

 Office of Structures <i>Guidelines and Procedures</i> <i>Memorandum</i>	INSPECTION
	Number: OOS-GPM-SI-116
	Date: 08-06-2026
Underwater Bridge Inspection Program	Approval: 

Definition

An Underwater Bridge Inspection is an inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water, by wading or probing, generally requiring diving or other appropriate techniques. An underwater inspection is required if any portion of a substructure is exposed to water deeper than 3 feet during periods of normal low water. The inspection generally consists of a diver using commercial Self-Contained Underwater Breathing Apparatus (SCUBA) equipment or Surface Supplied Air (SSA) equipment.

Frequency

Routine full inspections of the underwater portion of the bridge substructure and surrounding channel shall be performed at 48 month intervals. These inspections shall be coded in SI&A Item 92B. If a diver is used to supplement a routine inspection for a bridge not on the UWI list, Item 92B shall not be coded, and a remark indicating why the diver was requested shall be indicated in the Remarks area of the SIA.

Frequent full inspections of the underwater portion of the bridge substructure and surrounding channel may be performed at regular intervals less than 48 months as determined by the Engineer considering such factors as construction type, condition rating, foundation materials, scour, environment, known deficiencies, etc. The reason for the frequent full inspection shall be documented. These inspections shall be coded in SIA Item 92B and the reason for frequent full inspection indicated in the Remarks area of the SIA.

Frequent inspections of specific underwater structural elements or surrounding channel may be performed at regular intervals less than 48 months as determined by the Engineer. The frequent special inspections shall be documented. These inspections shall be coded in the appropriate category of SIA Item 92, with the reason for frequent specific inspections, the elements to be inspected and any special inspection procedures indicated in the Remarks area of the SIA.

Initial underwater inspections for new bridges or for bridges where the underwater portions have been rehabilitated must receive an initial underwater inspection within 12 months of the bridge being opened or receiving a major rehabilitation.

Qualifications

1. The Inspection Team Leader who will oversee and coordinate the underwater inspection shall meet FHWA's qualifications for an individual in charge of a bridge inspection team as outlined in 23 CFR Part 650, Subpart C, NBIS, Section 650.309. The Inspection Team Leader shall also possess a minimum of five (5) years acceptable experience in this type of work.

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2. The Diver(s) who will actually perform the underwater inspection must successfully complete an FHWA-approved underwater bridge inspection training as described in 23 CFR Part 650, Subpart C, Section 650.309. If a Diver meets the qualifications required for Inspection Team Leader, the Diver can serve as both the Inspection Team Leader and the Diver. At least one Diver on site must have at least 5 years experience. A graduate engineering degree can substitute for 2 of the required years of experience. A PE license can substitute for an additional 2 years (for a total of 4 years).

General Requirements

An underwater bridge inspection shall be a complete visual and tactile inspection of the stream or river bottom, underwater portions of the substructure and foundation elements as well as dolphins and fender systems between the splash zone and the mud line.

All materials between the splash zone and the mud line, including concrete, steel, and timber shall be investigated for any indications of corrosion, erosion, vermin attack, spalling, cracking, scouring, or other deterioration. Any changes in the waterway channel, banks, or bottom profile shall be investigated and documented. Pilings may be cast in place concrete, precast concrete, steel, or timber. Piers and abutments below water shall be examined for any deterioration and/or movement. Dolphins, fenders and bulkheads shall be examined for deterioration, marine attack and damage by vessels. The river bottom around piers and abutments shall be examined for scour holes and unintended exposure of piling.

Due to limited underwater visibility, the inherent access restrictions of the underwater environment, and the presence of marine growth, the required underwater diving inspection precision depends on the level of effort. FHWA defines three underwater diving inspection intensity levels as follows:

Level I - A general visual/tactile inspection using large sweeping motions of the hands where visibility is limited. It must be detailed enough to detect obvious major damage or deterioration. It should confirm the continuity of all underwater elements and detect undermining or exposure of normally buried elements. It may also include limited probing of the substructure and adjacent channel bottom.

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Level II - A detailed visual/tactile inspection that requires marine growth to be removed from portions of the structure, i.e., a representative sampling of underwater elements. It is intended to detect and identify damaged and deteriorated areas that may be hidden by marine growth.

For piles, a one foot high band should be cleaned at designated locations, generally near the waterline, at the mud line, and midway between the waterline and the mud line:

- H-piles: clean flanges and web
- rectangular piles: clean at least three sides
- round piles: clean at least three-fourths of the perimeter
- large diameter piles (> 3 ft): clean one foot squares at four equally spaced locations around the perimeter

For solid faced elements such as pier shafts, footings, etc., one-foot squares should be cleaned at four randomly spaced locations, near the waterline, at the mud line, and midway between the waterline and the mud line.

Level III - A detailed inspection typically involving either a non-destructive and/or destructive evaluation conducted to detect hidden or interior damage to include ultrasonics, coring, boring, physical material sampling, etc.

The Division Chief, SIRE – Structures Inspection or the Local Area Program Manager shall maintain in the inspection records for each bridge, the location and description of all underwater elements, and any specific procedures for performing the underwater bridge inspection. As a minimum, all routine underwater bridge inspections in Maryland shall be a Level II intensity. Each inspection report shall indicate the level of inspection which was performed. In addition, the inspections shall conform to the Specific Requirements presented in this GPM.

There may be occasions when it is appropriate for a Level I or Level III intensity interim inspection be performed. It will be requested by either the Engineer, the Division Chief, SIRE – Structures Inspection or the Local Area Program Manager.

Particular attention shall be directed to the dimensions of all substructure units and their conformance to the As-Built plans. Any divergence from these plans shall be accurately reported. Any dimensions not documented on the plans or noted elsewhere shall be field measured and included in the inspection report.

Locations of all existing utilities and submarine cables that may be located on or adjacent to bridges shall be noted. These pipes, conductors, and/or conduits shall be carefully protected and

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maintained so that no interruption to power or any other utility source occurs due to the underwater bridge inspection team's operations.

For any structure over navigable water, the underwater bridge inspection team's firm shall be responsible for full compliance with all regulations of the United States Coast Guard (USCG) and the Army Corps of Engineers including providing the USCG with at least 30 days advance notification. All inspections shall be conducted so as not to interfere with the waterways. The underwater bridge inspection team shall perform its work so that the structure is capable of passing marine traffic at all times.

The underwater bridge inspection team shall inform the Division Chief, SIRE – Structures Inspection or the Local Area Program Manager if debris needs to be removed in order to perform the inspection. The inspection shall not commence until the debris is removed.

If at any time during the underwater bridge inspection a critical finding is encountered, then the Professional Engineer on site shall immediately notify the Division Chief, SIRE – Structures Inspection or the Local Area Program Manager and comply fully with the requirements of Critical Findings, OOS-GPM-SI-117.

Specific Requirements

Concrete Piles

Inspect and document the condition of all concrete for:

1. Spalls (measure size – width, length, depth and indicate location).
2. Exposed reinforcing steel.
3. Soundness and visible appearance.
4. Cracks (measure size – length and location)
 - a. If a crack is spalling on each edge, record actual crack size which is measured deeper than the spalled surface.
 - b. Crack length should be measured from the splash zone to the end of crack underwater. If a crack does not start at the water line, locate the crack with reference to the water line.
 - c. A bent number, pile number and face direction is required when recording location of cracks. The direction of numbering bents and piles is from north or west.
5. Scour - inspect for scour at base of piling and record depth.
6. When marine growth covers the piles, a minimum of 25% of the piles shall be thoroughly cleaned from the splash zone to the mud line. The number of areas cleaned will depend on the

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condition of the concrete. The areas will be determined in the field and identified in the inspection report. Power washing may be necessary. Care shall be taken to insure that no piles are damaged.

Steel H-Piles

1. Inspect and document the condition of the steel for:
 - a. Coating
 - b. Rust - observe the condition of pile before scraping:

Light rust – loose rust formation is staining steel or beginning to show through the coating by pitting paint surface

Moderate rust – a looser rust formation beginning to scale or flake (1/16” and less surface pitting). These areas are discernible with no appreciable loss in steel.

Severe rust – a heavy rust scale or heavy pitting of metal surface (1/8” and greater pits). For piles with severe rust, it is recommended to make a complete pass up and down the pile to determine the worst areas of deterioration. Scrape one or two areas to determine section loss. Section loss of steel should be recorded in this condition.
 - c. Section Loss - locate areas and record remaining thickness of flange and web. After locating the worst areas, scrape rust flakes off to bare metal and then measure section loss with calipers and a ruler. Record the remaining section and locate the areas so they may be monitored in future inspections.
2. When marine growth covers the piles, a minimum of 25% of the piles shall be thoroughly cleaned from the splash zone to the mud line. The number of areas cleaned will depend on the condition of steel. The areas will be determined in the field and identified in the inspection report. Power washing may be necessary. Care shall be taken to insure that no piles are damaged.
3. Inspect for scour at base of piling and record depth.
4. If steel pile is encased in concrete at water line, inspect closely for loss where pile enters the concrete jacket.
5. If angle cross bracing extends underwater, inspect connections.
6. Inspect for misalignment.

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Timber Piles

All timber piles at abutments, piers and bents (including bents not in waterway) shall have their exposed areas of timber piles inspected in accordance with the requirements set forth below. The timber pile bents outside of the water that have been replaced with steel pile bents will not be inspected. The timber piles will be inspected from the mud line or ground line up to the underside of pile cap using small tools.

1. When vegetation or marine growth covers the piles, a minimum of 25% of the piles shall be thoroughly cleaned from the underside of the bent cap to the mud line or ground line. The number of areas cleaned will depend on the condition of the timber. The areas will be determined in the field and identified in the inspection report. Hand tool cleaning or power washing may be necessary. Care shall be taken to insure that no piles are damaged.
2. Minimum pile diameters and maximum ice pick penetration shall be measured and recorded at 2 ft. intervals on each pile from the underside of bent cap to the mud line or ground line. Prepare a table of actual and effective pile diameters to be used for load rating purposes.
3. Inspect all timber piles for infestation, marine borers, vermin, etc., such as shipworms, termites, beetles and caddis worms; check for evidence of fungus decay; check for damage from collisions and/or overstressing of members; check for evidence of deterioration and excessive weathering such as splits, checks, cracks, shakes, and surface roughness; and check pile batters and locations with the As-Builts.

Use engineering judgment to determine the most representative pile at each support for coring. Any additional piles with evidence of interior deterioration due to fungus decay or damage from vermin shall also be cored. The piling shall be tested by use of an Increment Borer to determine depth of penetration and size of area of decay or damage. A sharp Increment Borer which extracts a core 0.2 inch (nominal) in diameter shall be used, taking care that the Increment Borer is perpendicular to the pile surface, and checks and knots are avoided. Cores extracted by an Increment Borer shall be examined and the findings recorded.

All cored holes shall be immediately plugged with treated, tight-fitting oak plugs. The oak plugs shall be treated with an approved wood preservative. Care shall be used in selecting the proper diameter plugs, and in driving to avoid breaking the plug or splitting the piles. All cored piles shall be identified on the inspection report.

4. All piles shall be sounded with a hammer and probed with a heavy duty 6" (min.) blade ice pick which is in new condition.

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5. The pile diameters, surface condition and texture, soundness, ice pick penetrations, core results, evidence of deterioration, damage and overstressing, pile batter, and any other important observations shall be recorded for use by the engineers.
6. For timber pile bents, Inspect all bolt holes at cross bracing. If there is evidence of deterioration, then the cross bracing may have to be removed to provide access to the hole. Cross bracing shall be reinstalled when inspection is complete.

Pile Footings

1. Inspect for scour at piling and record depth of scour.
2. Inspect and document the condition of the concrete for:
 - a. Spalls (measure size – width x length x depth).
 - b. Any exposed reinforcing steel.
 - c. Soundness and visible appearance.
 - d. Cracks (measure size – length and location).
 - e. Record any voids or cracks where the pile enters the footing.
3. Inspection of footings which were originally constructed below the mud line will require measurements of each exposed pile from the bottom of footing to the mud line. Take photographs of bottom of footing showing exposed pile when possible.
4. Inspect piles for soundness and section loss and document findings. See pile inspection section.
5. Inspect for drift lodged between piling.

Spread Footings

1. Inspect for scour adjacent to spread footings and document findings. Provide measurements for scour areas in reports (width x length x depth).
2. Inspect for scour or soft material at and under spread footings by surveying along the perimeter of the footing and document findings. Use probing rod and rule during inspection. Inspect and document by the following procedures:
 - a. Station footing from upstream end to downstream end at 2' increments.
 - b. At these stations measure the following:

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water depth, height from bottom of footing to mud line, and depth of scour from edge of footing to point under footing where bearing is established

- c. Measure from top of footing to water line on upstream and downstream ends.
 - d. Measure from top of footing to a known point on the substructure.
3. Inspect condition of concrete and document findings for:
 - a. Spalls (measure size – width x length x depth and indicate location).
 - b. Any exposed reinforcing steel.
 - c. Soundness and visible appearance.
 - d. Crack (measure size – length and location).
 4. Inspect footings keyed into rock and document findings for:
 - a. Separation at base of footing and rock foundation. This condition could indicate foundation or substructure movement.
 - b. Voids between footing and rock foundations, which could have been formed by trapped clay, silt, loose rock or mud in concrete.

Scour

Inspect and document the river bottom beneath the bridge and around the piers, abutments and piles for the development of scour holes and unintended exposure of any portion of the substructure.

1. Measure the distance from mud line to the bottom of footing and the length of exposed piles.
2. Locate areas of scour and measure depth of scour.
3. Report condition of existing slope protection, or scour protection.

Soundings and Clearance

Soundings shall be taken on a ten (10) foot grid (10, 20, 30 ft. intervals) on each end of the structure up and down stream and along the face of abutments and piers. The measurements for soundings and cross sections shall be taken at previously established locations whenever possible. The vertical clearance shall be taken at the previously established location, usually the lowest point of the superstructure.

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Scour shall be reported when there is a differential of 2 feet, either plus (aggradation) or minus (degradation) in the stream bed when compared to the base soundings or if any undermining of the substructure is present.

Dolphins and Fender Systems

Examine for same deterioration as substructure piles.

Piers and Abutments

Piers and abutments below the water and immediately above the water line shall be inspected for any indications of movement, corrosion, erosion, marine borer attack, spalling, cracking, scouring, or other deterioration. Any conditions of current flow, or change in river bottom profile or any condition of the underwater portion of the structure not shown on the plans shall be investigated and documented.

Submarine Cables

Check for damage to the cables from vessels or floating objects, kinks in the cables, exposure of cables when they should be buried, and determine and plot the existing location of the cables.

Documentation

The inspection report shall be submitted within 60 days of the completion of the inspection and shall include as a minimum the following sections:

1. Title Page - This sheet shall identify the bridge, the date of inspection and the firm(s) responsible for the inspection. This sheet shall be signed by the Inspection Team Leader or Dive Team Leader, and signed/sealed by the Professional Engineer responsible for the inspection.
2. Description - Provide a brief description of the bridge's configuration and underwater substructure elements. Names of all underwater inspection team members including the Professional Engineer on site during the inspection shall be provided. Access, equipment, and inspection techniques including any special procedures shall be noted.
3. Findings and Evaluation - Provide a narrative discussion summarizing the inspection findings including evaluations of all underwater structural elements. Discuss condition of stream channel, channel protection, comparison to Base Soundings and scour. For all elements, provide a comparison to prior report's findings.

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4. Sketches - Provide detailed elevation sketches of all underwater substructure elements showing appropriate references such as top of footing, waterline, mud line, etc. All defects shall be clearly located and dimensioned. These sketches are necessary for the development of repair plans or for future comparisons.
5. Soundings - Provide current soundings and a comparison of current soundings with the Base Soundings. The Base Soundings must be included in the report.
6. Timber Pile Tables - For all timber pile bents, prepare a table of actual and effective pile diameters by measuring at 2 ft intervals the diameters and corresponding pick penetrations, from mud line or ground line to underside of bent cap. The table shall indicate which piles were cleaned of marine growth (minimum 25% of piles) and which piles were cored with an increment borer (minimum one pile per bent, select the worst).
7. Photographs - Where necessary, include pictures pertinent to the report and appropriately referenced in the Findings and Evaluation discussion.
8. Element Data, Structure Inventory & Appraisal Data (SIA) - Provide updated Pontis elements and any proposed changes to SIA data.
9. Recommendations – Provide any recommended repairs, analyses, non-destructive or destructive evaluations, scour studies, inspection frequency changes, special inspection procedures, monitoring schemes, etc.