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1.5 REPORTING SYSTEMS

1.5.1 Introduction

There are many different mechanisms available to record, organize, and catalog bridge inventory and inspection data. Over the years, several bridge management systems and tools have been developed to aid structure owners in cataloging their bridge inventories. Wisconsin has developed the Structures Highway Information System (HSIS) to house and maintain data on its inventory of bridges and ancillary structures. Wisconsin uses two distinctly different reporting systems in collecting and managing its structure inspection data: Element Level and National Bridge Inventory (NBI) System.

The WisDOT Highway Structure Information System (HSIS) is maintained by the Bureau of Structures (BOS) located in the Wisconsin Department of Transportation (WisDOT) Central Office and warehouses data on all public bridges in Wisconsin. This system consists of a database of inventory data, Inspection data (NBI and element level data), electronic directory and storage of supplemental information files (approved format such as .pdf, .doc, etc.), and is utilized to create the annual National Bridge Inventory (NBI) file. As mandated by the Federal Highway Administration (FHWA), the NBI file is created annually to submit Wisconsin's Bridge data in the format described in the FHWA Coding Guide for all public bridges in Wisconsin.

Beginning in October 2014, the FHWA required all State DOTs to begin collecting element level condition data in addition to the NBI file. All State DOTs were required to begin reporting element level inspections on NHS bridges to the FHWA by April 2015.

Although a hardcopy paper bridge file may be located at each region for state bridges and located at each county for their local bridges, the electronic file within HSIS shall be designated as the "Official Bridge File" following NBIS Metric #15: Inspection procedures: Bridge Files. It is imperative the bridge file is maintained accurately.

Per Federal requirements; Regional inspection Program Managers have a maximum of 90 days for state-owned bridges and County inspection Program Managers have a maximum of 180 days for locally-owned bridges from the date of any change in the reporting status of the bridge (*i.e.,* inspection SI&A item change, overlay) to report revised data. WisDOT requires this inventory and inspection data to be entered into HSIS within 28 days of an inspection or change.

1.5.2 Structure Identification

The Wisconsin Department of Transportation (WisDOT) follows an alphanumeric coding system to identify the various bridge and ancillary structures in the WisDOT right-of-way. In some cases, multiple I.D. plaques are attached to designate the separate components of the structure, such as structure number, lighting circuit, and sequence decal. Refer to the WisDOT Facilities Development Manual (FDM), Chapter 16, Standard Detail Drawings (S.D.D.).

1.5.2.1 Bridges, Small Bridges, Noise Barriers, and Retaining Walls

These structures are identified using a name plaque. Refer to S.D.D. 12a3 in the WisDOT FDM for details of the plaque. The ID code found on the plaque is in the form "X-CC-NNNN-UUUU", where "X" identifies the structure type (B-bridge, C-small bridge, N-noise barrier, L-High Mast Light pole, or R-retaining wall); "CC" is the two-digit county number; and "NNNN" is the unique four-digit structure number. However, if there are unused leading zeroes, these may be omitted (*i.e.,* B-40-60).

Some longer bridges are subdivided into units. On these structures, the ID code will be "X-CC-NNNN-UUUU" where "UUUU" is the unique four-digit unit identifier.

1.5.2.2 Sign Structures and Overhead Sign/Signal Support

Sign structures and overhead sign supports are identified using a structure plaque. The plaque is either in a vertical or horizontal configuration dependent on whether or not the sign bridge is structure mounted. Refer to S.D.D. 12a4 in the WisDOT FDM for details of the plaque. The ID code found on the plaque is in the form "S-CC-NNNN", where "S" designates a sign bridge; "CC" is the two-digit county number; and "NNNN" is a four-digit region-provided location number.

If the sign bridge contains lighting, a circuit plaque and sequence decal will also be present. The circuit plaque is mounted to the sign bridge and the sequence decal is mounted to the luminaire. Refer to S.D.D. 10a3 in the WisDOT FDM for details of these plaques. The circuit plaque ID code is in the form "A-B-CD", where "A" and "B" identify the two circuits that the structure is on; and "CD" identifies the distribution center. The sequence decal code is in the form "AZZ", where "A" is the circuit pole and "ZZ" is the two-digit luminaire sequence number.

Figure 1.5.2.2-1: Structure Plaque and Circuit Plaque Mounted on a Sign Bridge. (Note that the location number "300" would read "0300" according to current convention.)

1.5.2.3 High Mast Lighting

High mast lights are identified using four separate plaques, the structure plaque, circuit plaque, luminaire sequence plaque, and the north plaque. The structure plaque and circuit plaque are mounted to the hatch door, the sequence decal is mounted to the luminaire and the north plaque is mounted to the light ring. Refer to S.D.D. 10a4 in the WisDOT FDM for details of these plaques. The ID code found on the plaque is in the form “CC-NNNN”, where “CC” is the two-digit county number, and “NNNN” is a four-digit region-provided location number. The circuit plaque ID code is in the form “A-B-CD”, where “A” and “B” identify the two circuits that the structure is on; and “CD” identifies the distribution center. The sequence decal code is in the form “AZZ”, where “A” is the circuit pole and “ZZ” is the two-digit luminaire sequence number. The north plaque is simply a single letter “N”.

Figure 1.5.2.3-1: Structure Plaque and Circuit Plaque Mounted on a High mast Hatch Door. (Note that the location number “028” would read “0028” according to current convention.)

1.5.3 Element Levels

Each structure element, (*e.g.,* wing walls, steel girders, prestressed concrete beams, decks, slabs) has been assigned a unique element number. Structural elements are listed on the structure inspection form with their associated element numbers.

Each element has a list of possible defects associated with the element and its particular material (steel, concrete, timber, etc.). For instance, the defect “Exposed Prestressing” is found under prestressed concrete elements but absent from reinforced concrete elements.

Elements are then grouped into condition states that reflect the level of element deterioration as based on the defect condition states. All elements have a possibility of four condition states. These condition states are described in detail in Part 2 of this manual as well as in the WisDOT Bridge Inspection Field Manual.

1.5.4 National Bridge Inventory (NBI)

NBI is an acronym for National Bridge Inventory. NBI ratings are based upon the item numbers and conditions set forth in the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges*. The NBI reporting system is presently used in Wisconsin to determine the sufficiency number for the bridge and not to rate the individual elements of each structure. An NBI inspection looks at the bridge differently than an element level inspection. Where an element level inspection considers each bridge element separately, the NBI inspection lumps all like-function elements together into a functional group. For example, on a steel girder bridge, the girders, floor beams, and stringers together would be considered the superstructure. Likewise, the abutments, piers and pier caps would be considered the substructure, and so on. The following element categories in an NBI inspection are rated for each inspection and receive an overall condition rating:

1. **Deck** (Item 58)
2. **Superstructure** (Item 59)
3. **Substructure** (Item 60)
4. **Culvert** (Item 62)
5. **Channel** (Item 61 – Channel and Channel Protection)
6. **Waterway** (Item 71 – Waterway Adequacy)

The deck, superstructure, and substructure are considered major components of a bridge, and they are rated independently of culverts. The Culvert rating, likewise, is used only for culvert structures. The Waterway and Channel ratings refer to those item’s adequacy and condition and would only be used for structures over waterways. The condition ratings used are defined and described in Figures 1.5.4-1 through 1.5.4-4 below.

Condition Ratings for Deck, Superstructure, Substructure	
Condition Rating	**Description**
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION – no problems noted.
7	GOOD CONDITION – some minor problems.
6	SATISFACTORY CONDITION – structural elements show some minor deterioration.
5	FAIR CONDITION – all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.
4	POOR CONDITION – advanced section loss, deterioration, spalling, or scour.
3	SERIOUS CONDITION – loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION – advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken
1	“IMMINENT” FAILURE CONDITION – major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put bridge back in light service.
0	FAILED CONDITION – out of service, beyond corrective action.

Figure 1.5.4-1: FHWA General Rating Guidelines for NBI Inspections

Condition Rating	Description
N	NOT APPLICABLE, use when structure is not a culvert.
9	No deficiencies.
8	No noticeable or noteworthy deficiencies which affect the condition of the culvert. Insignificant scrape marks caused by drift.
7	Shrinkage cracks, light scaling, and insignificant spalling which does not expose reinforcing steel. Insignificant damage caused by drift with no misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.
6	Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.
5	Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have a significant distortion and deflection in one section, significant corrosion or deep pitting.
4	Large spalls, heavy scaling, wide cracks, considerable efflorescence, or opened construction joint permitting loss of backfill. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have a significant distortion and deflection throughout, significant corrosion or deep pitting.
3	Any condition described in Condition Rating 4 but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, excessive corrosion, or deep pitting with scattered perforations.
2	Integral wingwalls collapsed, severe settlement of roadway due to loss of fill. Section of culvert may have failed and can no longer support embankment. Complete under mining at curtain walls and pipes. Corrective action required to maintain traffic. Metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion.
1	Bridge closed. Corrective action may put culvert back in light service.
0	Bridge closed. Replacement or major rehabilitation necessary.

Figure 1.5.4-2: Condition Ratings for Culverts.

Condition ratings for the deck, superstructure, substructure, and culvert items can be described in more general terms to help the inspector narrow down his/her appraisal. Condition ratings 9 through 7 denotes the component is in good condition, with condition rating 9 reserved for new structures.

Condition ratings 6 through 5 denotes the component is in fair condition. The minor section loss mentioned in condition rating 5 implies that the section loss is barely measurable.

Condition ratings 4 through 3 denotes the component is in poor condition and that there is a reduction in serviceability or load-carrying capacity as compared to when the structure was new. There is a significant change from condition rating 5 to 4. With a rating of 4, measurable section loss is advanced implying that a capacity loss can be measured. Condition rating 3 means that the structure may be prone to localized failures.

Condition ratings 2 through 1 denotes the component is in critical condition, and a condition rating of zero means the structure is failed and/or closed.

Individual member conditions should not necessarily be the dominating influence over the NBI ratings. NBI ratings are to be an appraisal of the component as a whole, and not an appraisal of localized areas of deterioration.

Condition Rating	Description
N	NOT APPLICABLE; use when bridge is not over a waterway (channel).
9	There are no noticeable or noteworthy deficiencies that affect the condition of the channel.
8	Banks are protected or well-vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.
7	Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.
6	Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor streambed movement evident. Debris is restricting the channel slightly.
5	Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.
4	Bank and embankment protection are severely undermined. River control devices have severe damage. Large deposits of debris are in the channel.
3	Bank protection has failed. River control devices have been destroyed. Streambed aggradation, degradation or lateral movement has changed the channel to now threaten the bridge and/or approach roadway.
2	The channel has eroded to the extent the bridge is near a state of collapse.
1	Bridge is closed because of channel failure. Corrective action may put back in light service.
0	Bridge is closed because of channel failure. Replacement is necessary.

Figure 1.5.4-3: Condition Ratings for Channel Condition.

Functional Classification			
Principal Arterials – Interstates, Freeways, or Expressways			
	Other Principal and Minor Arterials and Major Collectors		
		Minor Collectors, Locals	
Condition Rating			**Description**
N	N	N	NOT APPLICABLE, bridge not over a waterway
9	9	9	Bridge deck and roadway approaches above flood water elevations (high water). Chance of overtopping is remote.
8	8	8	Bridge deck above roadway approaches. Slight chance of overtopping roadway approaches.
6	6	7	Slight chance of overtopping bridge deck and roadway approaches.
4	5	6	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with insignificant traffic delays.
3	4	5	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with significant traffic delays.
2	3	4	Occasional overtopping of the bridge deck and roadway approaches with significant traffic delays.
2	2	3	Frequent overtopping of the bridge deck and roadway approaches with significant traffic delays.
2	2	2	Occasional or frequent overtopping of the bridge deck and roadway approaches with severe traffic delays.
0	0	0	Bridge is closed.

Figure 1.5.4-4: Condition Ratings for Waterway Adequacy.

1.5.5 Fracture Critical

To aid the inspector in performing Fracture Critical Inspections, Wisconsin has developed Fracture Critical Inspection Report Forms; DT2010 and DT2011. These are supplements to the Bridge Inspection Report entry and can be uploaded into HSIS during inspection data entry. Form DT2010 allows for specific field inspection notes for each member/member component. The final inspection report may have several pages of this form. The inspector may utilize form DT2011 to sketch the bridge and identify the fracture critical and tension members/member components. Much of the required information for a Fractural Critical Inspection is the same as that required for element level reporting.

Each fracture critical member (FCM) or member component shall have its condition recorded. If no deficiencies are noted, an “OK” should be recorded. Additional information should be recorded for serious deficiencies and placed on attachment inspection forms. Such information may be additional narrative, sketches or photographs. The description of such deficiencies should include exact location and detailed dimensions that could help in determining the overall condition rating of the bridge.

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