inspection of the Kellogg Creek Bridge # 22142 located in Milwaukie, Oregon.

Bridge #22242 abutments are connected against the downstream wing walls of Kellogg Lake Outlet Bridge #01949. Bridge #01949 is just upstream of #22142 and controls the flow from Kellogg Lake through both bridges. The outflow from bridge #09149 crosses over a concrete slab into the channel below. A fish ladder carries some flow through the opening. Both bridges outflow to the Willamette River approximately 150 feet downstream.



Lat: 45 26 30.50N, Long: 122 38 31.99W

The primary purpose of the inspection was to locate any potential scouring or undermining of the bridge footings.

Scour is defined as the removal of material from a streambed as a result of the erosive action of running water. Scour can cause undermining or the removal of supporting foundation material from beneath the abutments when streams or rivers flow adjacent to them. Undermining reduces the bearing area of spread footing as well as lateral restraint. Bearing pressures and lateral resistance in areas of undermining can be computed based upon field measurements. However, it is probable that at least the periphery of the remaining ground has had its soil strength properties reduced and so



any computations should be made with great conservatism, especially considering the often catastrophic consequences of scour failures. Scour will also increase the effective length of piles in pile bents or of exposed piles below pile caps. These conditions can be evaluated as noted for piles, above.

MIC performed the underwater inspection utilizing a four person surface supplied diving crew in accordance to OSHA / OR-OSHA regulations 1910.410, Subpart T. The diver accessed the water by walking down the bank on the South side of the bridge. The inspection started on the South abutment across the weir along the East to the North abutment, along the fish ladder to the West, around the fish ladder (to the North) along the North Abutment back to the East.

The diver did not find any scour or undermining of the structure under the water's surface. All the scouring and undermining was visible above the water and is pictured in the following pictures. The diver noted approximately 8 inches of undermining on the South abutment (pictured below). The north abutment was undermined approximately 42 x 36 inches in the Southwest corner near the boulder.

The diver then crossed the channel, six times, taking measurements and inspecting the channel bottom looking for scour holes. A bathymetric drawing showing the water depths was generated by using the diver's pneumofathometer which is accurate to 1% of water depth. No overly large scour holes were found in the channel bottom during the dive. Maximum depth reached was approximately five feet near the opening of the fish exit.

The inspection was video recorded in DVD format and has been uploaded to a Dropbox folder for viewing.

No exposed piles were visible.

No as-builts of the bridge were provided.

* Level of inspections: Originating in the United States Navy and diving industry, NHI and FHWA, the diving inspection designation of standard levels of inspection can be used. Three diving inspection intensity levels have evolved as follows:



Level I: Visual, tactile inspection.

A Level I inspection consists of a "swim-by" overview at arm's length with minimal cleaning to remove marine growth. Although the Level I inspection is referred to as a "swim-by" inspection, it must be detailed enough to detect obvious major damage or deterioration. A Level I inspection is normally conducted over the total (100%) exterior surface of each underwater element, involving a visual and tactile inspection with limited probing of the substructure and adjacent streambed. The results of the Level I inspection provide a general overview of the substructure condition and verification of the as-built drawings. The Level I inspection can also indicate the need for a Level II or Level III inspections and aid in determining the extent and selecting the location of more detailed inspections.

Level II: Detailed inspection with partial cleaning

A Level II inspection is a detailed inspection which requires that portions of the structure be cleaned of marine growth. It is intended to detect and identify damaged and deteriorated areas which may be hidden by surface growth. A Level II inspection is typically performed on at least 10% of all underwater elements. In some cases, cleaning is time consuming and should be restricted to critical areas of the structure. The thoroughness of cleaning should be governed by what is necessary to determine the condition of the underlying material. Removal of all growth is generally not needed. Generally, the critical areas are near the low waterline, near the mud line, and midway between the low waterline and the mud line. On pile structures, for example, 10-inch high bands should be cleaned at designated locations:

- Rectangular piles - the cleaning should include at least three sides
- Octagonal piles - at least six sides
- Round piles - at least three-fourths of the perimeter
- H-piles - at least the outside faces of the flanges and one side of the web

On large faced elements, such as piers and abutments, 1 foot by 1 foot areas should be cleaned at three levels on each face of the element. Deficient areas should be measured, and the extent and severity of the damage documented.

Level III: Highly detailed inspection with nondestructive testing

A Level III inspection is a highly detailed inspection of a critical structure or structural element, or a member where extensive repair or possible replacement is contemplated. The purpose of this type of inspection is to detect hidden or interior damage and loss in cross-sectional area. This level nondestructive of inspection includes extensive cleaning, detailed measurements, and selected nondestructive and partially destructive testing techniques such as ultrasonic, sample coring or boring, physical material sampling, and in-situ hardness testing. The use of testing techniques is generally limited to key structural areas, areas which are suspect or areas which may be representative of the underwater structure.



Looking South from the North Across the Bridge



South Concrete Footing – Poured on Rock
Undermined Maximum 8 inches (No Foundation Piles Visible)



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Looking North at Fish Ladder



Looking West – Fish Ladder and North Abutment



Looking East at Weir



Looking East



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Looking Northwest at Fish Ladder



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Looking at North Abutment SW Corner



North Footing between Fish Ladder and Footing
This area is 237 inches long



Looking East – Fish Ladder Weir in Foreground



North Footing – SW Corner (by lodged boulder)
Scour depth 42 inches x 36 inches wide



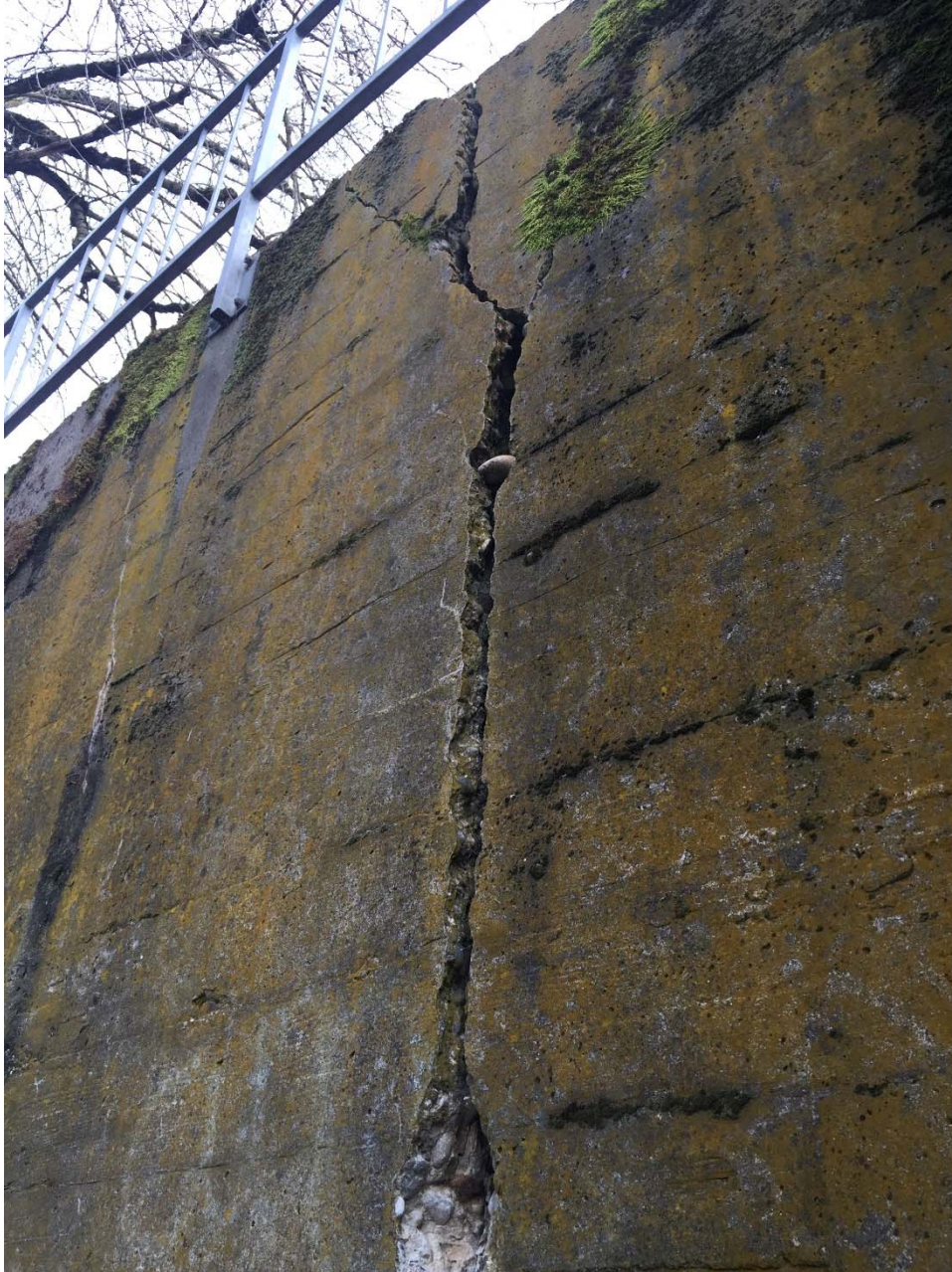
North Footing SW Corner (by boulder) – Scour Width



Possible Animal Hole – North Abutment West Corner
Hole is 72 Inches Deep
One of Two Holes



Animal Holes – North Abutment, West Side



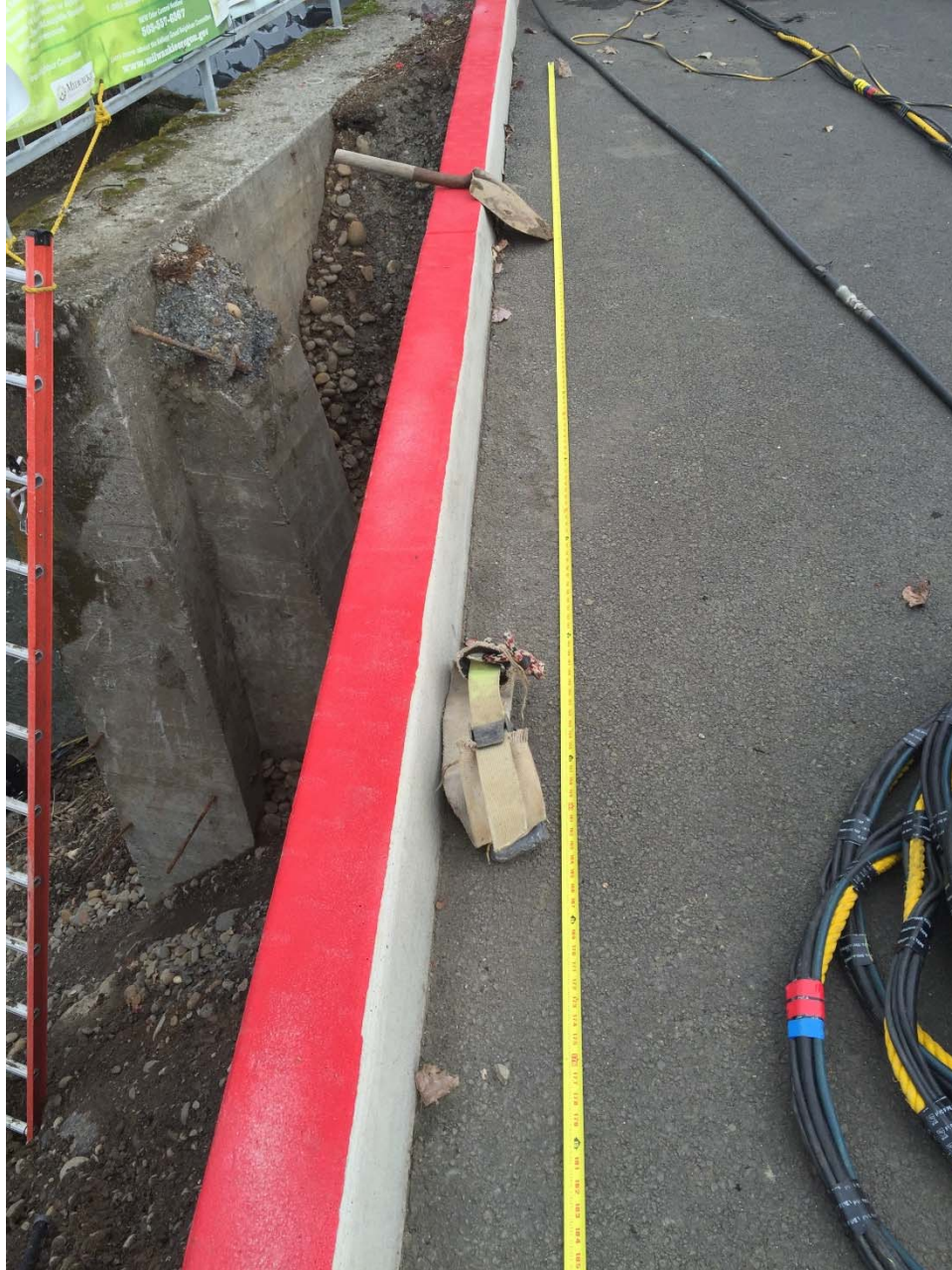
North side of bridge, West retaining wall. Crack fill height of wall approximately 17 feet in length. Handrail on top of retaining wall has begun to warp.



Wall Pushed Out (West) 1 to 1.5 inches



Undermining – South Abutment (Approach)
West Wingwall in Foreground



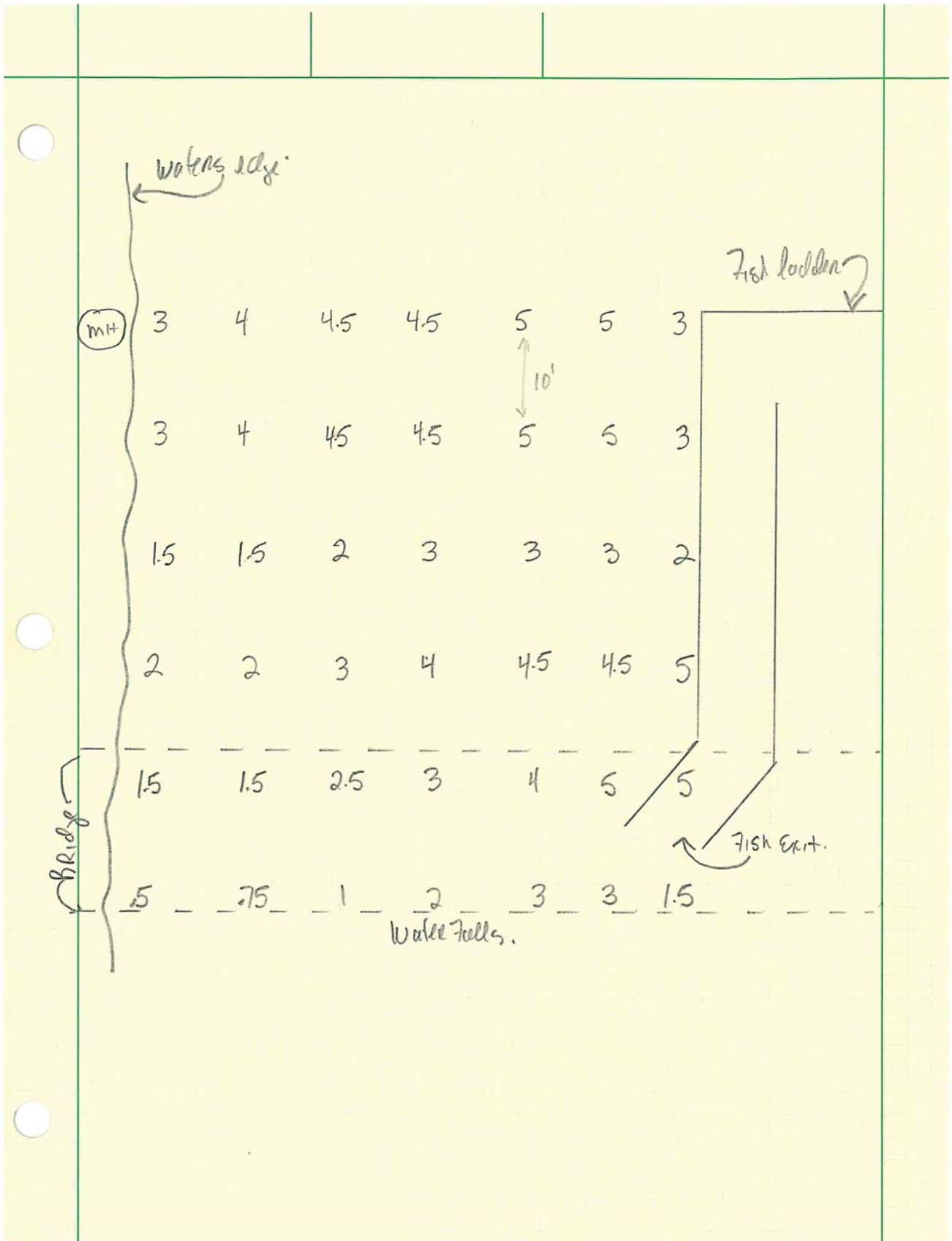
Length of Undermining (18 feet in length)



Looking at Undermining South Approach



Survey Marker, South Abutment, West Wingwall



Bathymetric Soundings Across Channel