Chapter 4: Inspection Types

The scope, intensity, and interval of bridge safety inspections are discussed here to provide a better understanding of the purpose and use of each inspection type and to assist in the development of scope of inspection work for individual inspections. An inspection event, particularly for large, complex, or deficient structures, often requires that a variety of inspection types be performed, using a variety of methodologies.

Inspection types include Initial, Routine, Underwater, NSTM, Damage, In-depth, Special, Scour Monitoring, Service, and Ohio cursory. Each of these inspections may occur individually or several inspections may occur concurrently. When multiple inspection types occur concurrently, each inspection type should be selected and data recorded in the appropriate fields under Chapter 7.6.

All vehicular carrying bridges owned or maintained by the state or bridges carrying NHS routes (B.H.03 – NHS Designation is coded "Y" for route carried on the bridge) element data is required to be completed for the bridge including the total quantities and condition state quantities. See Chapter 7.7.2 for additional information.

4.1 Initial Inspection

NBIS Definition: The first inspection of a new, replaced, or rehabilitated bridge. This inspection serves to record required bridge inventory data, establish baseline conditions, and establish the intervals for other inspection types.

An initial inspection is the first inspection of a new structure, a structure that has changed ownership or a reconstructed structure. It is a close-up hands-on inspection of the structure to document its baseline condition.

4.1.1 Purpose of Initial Inspections

The purpose of the initial inspection is to verify the safety of the bridge, in accordance with the NBIS and Department standards, and establish baseline conditions. It also serves to provide required inventory information of the as-built structure type, size, and to document its structural and functional conditions by:

- Providing quality NBIS inventory data per the SNBI required by Federal regulations along with all other data required by Department standards.
- Determining baseline structural conditions
- Eliminating deficiencies recorded under previous inspections after reconstruction.
- Documenting clearance envelopes (for features carried and those intersected) and bridge waterway openings are to be documented at this time.
- Identifying maintenance needs, including preventative maintenance activities or uncompleted construction items.
- Noting the existence of elements or members requiring special attention, such as NSTM, fatigue-prone details, and underwater members.
- Verifying construction/rehabilitation contracts.
- Compiling documents, including but not limited to, photographs, drawings (design, as-built and shop drawings), scour analysis, foundation information, hydrologic and hydraulic data are to be inserted into the bridge file. Selected construction records (e.g. pile driving records, field changes, etc.) may also be of great use in the future and should be included.

In the event that inspection or maintenance responsibility of a bridge changes, an email notifying ODOT Central Office – Office of Structural Engineering, shall be written by the initial Control Authority of the structure. The

email shall outline the inspection and maintenance responsibilities of all parties. The SFN will remain the same, however the program responsibilities will change. This documentation should be added to the bridge file.

4.1.2 Scope and Interval of Initial Inspections

The level of effort required to perform an initial inspection will vary according to the structure's type, size, design complexity, and location. An initial inspection is to be a close-up inspection of all members of the structure to document the baseline conditions. Traffic control and special access equipment may be required.

Initial inspections are performed for each new, replaced, rehabilitated, and temporary bridge as soon as practical, but within 3 months of the bridge opening to traffic. For phased construction of the bridge, initial inspections should be completed for each stage when traffic is placed on any newly constructed portion of the bridge within 3 months of the phase open to traffic. Bridges open to traffic during construction operations are required to be inspected on their regular interval. Anytime ownership changes, the bridge shall receive an initial inspection.

For bridges requiring NSTM or underwater inspections, the respectable inspection type shall be completed within 12 months of opening to traffic following the guidance in Section 4.3 Underwater Inspection or Section 4.4 NSTM Inspection.

4.2 Routine Inspection

NBIS Definition: Regularly scheduled comprehensive inspection consisting of observations and measurements needed to determine the physical and functional condition of the bridge and identify changes from previously recorded conditions.

Routine inspections provide documentation of the existing physical and functional conditions of the structure. All changes to the inventory since the previous inspection are to be documented and updated. The written report will include appropriate photographs and recommendations for major improvements, maintenance needs (preservation, preventative maintenance or on-demand repairs), and follow-up inspections. Load capacity analyses are re-evaluated only if changes in structural conditions or pertinent site conditions have occurred since the previous analyses.

4.2.1 Purpose of Routine Inspections

Routine inspection shall satisfy the requirements of the NBIS and Department standards. Routine inspections serve to document sufficient field observations/measurements and load ratings needed to:

- Determine the physical and functional condition of the structure.
- Ensure that the structure continues to satisfy the present service and safety requirements.
- Determine the need for establishing or revising a weight restriction on the bridge.
- Determine improvement and maintenance needs.
- Identify any inventory changes from the previous inspection.

4.2.2 Scope of Routine Inspections

The level of scrutiny and effort required to perform a routine inspection will vary according to the structure's type, size, design complexity, existing conditions, and location. Routine inspections are generally conducted from the deck, ground and/or water levels. Generally, every element in a bridge does not require a hands-on inspection during each routine inspection but requires a visual view to provide an acceptable level of assurance of the bridge's ongoing safety. Routine inspection may require the use of ladder, lift, snooper, boat, waders, rope access, UAV (drones), dive inspection, traffic control, confined spaces, or other method(s) to adequately

determine the condition of the bridge. During routine inspections, particular attention should be given to scour, erosion, (new rock fields, debris) and overall stability of the substructure.

For bridges over waterways and when B.IR.03 – Underwater Inspection Required is code N (underwater inspection not required), the routine inspection should include probing of the substructure units unless the water level or velocity do not allow with an interval not to exceed as specified in Chapter 4.3.2. The probing of the substructure units shall be performed in accordance with Chapter 4.3.3.1. Additionally, channel photos shall be documented for each routine inspection per Chapter 4.3.5.3.

Areas that should have a hands-on inspection during each routine inspection, include, but are not limited to:

- Those areas explicitly determined by previous inspections
- Load carrying members in poor condition, critical sections of controlling members on posted bridges
- Substructure units vulnerable to scour
- Areas determined by the Program Manager, for example:
    - End regions of steel girders or beams under deck joints
    - Cantilever portions of concrete piers or bents
    - Ends of prestressed concrete beams at continuity diaphragms
    - Pin and hanger/hinge assemblies
    - Redundancy retrofit systems

Increased routine inspection intervals or level of inspection are at the discretion of the Control Authority or Program Manager.

4.2.3 Interval of Routine Inspections

The Ohio Revised Code requires routine inspection intervals to be established by the Director of Transportation, but not to exceed 24 months. The inspection interval criteria will be recognized as the ***Reliability Based Inspection interval***, or RBI.

It must be emphasized that the objective is to select the most appropriate routine inspection intervals using a reliability-based procedure. As a result, some bridges may have longer intervals while some must be shorter. Bridges that meet any one of the six criteria below must receive a routine inspection every 12 months. Bridges that do not meet the criteria listed may extend the RBI interval, not to exceed 24 months.

Criteria for the 12-month Routine Bridge Inspection interval:

- B.C.13 – Lowest Condition Rating coded lower than "7 – Good"
- Non-Redundant Steel Tension Member (NSTM) bridges
- Scour vulnerable bridges
- Load posted or restricted bridges
- Newly constructed or rehabilitated within 3 years
- Other additional bridges determined by the Control Authority

4.2.3.1 Routine Inspection Interval Tolerance

For routine inspections on a 12-month interval, there is an acceptable tolerance for the next inspection of ***up to 2 months after the month in which the inspection is due.*** For example, if the routine inspection date of a 12-month RBI bridge is in the month of July, the next routine inspection must be completed by the end of September the following year.

For routine inspections on a 24-month interval, ***there is no additional routine inspection tolerance as the ORC states that routine bridge inspections will not exceed 24 months.***

4.2.3.2 Routine Inspection Interval Updates in AssetWise

The routine inspection interval will be updated in AssetWise based on the above RBI criteria. This update will be performed continually by ODOT Central Office.

4.3 Underwater Inspection

NBIS Definition: Inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water or by wading or probing, and generally requiring diving or other appropriate techniques.

Underwater inspections provide documentation of the existing condition of portions of the structure which are submerged in water.

4.3.1 Purpose of Underwater Inspections

The purpose of the underwater inspection is to provide information on underwater portions of a bridge to evaluate their overall degradation, safety, and to assess the risk of scour.

4.3.2 Interval of Underwater Inspections

Bridges crossing waterways that can receive underwater inspections using visual, wading, or probing techniques will not require Underwater Dive inspections. This type of underwater inspection should be done at every routine inspection. If a visual, wading, or probing techniques cannot be completed within the last two inspection cycles, the next cycle an underwater inspection shall be completed within 60 months of the last probe inspection. This level of inspection and findings shall be reported as a routine inspection and documented within the routine inspection report and notes.

Structures over water that cannot receive a probing inspection shall be placed on the Underwater Dive list and receive Underwater Dive Inspections. First underwater inspections are completed within 12 months of bridge opening to traffic or a bridge rehabilitation including repairs to a portion of the structure underwater. All structures requiring underwater dive inspections shall be scheduled at intervals of 60, 24, or 72 months per the updated NBIS Method 1 criteria.

- 60 Month Underwater Dive Inspection Interval - This is the regular underwater dive inspection interval unless a bridge meets the criteria for a reduced or extended interval.
- 24 Month Underwater Dive Inspection Interval - Bridges meeting **ANY** of the following criteria **SHALL** be inspected at 24-month intervals:
    - B.C.15 – Underwater Inspection Condition Rating of 3 or less
    - B.C.09 – Channel Condition Rating of 3 or less
    - B.C.10 – Channel Protection Condition Rating of 3 or less
    - B.C.11 – Scour Condition Rating of 3 or less
- 72 Month Underwater Dive Inspection Interval - Bridges meeting **ALL** the following criteria can be inspected at 72-month intervals:
    - B.C.15 – Underwater Inspection Condition Rating of 6 or greater
    - B.C.09 – Channel Condition Rating of 6 or greater
    - B.C.10 – Channel Protection Condition Rating of 6 or greater

4.6 In-Depth Inspection

NBIS Definition: A close-up, detailed inspection of one or more bridge members located above or below water, using visual or nondestructive evaluation techniques as required to identify any deficiencies not readily detectable using routine inspection procedures. Hands-on inspection may be necessary at some locations. In-depth inspections may occur more or less frequently than routine inspections, as outlined in bridge specific inspection procedures.

An in-depth inspection is a close-up, hands-on inspection of one or more members and a close visual of all members above or below the water level to identify any deficiency not readily detectable using routine inspection procedures. An in-depth inspection may be limited to certain elements, span group(s), or structural units of a structure, and need not involve the entire structure. Conversely, in-depth inspections may include all elements of a structure. in-depth inspections can be conducted by itself or as part of a routine or other type of inspection.

4.6.1 Purpose of In-Depth Inspections

In-depth inspections serve to collect and document data to sufficient detail needed to quantify the physical condition of a bridge or select members. This data is more detailed than data collected during a routine inspection.

In-depth inspections should be routinely scheduled for selected bridges or members based on their size, complexity and/or condition. Major or complex bridges represent large capital investments and warrant closer scrutiny to ensure that maintenance work is identified and completed in a timely manner. These bridges tend to be more critical to local and area transportation because of the usual lack of suitable detours. It may be more difficult to provide a complete snapshot of the bridge conditions when access difficulties limit the scope of routine inspections.

4.6.2 Scope and Interval In-Depth Inspections

The level of effort required to perform an in-depth inspection will vary according to the structure's type, size, design complexity, existing conditions, and location. Traffic control and special equipment, such as under-bridge inspection units (snoopers), rigging, or staging may be needed for in-depth inspections. Personnel with special skills such as divers and riggers may be required. Non-destructive field tests and/or material tests may be performed to fully ascertain the existence of or the extent of any deficiency.

For large or complex structures, these inspections may be data driven or scheduled separately for defined segments of the bridge or for designated groups of elements, connections or details that can be efficiently addressed by the same or similar inspection techniques. If the latter option is chosen, each defined bridge segment and/or each designated group of elements, connections or details should be clearly identified as a matter of record and should be assigned an interval for re-inspection. The activities, procedures, and findings of in-depth inspections shall be completely and carefully documented more than those of routine inspections. Stated differently, In-Depth Inspection reports will generally be detailed documents unique to each structure that exceed the documentation of routine inspection forms.

A structural analysis for load carrying capacity may be required with an in-depth inspection to fully evaluate the effect of the more detailed scrutiny of the structure condition.

An in-depth inspection can be scheduled in addition to a routine inspection, though generally at a longer interval, or it may be a follow-up to a previous inspection. An in-depth inspection that includes all elements of the structure will satisfy the requirements of the NBIS and take the place of the routine inspection for that cycle and should be documented such that both routine and in-depth Inspection types are selected under item B.IT.01 – Inspection Type.

In-depth inspections do not reduce the level of scrutiny for routine inspections. Program Managers shall schedule in-depth inspection based upon condition and importance. Increased intervals are up to the discretion of the Control Authority or Program Manager.

4.6.3 Complex Bridges

Complex bridges shall receive an in-depth inspection on an interval not to exceed 60 months. Complex bridges include the following:

- Suspension Bridges - Bridges in which the floor systems are supported by catenary cables that are supported upon towers and are anchored at their extreme ends.
- Cable Stayed Bridges - Bridges in which the superstructures are directly supported by cables, or stays, passing over or attached to towers located at the main piers.
- Movable Bridges - Bridges having one or more spans capable of being raised, turned, lifted, or slid from their normal service location to provide a clear navigation passage.
- Any other bridge designated by the Program Manager

Every complex bridge should have its own operating and maintenance manual and inspection procedure in the bridge file. Due to the size and/or complexity of the bridge, a good field inspection plan is necessary to ensure historical continuity, track deficiencies, and communicate nomenclature. A good inspection plan should include most of the following:

- The type of inspection(s) to be completed
- A brief historical statement about the bridge type and condition
- Confirmation that the bridge has been properly cleaned for the type of inspection planned
- Copies of essential plans
- A mapped route to the site
- Keys for any locked access points
- Specialized inspection procedures which clearly identify the complex features
- Interval of inspection of those features
- Describe any specific risk factors unique to the bridge
- Clearly detail inspection methods and equipment to be employed
- Identification of non-redundant steel tension members and any E/E' fatigue-prone details
- Identification of access equipment and arrangements for them to be on-site
- Identification of required nondestructive testing (NDT) equipment and arrangements for it to be on-site
- Identification of traffic control requirements and arrangements for on-site implementation
- Press releases, if necessary
- Inspection time estimate
- Coordination with the owner and other agencies as required

In addition to an operation and maintenance manual and inspection procedure, the inspection team leader will have additional qualifications. The NBIS Team Leader who leads the In-Depth inspection of a complex bridge must meet the following requirements:

- NBIS Team Leader