APPENDIX IP 01-H

General Scope of Work - Underwater Inspection of Bridges
I. GENERAL

   A. Purpose: Inspect and appraise the underwater portion of bridges.

   B. References: The latest versions of the following Department accepted AASHTO and FHWA manuals and the latest versions of Department Publications and Policy shall replace those referenced in the General Scope of Work where appropriate:

      1. National Bridge Inspection Standards (NBIS).

      2. AASHTO Publications
         b. AASHTO Standard Specifications for Highway Bridges

      3. FHWA Publications:
         b. Recording and Coding Guide for the Structure Inventory and Appraisals of the Nation’s Bridges, Report No. FHWA-PD-96-001
         d. FHWA Technical Advisory: “Revisions to the National Bridge Inspection Standards (NBIS)”, T 5140.21, September 1988, and its updates.

      4. Department Publications and Policy:
         a. Bridge Management System 2 (BMS2) Coding Manual, Department Publication 100A
         b. Bridge Safety Inspection Manual, Policies and Procedures, Department Publication 238
         c. The Pennsylvania Department of Transportation Design Manuals, Parts 2 (Pub 13M) and 4 (Pub 15M)
         d. PA CoRe Element Coding Guide, Department Publication 590
         e. Active Department Strike-Off letters.

      5. Department Inspection and BMS2 Forms:
         a. BMS2 Coding Forms D-491 and their updates or a printout of the individual structure records from BMS2
         b. BMS2 D-450 Forms

II. TYPES OF WORK

   A. Description of Work Types

      Type 1. Underwater bridge inspections that require hard hat/scuba diving.

      Type 2. Underwater bridge inspection performed by probing and/or sounding methods.

      Type 3. Participation in meetings with bridge owners.
Type 4. Special underwater bridge inspection related work not covered by the other Types of Work and as directed by the Bureau of Maintenance and Operations. This work may include field work, reports, studies, and other tasks.

B. Categories of Work

Work for Type 1 and Type 2 inspections is to be divided into categories related to the water depth, water velocity, and number of units to be inspected at each bridge site as indicated in Exhibit 1.

C. Assignment of Work

1. **Type 1 and Type 2 Inspections**
   The Districts will assign this work to the Consultant via Work Orders listing the bridges and substructures to be inspected.

   Prior to finalizing your work schedule for a Work Order, review and verify the available information on the list of assigned bridges with the District (and local owner if appropriate) to confirm that the Type and Category of Work proposed is consistent for the work required at each site. This review will minimize duplication of effort and will provide the basis for formulating specific directions and expectations on each structure.

2. **Type 3 Work - Meeting with Bridge Owners**
   The District may authorize and assign this work to the Consultant if requested by the bridge Owner or if a critical deficiency is identified.

3. **Type 4 Work - Special Underwater Inspection Related Work**
   This work may only be authorized and assigned by the Director of the Bureau of Maintenance and Operations.

D. Cold Weather Adjustment for Inspections

1. **Type 1 Work**
   A Cold Weather Add-On Cost is to be allowed for Type 1 diving inspections when the site’s ambient temperature at the time of inspection is less than 35 degrees Fahrenheit. The District may authorize the Cold Weather Add-On Cost for Type 1 Work if documentation is provided in the inspection report.

2. **Type 2 Work**
   For Type 2 probing inspections, a Cold Weather Add-On Cost may be allowed for emergency inspections where ambient temperature is less than 20 degrees Fahrenheit or if the ice surrounding at the substructure unit is at least 4” thick or more at the time of inspection. For Type 2 work, the Cold Weather Add-On Cost is to be authorized by the Director of the Bureau of Maintenance and Operations only.

III. **BMS2 DATA**

   Complete all applicable portions of the bridge inspection forms, BMS2 Coding Forms
IV. FIELD INSPECTION

A. General

1. Prior to beginning field inspection, inform the bridge owner of the schedule and the names of the inspectors.

2. Record the ambient temperature, water velocity, and ice thickness at each substructure at the time of inspection.

B. Structure Inspection

1. Inspect the portions subjected to being submerged for damage, cracking, settlement, steel corrosion, deteriorated and scoured concrete, deteriorated pointing, broken and/or dislodged stones in masonry structures, deterioration and/or damage to piling, insect damage or wood decay, etc.

2. Provide special attention to determine the uniformity of bearing of footings and surrounding foundation materials and the lateral stability and soil support to the pile foundations, the effect or potential effect of scour, and also the soundness or effectiveness of any previous repairs.

3. Sound all timber and probe with a heavy duty 6 inch (min.) blade, ice pick or awl.

4. Identify limits of past scour protection.

C. Streambed Inspection

1. Inspect the streambed in the area of the substructure unit as to type of material, evidence of scour, condition of existing scour protection, debris, etc. Obtain elevations relative to a fixed permanent reference point marker to provide for accurate plotting of streambed contours and/or streambed profiles in the areas suspect of scour.

2. Provide stream bottom data on a minimum five (5) foot grid around each pier to extend beyond the scour hole but in no case less than twenty five (25) feet beyond the footing area. Estimate flow velocities and direction of flow relative to the foundation structure. Note all turbulence and unusual flow conditions.

3. Obtain channel cross-sections at the bridge and two bridge lengths upstream and downstream. For bridge lengths greater than 100’ obtain channel cross-sections at 200’ upstream and downstream. Significant features directly observable but beyond 200’ from the bridge should be included. Do not create new cross-sections, if existing cross-sections can be utilized. Mark any changes on the existing cross-sections from the bridge inspection file.

The cross section at the fascia must include the following:

a. Top-of-bank to top-of-bank channel section at upstream face of bridge.
b. Geometry of principal bridge openings up to the anticipated high water elevation.


c. Foundation units.

d. Stream bed materials and boring information.

e. Roadway profile in the vicinity of the bridge.

f. Discernible scour holes.

g. Structural countermeasures at the bridge.

h. Discernible high-water marks at the bridge.

i. Stream level at the upstream side of the bridge at time of inspection.

j. Reference marks on the bridge.

k. The upstream and downstream sections may be sounded from a surveyed water surface elevation. Obtain sounding by using a continuous reading strip chart Fathometer unless water conditions preclude use of a boat, in which case sounding poles or lead lines may be utilized.

D. Reference Point Marker

Place a permanent marker if one does not exist already (drill hole, nonferrous PK nail) on each abutment/pier (elevation/datum) that correlates to the report findings and which may be used in future underwater investigations and/or rehabilitation work. Provide one such marker per unit at a convenient location. This bench mark is to be referenced on the plan.

E. Verification of Field Conditions for the Observed Scour Assessment

At the substructure units being inspected, verify and update the field conditions recorded in the most recent Observed Scour Assessment Report. The District will provide one copy of the appropriate portions of the Observed Scour Assessment Report.

In the “UNDER THE BRIDGE” section of the Assessment, review data applicable to the substructure units being inspected. Mark all changes in red ink without erasing or obliterating original information. If previous information is valid, note each data item as such with a checkmark or the words “No change”. Update the Plan Sketch and Channel Cross Section at the Bridge accordingly. Record the date of the underwater inspection and inspection leader on each page.

This update of the Scour Assessment Plan and Cross Section is not in lieu of and does not satisfy the Underwater Inspection Report requirements set forth in Sections IV, Parts A through D and V of this Scope.

V. DRAWINGS

A. General

Prepare sufficient drawings to document the condition of the substructure units and stream. Use sketch abbreviations, terminology, and symbols as shown on the attached sketches and list of abbreviations (Attachment A).

B. Type 1 Diving Inspection Requirements

Include the following:
1. General plan, elevation, and contours.

2. Channel Cross sections showing Foundation Material, Footings, portions of substructure units which are underwater, remediation material and areas of scour.

3. Results of underwater inspections including details of section loss due to deterioration, or damage.

4. Streambed profile and soundings including areas of bed and bank scour.

5. Unusual structural elements unless documented by photographs.

C. Type 2 Probing Inspection Requirements

For Type 2 inspection (probing) furnish all the Type 1 information available.

D. Type 4 Inspection Requirements

Drawing requirements for Type 4 must be detailed in the proposal if available.

VI. PHOTOGRAPHS

Provide photographs of the bridge and underwater photographs (approximate 3” x 5”) to supplement field inspection notes and drawings. Photos may be used in lieu of detail sketches if the pictures are sufficiently clear, adequately dimensioned, and are properly identified and indexed.

All photographs must be in full color. Black and white photos are not acceptable. Xerographic/laser copies of photographs, electronically scanned prints, and prints from a digital electronic camera are acceptable substitutes for report photographs if the resolution and quality is acceptable to the Districts.

VII. INSPECTION REPORT

A. Report Requirements

Provide a written report using explicit terminology and language covering the factors relevant to the condition of the substructure, such as:

1. Detail general condition as revealed by the field inspection; past, present and potential flooding conditions, if relevant; history of repairs; and all other features which may affect the service life of the substructure.

2. Provide detailed descriptions of the inspection. Such details shall be referenced and shown on the drawings. Sketches should be such that aggradation and degradation of material around piers can be readily identified during subsequent inspections.

3. Compare channel cross-sections with those obtained in previous inspections and significant stream changes shall be identified.

4. Provide recommendations as to: need for minor repairs; need for major
5. repairs; scheduling of repairs; anticipated useful life of the substructure; recommended intervals for future inspections; and any other recommendations which may be pertinent to the perpetual safety of the structure, such as scour computations or substructure analysis.

6. When repairs are recommended, estimate quantities and cost of the repairs. Prioritize these repairs.

7. Highlight critical deficiencies and/or other important findings on a separate sheet(s).

8. Sign and seal the report by a Professional Engineer licensed in Pennsylvania.

B. Submission of Reports

1. Draft Report:
   Submit one (1) draft copy of the inspection report to the Engineering District within four weeks of completion of each field inspection for review and comments.

   For the first five draft reports completed, submit an additional copy to the Bureau of Maintenance and Operations.

2. Final Report:
   Submit the original and two copies of each final report within four weeks after receipt of review/comments of the draft copy.

3. Submission Schedule:
   Space submissions at frequent intervals to facilitate review.

VIII. QUALIFICATIONS OF PERSONNEL

A. The Engineer in charge of inspection and preparation of the inspection report must possess the following minimum qualifications:

   1. Be a Professional Engineer licensed in Pennsylvania.

   2. Have a minimum of five years experience in underwater inspection assignments in responsible capacity.

B. The underwater bridge inspection diver(s) shall meet the NBIS qualification requirements and be a certified diver, with at least two years experience in underwater bridge inspection.

C. A Professional Engineer shall be on site either in the boat or as underwater bridge inspection diver during the inspections.

D. A Team Leader meeting the NBIS qualification requirements shall be on site. The Team Leader must also hold a valid certification as “Bridge Safety Inspector” issued by the Department. The Professional Engineer on site or the underwater bridge inspection diver can also be the Team Leader if they meet all the requirements of this paragraph.
E. Prior to the start of this work, submit a detailed resume of each inspection team member for approval to the Bureau of Maintenance and Operations. Team members may be added later provided similar approval has been granted.

IX. SAFETY OF PERSONNEL

Safety is of utmost importance. Take all necessary precautions for the safeguard of all personnel involved in this project and follow all applicable Department and OSHA, Part 1910 requirements.

X. REPORTING CRITICAL DEFICIENCIES TO OWNER

Contact owner and District Bridge Engineer immediately if there is an emergency situation (i.e. critical deficiency). Telephone conversation and notes/sketches sent by email or facsimile will suffice for initial notification.

Place emphasis on discussion of uncorrected critical and other deficiencies brought forward from the previous inspection report. Highlight these deficiencies in the current inspection report.

This task is to be considered incidental to Type 1 and Type 2 work.

XI. TYPE 3 WORK - MEETINGS WITH BRIDGE OWNERS

This work is to provide for meetings to interpret and discuss the technical findings of the underwater bridge inspection reports with the bridge owners and/or public.

Discuss critical structural and safety related deficiencies, recommendations and alternatives contained in the report. Make summary notes of the meeting, including any handouts provided, attendance list, items discussed, and any follow-up items needing resolution. Provide three copies of the notes (one copy to Owner, District Bridge Engineer and Bureau of Maintenance and Operations), within one week of the meeting.

A. Convene the meeting within three days after identifying a critical structural deficiency(ies) and present a Plan of Action (POA) addressing the deficiency(ies) to the Owner. Refer to IP 2.13.2. and IP 2.14 for information regarding the general requirements for the POA. During the meeting, ensure the Owner has a thorough understanding of the critical nature of the defect(s) and the need for timely action as identified in the POA. Attendance by the engineering services consultant for the Local Owner is limited to the role of advising, communicating and facilitating the Owner’s understanding of the deficiency’s effects on safety and development of the POA.

B. Provide liaison between the District and the Owner when it is necessary to take immediate actions, permanent or temporary in nature, to safeguard public safety (e.g. temporary shoring, bridge closing) before the POA is fully developed.

C. If more time is needed to develop the POA because of the complexity of the problem, request a POA documentation time extension via e-mail to the District Bridge Engineer, copy to the Local Bridge Coordinator and Chief Bridge Engineer, before the end of day three (3). Include a description of actions taken to date to ensure public safety.
D. The Plan of Action shall provide essential information and be structured to match the BMS 2 field information for IM01-IM15. The narrative format must show all maintenance actions and schedule required for repairs and restoration of safety to an acceptable level. In addition to the coding IM01-IM05 describing and prioritizing the deficiency in BMS2, address the following fields:

- IM06 Date Recommended
- IM07 Status of Work Candidate – Identify if the work will be done by the local owner forces or contractor, and whether work has been completed using appropriate coding. Typical codes include 1,2,5,6. (Note: For local and other owners for codes 1 and 5, “Dept” indicates “owner”).
- IM08 Target Year
- IM09 Location
- IM10 Estimated Cost
- IM11 Work Assign
- IM12 Drawing Indicator
- IM13 Permit Indicator
- IM14b POA Date - Fields IM14a Date Completed and IM14c Mitigated Date must be entered following completion of the work
- IM15a Notes - A brief description of steps taken to address the deficiency which can include closing, posting, restricting, traffic temporary shoring, etc. The actions must restore the structure safety to an acceptable level. Note that additional work may be required at a later time to restore full level of service. A schedule for additional work should be included. Following completion of the immediate work and based on justification included in the plan, record the remaining additional repairs in BMS 2 and note as such in item 15b.

E. The meeting with the Local Owner should not be adjourned until agreement has been reached regarding specific action to be taken and associated schedule. After confirming the finished plan’s acceptability with the District Bridge Engineer, enter the appropriate information for each critical deficiency in the BMS2 IM fields (IM01-IM15). Upload documents related to the critical deficiency into BMS2 EDMS such as narrative version of the plan, sketches, meeting minutes, etc.

F. Immediately notify the District Bridge Engineer if the critical deficiency will not be addressed within seven (7) days.

G. Provide follow-up monitoring of the progress toward completion of the POA and report via BMS2 to confirm completion of the approved maintenance action(s) identified in the POA. Enter the completion date(s), IM14a and IM14c, as appropriate in BMS2. The consultant shall immediately notify the Owner and the District should problems arise with respect to the completion of the work within the required timeframe.

XII. TYPE 4 WORK- SPECIAL UNDERWATER INSPECTION RELATED WORK

The description and requirements of this work will be determined at the time of assignment.
XIII. NONPROFESSIONAL SERVICES BY OTHERS

Examples of this type of work include, but are not limited to:

a. Use of Geophysical methods to detect scour
b. Nondestructive testing of subsurface elements
c. Coring of wood or concrete
d. Soil sampling of material around units and upstream

These items, when sub-contracted, will be paid as a direct cost for non-professional services. The consultant will be paid the actual cost based on certified invoices.

If the anticipated cost for non-professional services exceeds Ten Thousand and 00/100 Dollars ($10,000.00) per Work Order, solicit three (3) bids for that work. The responsible vendor submitting the lowest bid shall be engaged for the services.

XIV. METHOD OF PAYMENT

The method of payment for this will be Cost Per Unit of Work, based on the Categories of Work listed in Exhibit 1.

The Cold Weather Add-On Cost will be paid only for those substructures authorized by the Department.

XV. DEADLINES

Prepare to start work immediately upon receiving Notice to Proceed. Complete all work expeditiously, but not later than the date specified in each Work Order.

XVI. DEPARTMENT PROJECT MANAGEMENT

PennDOT Project Manager:
  Asset Management Division
  in the Bureau of Maintenance and Operations

Work Order Administrator and Technical Review:
  District Bridge Unit
  in the Engineering District issuing Work Order.

XVII. RELEASE OF INSPECTION INFORMATION

Place the stamp appropriate to structure owner per section IP 1.8.3 on the front cover of the inspection report. Do not release or distribute inspection information without the written permission of the District Bridge Engineer for State structures or the structure owner.

For Department structures, attach the following label to each page of the structure inspection report that is released:
This document includes structure safety inspection information that is not public pursuant to 65 P.S. §67.101 et seq. and 23 U.S.C. §409 and may not be published, released or disclosed without the written permission of the PA Department of Transportation.
## Proposed Scope of Work

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### Critical Deficiency Meetings

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### Notes

1. Unless otherwise noted, only one Partial/interim inspection allowed.
2. Other Bridge Load Ratings will be requested on as-needed basis.
3. Other Partial/Interim inspections will be requested on an as-needed basis.
4. Unless otherwise noted, only one Critical Deficiency Meeting allowed.