National Bridge Inspection Standards & Bridge Maintenance Program Review Vinton County April 25, 2014

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

IN ATTENDANCE:

Brian Reedy, Assistant to Engineer
Matt Lawler, DLZ
Brandon Sopko, DLZ
Mark Stockman, CEAO Federal Bridge QA/QC Engineer

SCOPE OF REVIEW:

The review consisted of interviews with Vinton County personnel, reviews of inspection and inventory data, and reviews of Vinton County bridge records. The office evaluation assessed Vinton County's organization, procedures, resources, and documentation regarding the inspection, inventory, and maintenance operations for bridges. In addition, field reviews of eight 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 Vinton 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
8230587	VIN 00018-0300	095	1936	17'	6A	same
8230579	VIN C0018-0250	111	1936	20'	4A	2A
8230625	VIN C0018-0400	111	1939	27'	4P	same
8234914	VIN T046R-01	344	1999	76'	8A	same
8233756	VIN T034J-0150	321	1941	27'	4P	5P
8230692	VIN CR18-0350	344	1993	54'	5A	same
8230617	VIN C0018-0360	111	1936	18'	6A	5A*
8230595	VIN C0018-0340	231	1964	60'	5A	same

* condition had worsened within last year

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/fapg/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 NHS system beginning April 1, 2015.

Vinton County has inspection responsibilities for 210 bridges, 119 of which are longer than 20 feet in length and 91 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. Vinton County records showed 211 bridges inspected (122 over 20' and 89 10'-20'). The county should review their records and ensure that the correct number of bridges is in the SMS. Review of the inventory span lengths showed possible 10 bridges had the NBIS designation Y/N coded incorrectly. (20' spans and no skew, yet coded NBIS=Y) NBIS bridges must be greater than 20' clear span. These should be field checked at the next inspection and the coding corrected if necessary.

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"), and only 1 bridge rating was out of tolerance with regards to complete compliance with the National Bridge Inspection Standards (NBIS). Comments are listed below.

Inspection Procedures

Vinton County uses a consultant (DLZ) to do the inspections. Previously, the inspector brought last year's inspection to the bridge on paper. A laptop was at the bridge site for supplemental data. Comments from the previous inspection are also brought to the bridge. Ratings were recorded on paper in the field and were put into the BMS via direct entry to the BMS. Comments were recorded on the BR-86 and on a separate Summary Spreadsheet. Future inspections will be done using a tablet at the bridge site and bridge ratings will be recorded electronically. The county was informed that Summary ratings of 5 or lower require complete comments in the individual items describing the Location, Extent, and Severity of the defect (LES) including pictures or sketches. The comments that the county has been making were numerous, but improvements could be made in detailing the Location, Extent, and Severity of the defects. Vinton County inspection personnel are inspecting bridges in

compliance with the Manual and the NBIS. With the exception of 1 bridge substructure rating, the condition ratings properly reflected the field conditions when compared to the Manual. The improper substructure rating is described below under Inspection Reports.

Several inspectors covered Vinton County in 2013. A review of the BMS inspection records indicated that an average of 9.9 inspections per day were completed in 2012 and the highest number was 16 inspections per day. One inspector averaged 11 bridges per day. The inspections include some smaller bridges between 10'-20' as well as NBIS length bridges. The county was advised that a high number of inspections per day (>10), could result in deeper scrutiny of the inspection bridge program, but it is not regarded as a violation of the NBIS.

The County does not use the ODOT snooper. The inspector does use photographs to document deficient bridge conditions and photographs are available for every bridge.

Frequency of Inspections

Ohio State Transportation Laws require all State and local bridges to be inspected annually. Vinton County was current on all annual inspections. The NBIS maximum inspection frequency of two years is met. All Bridges over 10 feet in length are inspected annually. No bridges are inspected more often than once per year.

Qualification and Duties of Personnel

Mr. Ronald Sharrett is the County Engineer and as such has overall responsibility for the bridge program. He is a PE and PS.

Mr. Brian Reedy is the Program Manager. He has approximately 24 years inspection experience. He took the ODOT Level 1 & 2 Bridge Inspection courses in 1997. He has not taken a Refresher. He will need to take a Refresher class within the next year to remain qualified as Program Manager.

Mr. Matthew J, Lawler is the Reviewer and Team Leader. He is a PE and has 25 years of bridge inspection experience. He took the ODOT Level 1&2 inspection classes in 1990 and the Refresher in 2011. He is qualified to be a Reviewer and Team Leader.

Mr. Patrick A. Toman is a Team Leader. He is a PE and has approximately 15 years of bridge inspection experience. He took the ODOT Level 1&2 inspection classes in 1999 and the Refresher in 2011. He is qualified to be a Team Leader.

Mr. Jeffrey A. Miller is a Team Leader. He is a PE and has approximately 13 years of bridge inspection experience. He took the ODOT Level 1&2 inspection classes in 2001 and the Refresher in 2011. He is qualified to be a Team Leader.

Mr. Brandon Sopko is a Team Member. He is a EI and has approximately 4 years of bridge inspection experience. He took the ODOT Level 1 inspection class in 2012 and Level 2 in 2014 and the Refresher in 2013. He is qualified to be a Team Member.

Mr. Miles Whtesel is a Team Member. He is a EI and has approximately 3 years of bridge inspection experience. He took the ODOT Level 1 inspection class in 2012. He is qualified to be a Team Member.
Mr. Ian Foye is a Team Member. He is a EI and has approximately 2 years of bridge inspection experience. He is qualified to be a Team Member.

Mr. Matthew J. Lawler is the Load Rating Engineer. He is a registered Professional Engineer in Ohio, license number 60508. He is qualified to do load ratings.

Inspection Reports

As part of this review, eight bridges were field reviewed to compare conditions with the most recent BR-86. The General Appraisals and Summary Ratings for all bridges except one matched the Manual. Bridge 8230579 had a scour condition that should be rated a 4 (not 3) and then the Summary would become a 2 (not 4). (The scour on this bridge was below the footing.) Summary ratings correspond with the NBIS inspection items. All discrepancies were discussed at the bridge site.

Inventory Items

During the Field Review, the CEAO QA/QC Engineer checked select inventory items and the following issues were found: (note – all item numbers are referenced to the SMS, not BMS)
- Approach Roadway Alignment (item 72) was incorrect for SFN 8230587, SFN 8230579, 8234914, 8230617 and 8230625.
- SFN 8230587 had the Approach Roadway Width (item 32) and Overall Structure Length (item 49) incorrect.
- SFN 8230579 Scour Code (item 113) should be 3, not 5.
- SFN 8234914 Structure Type (item 43B) should be Pony, not Thru. Bridge Rail Safety code (item 36A) should be 0, not 1.
- SFN 8230692 Structure Type (item 43B) should be Pony, not Thru. Bridge Rail Safety code (item 36A) should be 0, not 1. Lat/Long coordinates were incorrect, showing a location miles away. Rating Factors in the inventory were incorrect (were left over from previous bridge)
- SFN 8230617 had the Overall Structure Length (item 49) incorrect.
- SFN 8230595 had the Approach Roadway Width (item 32) incorrect.

During the Office portion of the review, additional inventory items in the BMS were checked and the following errors were found:
- All 25 trusses were coded as Thru trusses but were actually pony trusses. The Structure Type coding should be checked and be corrected to 34A (Pony) if necessary.
- 55 bridges showed a Pier Foundation coding of Unknown, but they were single spans and had no piers. This should be corrected.
- 4 bridges (3 steel beam and 1 prestressed concrete beam) had equal Inventory and Operating Rating Factors. The Rating Factors should not be equal.
- 7 bridges were load rated above 100% legal but were coded with an Operating Status = R. This should be changed to P and the Load Rating information in the Inventory should be changed to show Method of Rating = Engineering Judgment, Ohio % Legal below 100%, and

Rating Factors < 1.00. Engineering Judgment documentation must also be done on these bridges.
- SFN 8230056 showed 150% legal but was posted. The Load Rating information in the Inventory should be changed to show Engineering Judgment, Ohio % Legal below 100%, and Rating Factors < 1.00. Engineering Judgment documentation must also be done on this bridges.

Also during the review of the BMS data, all (100.0%) bridges showed the General Appraisal did match the lowest of the Superstructure, Substructure, or Culvert Summaries. This is excellent. However, the 1-4 codes correlation to 0-9 codes should be checked. The inventory showed 30 (1.2%) instances of inconsistency. If deviations in the 1-4 coding are necessary, then the inspection comments should explain why.

Files

Vinton County maintains Bridge files mostly on computer for each bridge. Most of the items listed as significant components in Metric 15 are in place. One bridge file was reviewed as an example for the county to see the requirements. Following is a review of that bridge file. Scour Evaluations have been done mentally. The county was advised to add written Scour Evaluations to the file if they have them and develop channel data, including channel x-sections and hi water data if needed for each bridge over water.

SFN …….……	__8230005 _____
Inspection Reports ……	___Yes_____
Inventory, photos, repairs……..	___Yes_____
Load analysis calculations ……..	___Yes_____
Load posting documentation ……..	___Improve – add dates
Critical Findings ……	___Improve – add dates
Scour Evaluation ……..	_Yes, but not written___
Scour POA …….	___Yes_____
Significant Correspondence ……	___Yes_____
Special eqpt./procedures …….	_____N/A_____
Waterway data, flood, channel, etc. ……...	_____ No ____

Bridge load rating files for SFN 8230579, 8230595, and 8233756 were checked and none of the bridge load ratings had a PE stamp or signature. Section loss was accounted for in the calculations. It was recommended to create a cover letter with PE stamp and signature to accompany all copies of load ratings.

In addition, SFN 8233756 load rating information in the inventory did not match the posting. The Analysis showed the bridge should be posted at 20 tons but the sign was 30 tons. The sign used the 75 % Legal, not the lowest tonnage from the Ohio legal trucks. This should be reviewed and corrected so the inventory load rating data matches the sign and analysis in the file. If the posting deviates from the Operating rating, the file should make note of that and the

inventory changed to show method of rating = engineering judgment. All other load postings should be reviewed to ensure the sign at the bridge is showing the correct load limit.

All bridges using the Method of Analysis = 0 (Field Evaluation and Documented Engineering Judgment) must have documentation of the engineering judgment. The county needs to create a BR-100 Load Rating Summary for each bridge and include a narrative explaining the engineering judgment for the load rating.

Fracture Critical Files for SFN 8230692 and 8234914 were reviewed. FC Members were identified and Fatigue Prone Details were shown. A FC Inspection procedure was not done. Gusset Plate calculations for these two bridges included the unstiffened edge length test, but did not include a PE stamp or signature. All Fracture Critical bridges need to have a FC Procedure and the cover letter for load ratings should include the gusset plate calculations. A sample of a FC Procedure was given to the county.

All bridges have been evaluated for scour, but the evaluations need to be in writing.

Load Rating

The inventory shows 117 (100.0%) of the County bridges have been load rated or evaluated with Engineering Judgment, and 2 did not need load rated because they did not carry vehicular traffic.

Load Posting

The BMS showed Vinton County has 20 bridges that are load posted for capacity and 7 posted for other reasons. (the 7 posted for other reasons should show posted for load capacity) 1 bridge is closed. If the county needs to post a bridge they use Operating Rating to post their bridges and Gross Tonnage signs are used.

Special Features

The County has 0 bridges with special features.

Fracture Critical Bridges

Vinton County has 25 fracture critical bridges.

Underwater Inspections and Scour

No bridges need an underwater inspection according to the BMS.

0 bridges are coded as Scour Critical. All bridges have been evaluated for scour but none had the scour evaluation in writing. The county should develop a plan to create a written evaluation for all bridges over water.

QA/QC
The bridge inspector Team Leader are licensed PEs. The inspections are done by teams of 2 and discussions of ratings are held by the team. The QA/QC section of the 2014 Bridge Inspection Manual meets the FHWA requirement for QA/QC.

Critical Findings
The county does not have a Critical Findings procedure in place. However, they have a routine practice to immediately call in bridge issues that needed immediate attention to protect public safety. This practice was not documented in any procedure. They were given the ODOT flowchart with a recommendation to adopt the flowchart, or something similar, as a Critical Findings Procedure to meet the requirements of Metric 21.

The county did document a Critical Finding for bridge SFN 8230692 dated 7/1/2010. It was adequate however dates should have been noted to document the time frames of actions taken.

Bridge Maintenance
The County has up to 17 county personnel to do bridge work. They do not have a dedicated bridge crew, but assign workers to the bridges as needed. Work performed on bridges includes maintenance, guardrail, pothole repair.

The county has a contract construction program that does complete replacements, Concrete overlays, and pile encasements. The amount is approximately 3 Million dollars per year. County uses local funds but does not use federal funds and does not use credit bridge funds.

Plans for emergency projects are done in house by the bridge staff. The work is done by county forces or contractors, depending on the nature of the work. Projects are selected by inspection conditions, and available funding. Labor, equipment and materials are all documented.

CONCLUSIONS AND RECOMMENDATIONS

1. The following should be corrected:
- Approach Roadway Alignment (item 72) was incorrect for SFN 8230587, SFN 8230579, 8234914, 8230617 and 8230625.
- SFN 8230587 had the Approach Roadway Width (item 32) and Overall Structure Length (item 49) incorrect.
- SFN 8230579 Scour Code (item 113) should be 3, not 5.
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- SFN 8230617 had the Overall Structure Length (item 49) incorrect.
- SFN 8230595 had the Approach Roadway Width (item 32) incorrect.
- All 25 trusses were coded as Thru trusses but were actually pony trusses. The Structure Type coding should be checked and be corrected to 34A (Pony) if necessary.
- 55 bridges showed a Pier Foundation coding of Unknown, but they were single spans and had no piers. This should be corrected.
- 4 bridges (3 steel beam and 1 prestressed concrete beam) had equal Inventory and Operating Rating Factors. The Rating Factors should not be equal.
- 7 bridges were load rated above 100% legal but were coded with an Operating Status = R. This should be changed to P and the Load Rating information in the Inventory should be changed to show Method of Rating = Engineering Judgment, Ohio % Legal below 100%, and Rating Factors < 1.00. Engineering Judgment documentation must also be done on these bridges.
- SFN 8230056 showed 150% legal but was posted. The Load Rating information in the Inventory should be changed to show Engineering Judgment, Ohio % Legal below 100%, and Rating Factors < 1.00. Engineering Judgment documentation must also be done on this bridges.

2. All (100.0%) bridges showed the General Appraisal did match the lowest of the Superstructure, Substructure, or Culvert Summaries. This is excellent. However, the 1-4 codes correlation to 0-9 codes should be checked. The inventory showed 30 (1.2%) instances of inconsistency. If deviations in the 1-4 coding are necessary, then the inspection comments should explain why.

3. Comments should be improved to assure that Location, Extent and Severity are properly described, especially when the Summary Rating <=5. Summary ratings 6 or higher can use nominal comments.

4. Most Load Ratings did not have a PE stamp and signature. A cover letter containing the PE stamp and signature should be developed to accompany all load ratings. The cover letter should also refer to Gusset Plate calculations.

5. The number of bridges in the county records differed from the records in the BMS. The county should review their records and ensure that the correct number of bridges is in the SMS.

6. Up to 10 bridges had the NBIS designation Y/N coded incorrectly. NBIS bridges must be greater than 20’ clear span. These should be field checked at the next inspection and the coding corrected if necessary.

7. Waterway data (channel cross-sections, high water data, head cut, undermining, etc.) should be added to the bridge files if they are needed to record unusual channel conditions.

8. Posted bridges should be checked to ensure that the load analyses in the file are interpreted correctly and that the bridge is posted at the lowest tonnage for the Ohio Legal Trucks (not posted by Ohio % Legal). SFN 8233756 is one example of an incorrect posting that needs to be corrected.

9. The load rating information in the inventory should be reviewed and corrected so the inventory load rating data in the SMS matches the load rating analysis in the file. (even for bridges that are not posted)

10. All bridges using the Method of Analysis = 0 (Field Evaluation and Documented Engineering Judgment) must have documentation of the engineering judgment. The county needs to create a BR-100 Load Rating Summary for each bridge and include a narrative explaining the engineering judgment for the load rating.

11. All Fracture Critical bridges need to have a FC Inspection Procedure. Metric 16 lists specific risk factors and other details of what needs to be in the Procedure.

12. The county should adopt a Procedure for Critical Findings, such as the ODOT flowchart or something similar, to meet the requirements of Metric 21.

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 eight 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

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 ** 97%				
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 ** 93%				
23	Updating of Data				

** based on results of Field Review

Metric	Action Needed
2	PM needs Refresher class within year
12	All Ratings should be within 1 value of the MBI
13	PE stamp and signature needed. Documentation for Engineering Judgment needed.
22	Check inventory items during future inspections