

**National Bridge Inspection Standards &
 Bridge Maintenance Program Review
 Madison County
 October 23, 2019**

By: Mark Stockman, PE, PS
 CEAO Federal Bridge QA/QC Engineer

IN ATTENDANCE:

Jeff Coleman
 Ken Koppes
 Mark Stockman, CEAO Federal Bridge QA/QC Engineer

SCOPE OF REVIEW:

The review consisted of interviews with Madison County personnel, reviews of inspection and inventory data, and reviews of Madison County bridge records. The office evaluation assessed Madison County’s organization, procedures, resources, and documentation regarding the inspection, inventory, and maintenance operations for bridges. In addition, field reviews of six bridges were conducted to determine if ratings were consistent with the ODOT Coding Manual and FHWA Recording and Coding Guide and to determine if inventory items were coded correctly. The bridges were selected by Madison County to represent a variety of structure types and conditions. The bridges checked during the field review were:

SFN	CTY-RTE-SECT	TYPE	YEAR BUILT /REHAB	OVERALL LENGTH	County RATING	Suggested NBIS RATING
4930509	MAD 00016 03.900	111	1959	20'	3A	same
4930797	MAD 00091 00.280	321	1937	21'	3P	same
4930851	MAD 00022 10.060	395	1900	22'	5A	same
4932285	MAD 00012 09.870	221	1972	106'	4A	3P
4930207	MAD 00010 00.500	322	1971	170'	5A	same
4930983	MAD 00007 02.310	695	1983	16'	6A	same

FINDINGS AND COMMENTS:

General

Ohio State statutes establish requirements governing the safety inspection of all bridges within the State borders. ODOT with participation of FHWA has developed the ODOT publication Bridge Inspection Manual, hereafter referred to as the Manual, which establishes guidance and requirements regarding bridge inspections within the State. FHWA has determined that ODOT guidance meets or exceeds the FHWA NBIS requirements.

The federal regulations for administering the NBIS are located in the Code of Federal Regulations 23 Highways – Part 650 Subpart C - National Bridge Inspection Standards. The regulations can be found at the following web site:
<http://wwwcf.fhwa.dot.gov/legsregs/directives/fapq/cfr0650c.htm>

Ohio currently rates bridge element conditions with a 1-4 scale. Summary items conform to the definitions and rating scales established by the NBIS. The NBIS do not require element level condition rating for County bridges unless they are on the expanded National Highway System (NHS) beginning October 1, 2014.

Madison County has inspection responsibilities for 183 bridges, 94 of which are longer than 20 feet in length and 89 which are 10 feet to 20 feet long. The NBIS inspection and load rating requirements only pertain to highway bridges in excess of 20' long on public roads. Review of the inventory span lengths showed that all bridges except 1 had the NBIS designation Y/N coded correctly. County should check the f-f abutment distance for 4931939 and make corrections to item 306.

The office review and the field review demonstrated that County personnel were inspecting and coding bridges in accordance with ODOT's Bridge Inspection Manual ("Manual").

Inspection Procedures

Madison County uses their own staff to do the inspections. Previous inspection reports are available at site for review. Bridge inspections are recorded on paper. Comments are recorded on inspection reports. They are not brought to the bridge, but should be. Bridge plans are not carried to the bridge site for review, but are available if needed. Photos are not available for every bridge, but photos are taken of defects during inspection.

The County indicated that an average of 7 inspections per day were completed in 2018. Truss (pony/through/deck) takes 2.5 hours depending on size and if it is a FC inspection. It takes 2 hours for Beam/Girders. For a slab, it takes 1 hour. For a Culvert, it takes 1 hour.

The County does not have any bridges that require a snooper for inspection.

Frequency of Inspections

Ohio State Transportation Laws require all State and local bridges to be inspected annually. Madison County had 182 bridges inspected in 2018. The NBIS maximum inspection frequency of two years is met. All Bridges over 10 feet in length are inspected annually. The Program Manager based on inspection reports determines the need for a routine inspection frequency greater than once a year. There are a couple bridges that requires inspection more frequently than one year. SFN 4930207 and SFN 4930649 are both inspected monthly. These are just visual inspections, no inspection report is filed.

Qualification and Duties of Personnel

Mr. Bryan Dhume is the County Engineer, Program Manager and Reviewer. He is a PE and has 14 years of inspection related experience. He took the Bridge Inspection Level 1 in 2006 and Level 2 in 2007. He took a Bridge Inspection Refresher Training in 2018. Mr. Dhume is qualified as Program Manager and Program Reviewer.

Mr. Jeff Coleman is a Team Leader. He is a PE and has 1.5 years of inspection related experience. He took Bridge Inspection Level 1 and Level 2 in 2018. Mr. Coleman is qualified to be a Team Leader.

Mr. Ken Koppes is a Team Leader. He is a PE and has 4 years of inspection experience. He took Bridge Inspection Level 1 and Level 2 in 2015. He is qualified to be a Team Leader.

Mr. Nathan Ernst is a Team Member. He does not have any years of inspection related experience. He took Bridge Inspection Level 1 and Level 2 in 2017. He is qualified to be a Team Member.

Jeff Coleman (PE 82389) is responsible for doing the Load Ratings.

Inspection Reports

As part of this review, six bridges were field reviewed to compare conditions with the most recent inspection report. The individual condition ratings for all six bridges properly reflected the field conditions within the tolerance of 1 rating value when compared to the Manual. Summary ratings correspond with the NBIS inspection items.

Inventory Items

During the Field Review, the CEAO QA/QC Engineer checked select inventory items and the following issues were found:

- SFN 4930509
 - The Floor/Slab needs to match the Superstructure Item Slab (Both need to be 2)
 - Superstructure Summary needs to be 5 and not 4
 - There needs to be detailed comments since the GA=3
 - Scour item 113 needs to be 5 and not 8
 - Approach Alignment item 72 needs to be 8 and not 6
 - Item 409 Deck Drainage should be coded “off the ends”, not “over the side”
- SFN 4930797
 - Bridge Structure Type needs to be 321 and not 111
 - The Floor/Slab needs to match the Superstructure Item Slab
 - Scour item 113 needs to be 5 and not 8
 - Approach Alignment item 72 needs to be 8 and not 6
 - Item 475 should be steel beam, not slab
 - Detailed comments are needed since the GA=3
- SFN 4930851
 - Approach Wearing Surface item c1 needs to be 2 and not 1
 - Approach Guardrail item c5 needs to be 1 and not 2
 - Guardrail safety item 36(A) should be coded N since this is a culvert
 - Superstructure Arch, Arch Spandrel Walls, and Substructure Wingwalls, and Scour should not be rated since this is a culvert.
 - Scour item 113 needs to be 5 and not 8
 - Approach Guardrail item 401 needs to be another code – not 2

- Deck Drainage and Deck Type. Items 407 and 409 should not be coded since this is a culvert.
- Detailed comments are needed since the GA=5.
- SFN 4932285
 - Abutment Caps item c34 should not be rated since the abutment wall is a solid wall and does not have a cap
 - Pier Columns/Bents item c38 needs to be 3 and not 2
 - Superstructure Summary should be 3, not 4 since there is a thru hole in the web of the beam in the shear zone.
 - There needs to be detailed comments
- SFN 4930207
 - Approach Alignment item 72 is 8 and not 6
 - Detailed comments are needed because the GA=5
- SFN 4930983
 - Guardrail safety item 36(A) should be coded N since this is a culvert
 - Channel Hydraulic Opening item c53 needs to be 2 and not 1
 - Channel Summary should be 6 not 8
 - Scour item 113 needs to be 5 and not 8

Files

Madison County keeps all information and documents in paper files in cabinet and also on the server.

Load Rating

The inventory shows 94 (100.00%) of the County bridges have been Load Rated or Load Rating was not applicable. There were 2 bridges evaluated by documented engineering judgement. The county will do a BR100 for these two bridges.

Load Ratings were checked for SFNs 4932285, 4930797, 4930207, 4931336. The load posting at the bridge matched the load rating on all bridges. P.E. name and stamp were on all load ratings except for SFN 4932285. It needs a cover letter.

Load Posting

Madison County has 6 bridges that are load posted. There are 0 bridges closed for condition ratings. They use a mix of engineering judgment and analysis – hand calcs and BRR. The type of sign used for load posting is SHV. Posting is based on Operating.

Special Features

Madison County does not have any bridges that have special features.

Fracture Critical Bridges

The FC bridge inspection frequency is yearly. Madison County had SFN 4932838 and SFN 4931491 reviewed. They both had FCM's identified as well as both had the Fatigue Prone details shown. They both need to have the procedure detailed.

Underwater Inspections and Scour

There are 0 bridges require underwater inspections. There are 65 bridges considered scour susceptible and any bridge is inspected by probing if it looks to have a scour possible. There are 0 bridges that are scour critical.

Note, two bridges were missing the FC Y/N coding and the UW Y/N coding. They need to be added at the next inspection. Three bridges were missing the Plan information code in Item 709

QA/QC

The QA/QC section of the 2014 Bridge Inspection Manual meets the FHWA requirement. Quality Assurance checks are reviewed at inspection report approval. Upon notification from Mark is how often the inventory is checked for needed updates. Inventory data is input into the system via SMS. Updated inventory data needs to be forwarded to ODOT within 180 days. When changes are discovered during inspection it is entered into SMS. When changes from new construction or rehab are made, they are entered into SMS upon completion.

Critical Findings

The county does have a Critical Findings Procedure in place located in the SMS. Maintenance problems are identified on the bridge inspection form and on the repair list. Inspectors inform maintenance personnel of routine bridge maintenance problems with a repair list once the inspections have been completed. Inspectors notify the County Engineer when emergency repairs or critical findings are necessary. It is documented on the daily work reports. If a bridge requires emergency repairs, it would be noted on the inspection report and orally to the County Engineer. The Deputy Engineer is the one that checks proper placement of signs. They were instructed to use the SMS Critical Findings Report.

Bridge Maintenance

The NBIS inspection and load rating requirements only pertain to highway bridges in excess of 20' long on public roads. Review of the inventory span lengths showed that all bridges had the NBIS designation Y/N coded correctly.

Madison County has maintenance responsibilities for 182 bridges, 102 of which are longer than 20 feet in length and 80 which are 10 feet to 20 feet long. The County does force account bridge work as needed. The work includes deck replacements, and new structures. The approximate budget is \$150,000. Funds and Credit Bridge Funds are used.

The county uses in-house staff that consists of 4 employees. They use them to do patching of steel beams and concrete decks. The approximate budget is \$350,000.

Projects are identified and selected by the inspection reports and field visit information. Plans are developed in house by the County Engineers. The Bridge Crew are the ones who do the work of the emergency repairs. Repair work is documented on daily work sheets and photos. The County Engineer is empowered to order emergency road closures. Closures are done with a call to the traffic superintendent.

CONCLUSIONS AND RECOMMENDATIONS

- SFN 4930509
 - The Floor/Slab needs to match the Superstructure Item Slab (Both need to be 2)
 - Superstructure Summary needs to be 5 and not 4
 - There needs to be comments done
 - Scour needs to be 5 and not 8
 - Approach Alignment needs to be 8 and not 6
- SFN 4930797
 - Bridge Type needs to be 321 and not 111
 - The Floor/Slab needs to match the Superstructure Item Slab
 - Scour needs to be 5 and not 8
 - Approach Alignment needs to be 8 and not 6
- SFN 4930851
 - Approach Wearing Surface needs to be 2 and not 1
 - Guardrail needs to be 1 and not 2
 - Arch, Arch Spandrel Walls, Wingwalls, and Scour needs to all not be rated
 - Scour needs to be 5 and not 8
 - Approach Guardrail needs to be another code – not 2
- SFN 4932285
 - Abutment Walls and Abutment Caps needs to not be rated
 - Pier Columns/Bents needs to be 3 and not 2
 - Superstructure Summary needs to be 3, not 4, due to thru hole in shear zone
 - There needs to be comments done
- SFN 4930207
 - Approach Alignment is 8 and not 6
- SFN 4930983
 - Safety Features needs to not be rated
 - Hydraulic Opening needs to be 2 and not 1
 - Scour needs to be 5 and not 8
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The following items were provided to the county in detailed lists:

- BR-100 is needed on all engineering judgment bridges. They will check and fix
- SFN 4930649 – Item 64 and 66 need to be shown in tons
- They will add rating source item 709 to SMS Load Ratings page for 3 bridges
- Calculations will be checked for Legal Load RF's. They should not be equal
- NBIS Length can't be greater than Max Span for single span beam SFN 4931939 – they will check the f-f abutment distance and correct item 306.
- FC and UW inspection required Y/.N Switch needs completed in 2019 Inspection for 2 bridges
- FC bridges need to have a written FC inspection procedure as described in Metric 16.
- Comments need to be detailed on all bridges with $GA \leq 5$. Comments should be taken to the bridge.

The chart on the following page is a review of the 23 Metrics used to measure NBIS compliance and the chart represents a **preliminary, tentative** assessment of the county's level

of compliance. Action steps for compliance are listed at the bottom. The actual assessments of NBIS compliance are made by FHWA, based on documentation, and any final determinations of compliance may differ from this preliminary assessment. The Metric 12 & 22 result on the following page is based on the field review of the six bridges visited during the QAR using the NBIP Field Review Checklist - PY 2013, Minimum Level Review Items.

PRELIMINARY FHWA 23 Metric Matrix

23 metrics used by FHWA to measure NBIS compliance. Actual “score” by FHWA may differ.

Compliance Codes for the following Metrics:

- (C) Compliant
- (SC) Substantially Compliant
- (CC) Conditionally Compliant
- (NC) Not Compliant

Metric	Description	(C)	(SC)	(CC)	(NC)
1	State Bridge Inspection Organization				
2	Program Manager Qualification				
3	Team Leader Qualification				
4	Load Rating Engineer Qualification				
5	UW Bridge Inspection Diver Qualification				
6	Routine Inspection Frequency - Low Risk				
7	Routine Inspection Frequency - High Risk				
8	UW Inspection Frequency - Low Risk				
9	UW Inspection Frequency - High Risk				
10	FC Inspection Frequency				
11	Frequency Criteria				
12	Inspection Quality **				
13	Load Rating				
14	Posted or Restricted Bridges				
15	Bridge Files				
16	FC Bridges				
17	UW inspection procedures				
18	Scour Critical Bridges				
19	Complex Bridges				
20	QC/QA				
21	Critical Findings				
22	Inventory **				
23	Updating of Data				

** based on results of Field Review

Metric	Action Needed
12	Detailed Comments needed when Summary <=5 plus photos or sketches