

# National Bridge Inspection Standards & Bridge Maintenance Program Review

## Knox County

June 18, 2021

(October Data update)

By: Mark Sherman, PE

CEAO Federal Bridge QA/QC Engineer

### IN ATTENDANCE:

Clint Cochran, Deputy County Engineer

Mark Sherman, CEAO Federal Bridge QA/QC Engineer

Kenny Tong, FHWA

Alexis Bogen, FHWA

### SCOPE OF REVIEW:

The review consisted of interviews with Knox County personnel, reviews of inspection and inventory data, and reviews of Knox County bridge records. The office evaluation assessed Knox County's organization, procedures, resources, and documentation regarding the inspection, inventory, and maintenance operations for bridges. In addition, field reviews of 8 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 Knox County to represent a variety of structure types and conditions. The bridges checked during the field review were:

Asset Name	Bridge Type	County Rating	NBIS Rating
<a href="#">KNO-00121-0004_(4236394)</a>	Steel Pony Truss	4	6 (new stringers added after insp. 2021)
<a href="#">KNO-00089-0013_(4232585)</a>	prestressed Boxes	4	Agreed
<a href="#">KNO-00257-0054_(4235657)</a>	Steel Beam	4	Agreed
<a href="#">KNO-00027-0007_(4231104)</a>	Concrete Slab	4	Agreed
<a href="#">KNO-C0257-0033_(4235851)</a>	Steel twin Culverts	3	Agreed
<a href="#">KNO-00401-0009_(4237048)</a>	Steel Beam	3	Agreed

### 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 National Highway System (NHS) beginning October 1, 2014.

**Knox County** has inspection responsibilities for **324** bridges, **198** of which are longer than 20 feet in length and **126** 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 had the NBIS designation Y/N coded correctly.

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:**

**Knox County** supplements their own staff with John Wackerly , Burgess and Niple, and EP Ferris Consultants to do the inspections. Previous inspection reports are available at site for review. The previous year's inspection reports are on paper and transferred to AssetWise in the office. Bridge comments are recorded in the inspection form.

Bridge plans are available in the office. Photos are available for every bridge, and photos are taken (if needed) of defects during inspection and posted in Assetwise.

The County has **0** bridges that require a snooper.

A Team Leader is present at routine inspections.

#### **Frequency of Inspections** (metric 6 & 7)

Ohio State Transportation Laws require all State and local bridges to be inspected annually.

**Knox County** had **324** bridges inspected in 2020. The NBIS maximum inspection frequency of two years is met. All Bridges over 10 feet in length are inspected annually. The Engineer determines the need for a routine inspection frequency greater than once a year, based on inspections and history.

There are no bridges that require inspection more frequently than one year.

Knox County had 0 bridges overdue for Fracture Critical inspection at the time of this field review.

#### **Qualification and Duties of Personnel** (metric 1 & 2)

##### **Program Manager and Reviewer:**

**John Wackerly, Consultant**

List qualifications/yrs. Experience.

**40+ years.**

List courses attended (& approx. dates).

**Resume complete with bridge inspection certified instructor/trainer.**

**Team Leader and Team Reviewer and Load Rating Engineer:**

EP Ferris Consultants, Richland Engineering Consultants, Burgess and Niple:  
Consulting Engineers

List qualifications/yrs. experience (bridge inspection experience)

30+ yrs. Experience

List courses attended (& approx. dates).

Resumes and qualifications up to date and on file.

**Underwater Bridge inspector:** NA

**Inspection Reports** (metric 12)

As part of this review, eight bridges were field reviewed to compare conditions with the most recent inspection report. The individual condition ratings for all of the field sampled 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.

**Field Review:**

KNO-00121-0004\_(4236394) Tucker Road over Dry Creek Pony Truss

Item 58 Deck..... 7 New in 2020 At least an 8 or better.

Item 59 Superstructure.....4 Retrofitted with permanent shadow stringers in May 7 better.

Item 60 Substructure.....6 Agreed

Item 61 Channel.....6 Agreed

Item 61.01 Scour.....7 Agreed

Item 62 Culvert.....N

Item 36 Railing..... 0 0 0 0 Agreed

Item 72 Approach Alignment ..... 6 a 7 or 8 given approaches are straight and level with clear visibility.

See Table & Approach Item72 discussion in manual.

Comments: Excellent Comments in Assetwise.

Defect Photos: Excellent Photos in Assetwise.

Channel Photos: Excellent Photos in Assetwise.

KNO-00089-0013\_(4232585) Kinney Road over Dry Creek Prestressed Boxes

Item 58 Deck..... 6 No separate deck, code same as boxes 4

Item 59 Superstructure.....4 Agreed

Item 60 Substructure.....6 Agreed

Item 61 Channel.....6 Agreed

Item 61.01 Scour.....7 Agreed

Item 62 Culvert.....N

Item 36 Railing..... 0 1 1 1 Agreed

Item 72 Approach Alignment ..... 6 Should be a 7 or 8 given manual discussion.

Comments: Excellent Comments in Assetwise

Defect Photos: Great defect photos in Assetwise.

Channel Photos: Great Channel Photos

KNO-00257-0054\_(4235657) Glen Road Over Delano Run Steel Beams

- Item 58 Deck..... 4 Agreed
- Item 59 Superstructure.....4 Agreed, headed toward a 3 given increasing midspan section loss in several beams. Bridge posted for 15 tons back in 1981 right after construction, it now has several inches of asphalt on the deck and is condition rated a 4. A new load rating is strongly recommended.
- Item 60 Substructure.....5 Closer to a 6 but within 1 pt. with the only rusting/flaking occurring at the bottom of the pile abutments.
- Item 61 Channel.....6 Agreed
  - Item 61.01 Scour.....7 Agreed
- Item 62 Culvert.....N
- Item 36 Railing..... 0 0 0 0
- Item 72 Approach Alignment ..... 5 (Based on geometry and proximity of approach curve, I recommend a 6 rating, but within 1 pt. allowance.) No Posting sign installation date in Assetwise. Not a critical item for this QAR

Comments: Good Comments too general, Loc. Ext. and Severity on superstructure and substructure items would be helpful.

Defect Photos: Very few Defect Photos in Assetwise

Channel Photos: Could find no channel photos in Assetwise ( need upstream and downstream photos like that below.



Pic taken during field review.

KNO-00027-0007\_(4231104) Sycamore Road over Branch of Big Run Concrete Slab

- Item 58 Deck..... 4 Agreed
- Item 59 Superstructure.....4 Agreed
- Item 60 Substructure.....6 Agreed
- Item 61 Channel.....6 Agreed
  - Item 61.01 Scour.....6 Agreed
- Item 62 Culvert.....N
- Item 36 Railing ..... 0 0 0 0
- Item 72 Approach Alignment ..... 8 Agreed

Comments: Good, but brief Comments need to be more specific with respect to Location Extent and severity.

Defect Photos: Expected a little more in the way of Defect Photos to compliment comments

Channel Photos: Nothing in Assetwise. See previous comment.

**KNO-C0257-0033\_(4235851) Porter Road over Stream Twin Steel Culvert**

Item 58 Deck.....N

Item 59 Superstructure.....N

Item 60 Substructure.....N

Item 61 Channel.....5 Agreed

Item 61.01 Scour.....6 Agreed

Item 62 Culvert.....3 Agreed

Item 36 Railing..... 0 0 0 0 Agreed

Item 72 Approach Alignment ..... 8 Agreed

Comments: Would like to see more description in Comments and a few measurements.

Defect Photos: Not enough photos in sections under roadway

Channel Photos: Very Good upstream Channel Photo, need a downstream photo.

**KNO-00401-0009\_(4237048) Beckley Road over N B Kokosing River Steel beam cont.**

Item 58 Deck..... 5 Agreed

Item 59 Superstructure.....3 Agreed

Item 60 Substructure.....4 Agreed

Item 61 Channel.....5 Agreed

Item 61.01 Scour.....6 Agreed

Item 62 Culvert.....N

Item 36 Railing..... 1 0 0 0 no tubular backup

Item 72 Approach Alignment ..... 2 Agreed

Comments: Very Good Comments on Superstructure

The substructure comments are good, but it is hard to tell if severity of pile section loss is recent or not.

Defect Photos: Defect photos needed to show more like the close-up photos of the pier piling holes above. And the beam section loss.

Channel Photos: None in Assetwise. Long bridge with channel equally wide, may necessitate a channel measurement rather than photos.

### Inventory Items

Review of the bridge data showed **19** out of **195** bridges were missing comments when the rating was <=5. This requirement became effective Nov of 2020. **2** bridges should have Scour governing the substructure rating **KNO-C0038-0250\_(4232313); KNO-00401-0003\_(4231716)** . And **0** of those bridges have a disparity of 2 or more change in points for scour.

### Bridge Files: (metric 15)

**Knox County** keeps files listed below as follows:

All of the following are kept in electronic format and paper format unless noted.

- Inspection reports, including old inspections
- Design Calculations

- Plans
- Load analysis calculations
- Inventory forms
- Photos and sketches
- Repairs and maintenance history
- Scour evaluation N/A
- Scour POA N/A
- Fracture Critical File
- Load Posting/Closing
- Underwater inspections N/A
- Special inspection eqpt. or procedures N/A
- Flood data, waterway adequacy, channel cross sections

Note the NBIS Retention period: BR-86 report 10 years, All records 3 years after bridge removed, Load rating calculations 3 years after a new rating is done.

**Load Rating** (metric 13)

The inventory shows **198 (100.00%)** of the County NBIS bridges have been Load Rated or Load Rating was not applicable. There are **1** NBIS bridges evaluated by documented engineering judgement using the BR100 form.

Load Ratings were checked for **SFNs 4236580; 4234309; 4235029; 4232534**. The load posting at the bridge matched the load rating on all bridges. P.E. name and stamp were on all of the bridges. Documentation was on all of the bridges. BR100 form is available for all engineering judgment bridges.

Zero NBIS bridges have not been load rated.

Zero bridges had Oper. ratings equal to the Inv. rating. Column AM in the Load Rating Tab of Snapshot file.

Load Rating Data			
Load Rating Tab		# OF ERRORS	
Col. AN	Op RF greater than Inv RF?	0	
Col. AO	Posting and % Legal OK?	0	
Col. AP	"0" used instead of blank	0	
Col. AT	% legal < lowest RF	1	KNO-00121-0004_(4236394) 150% legal but coded P in Column AT
Col. AV	Item 70 correct?	0	
Col. AW	Method of Rating Alike?	0	
Col. AX	Op & Inv RF in Tons as req'd?	0	
Col. AY	Item 575 correct?	0	19 load rated NBIS bridges lacking EV2and EV3 load ratings
Col. AZ	Depth of fill completed?	0	

Zero Bridges have the %legal load not tied to the lowest Load Rating Factor

**Load Posting** (metric 14)

Knox County has **26** NBIS bridges that are load posted. There is **1** bridge closed for condition ratings. Posting is based on Operating Rating. **R12-H5** signs are the type of sign used for load posting.

The County has **28** bridges that are posted, but no posting date entered in Assetwise for sign installation. See Load Rating TAB column AM highlighted in Pink (ITEM 70.01)

There is **1** bridge where the % legal (Item 41) does not match the Posting code A or P (Item 734 See Column S & T in the Load Rating TAB **KNO-00033-0007\_(4232933) Has a P in column S but is 150% in column T. I suspect the P should be an A.**



METRIC 14 - Posting		Load rating data tab				
From Files review		# errors	#sampled	% PASS	COMPLIANCE	
7 Op RF < 3 tons but not closed	Column BB	0	198	100.0%	(C)	
8 Op RF = 0 but not closed	Column BC	0	198	100.0%	(C)	
9 % Legal < 100 but not posted	Column BD	1	198	99.5%	(SC)	KNO-00121-0004_(4236394) same bridge as above in load rating table
0 Item 41 = B	Column BE	0	198	100.0%	(C)	

There are **0** bridges rated 3 or less that are not closed.

**Special Features:** There are 0 bridges with unique or special features.

### Fracture Critical Bridges (metric 16)

There are 17 FC bridge in Knox County. The FC bridge inspection frequency is 12 months, done with routine annual inspections.

FC plans for **SFN 4230876 & 4237617**, were reviewed. The FCM's identified, but the FC Inspection Procedure and Fatigue Prone details will not meet FHWA approval. The county was advised they can use Inspection Manual Appendix D & E as guidelines to a complete FC plan.

Gusset Plate calculations; ??? for SFN# 4230876 or SFN# 4237617

**Underwater Inspections and Scour: NA**

### QA/QC

The QA/QC section of the 2014 Bridge Inspection Manual meets the FHWA requirement. The Inventory items are checked and updated during annual inspections.

### Critical Findings (metric 21)

The county currently does not have any critical findings, but does have a Critical Findings Procedure in place (using the ODOT inspection manual). The county engineer is the bridge inspector and develops the plans for emergency work.

### Bridge Maintenance (from Questionnaire)

The County does contract bridge work. The typical work is for large bridges, replacements and repairs. Fed Funds are sometimes used for bridge deck replacement and Credit Bridge Funds are used for bridge replacements. The annual budget varies from year to year but averages **\$300K - \$350K** for Contract work.

The county does force account bridge work and uses highway maintenance crews as needed.

Typical work items include all repairs and medium replacements. The annual budget for force account work is approximately **\$400K - \$500K**

The chart below is a review of the 23 Metrics used to measure NBIS compliance and the chart represent 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

**Action Items for Knox County:**

Metric 12: Scour Rating should control Substructure

Metric 16: Gusset plate calculations



