

From November 29, 2016 FHWA Event Report: Ohio Steel H-Pile Failure

Please review the attached FHWA Event Report for a bridge closure due to a failure of the steel H-pile foundation.

The H-piles buckled near the waterline. The failure is believed to be caused by an illegal oversize load crossing the structure. Rusting was observed at the locations of the pile buckling. The extent of the corrosion section loss is unknown.

Taking good notes and photographs during every inspection is an effective way to document findings. Inspectors should have access to all elements of a structure during an inspection.

During Routine NBIS Inspections, IDOT recommends all inspectors continue visual inspection and sound all surfaces of exposed steel piling for signs of deterioration. Wading and probing inspection techniques can be used for all submerged substructure units even if the structure is not in the underwater inspection program. When a foundation cannot be inspected due to normal high water levels, an underwater inspection should be performed. Illinois underwater inspection requirements can be found in Section 3.3.4 of the Structural Services Manual.

If an agency has concerns about exposed piling, the agency may institute a special inspection to monitor steel pile deterioration on a more frequent basis.

If excessive section loss (up to 30% in critical areas) causes the substructures condition rating (ISIS Item 60) to drop to a "4", a load rating will be required. Section loss requirements can be found in the *Illinois Highway Information System: Structure Information and Procedure Manual (SIP Manual)*. The manual is available by [clicking here](#).

Please review the Bureau of Local Roads and Streets Circular Letter 2014-15, "EXPOSED BRIDGE PILING", dated August 28, 2014 regarding Illinois' findings for exposed steel bridge piling. The Circular Letter is available by [clicking here](#).

Event Report

FHWA Office of Bridges and Structures

Subject: Closure of SR 14 Bridge - Due to H-pile Failure

Date of Event: Monday, October 3, 2016

Location: Streetsboro, OH

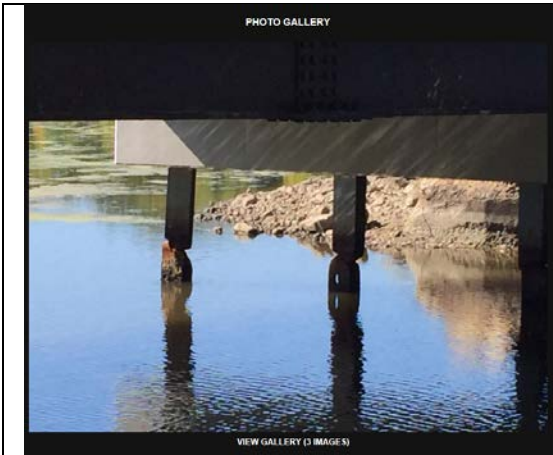
Discipline:	Structural Design	Structural Inspection	Geotech	Hydraulic
--------------------	-------------------	-----------------------	---------	-----------

Distributed for your:	Information	Action
------------------------------	-------------	--------

Audience:	For Internal Use	Public
------------------	------------------	--------

Relevant Policy or Guidance: None

Summary: On the evening of 10/3/16, ODOT was notified by a contractor working on an adjacent causeway project that the SR 14 bridge over Lake Rockwell appeared to be settling. A Construction Management team from ODOT reported to the site within hours and the bridge was immediately closed. ODOT engineers performed an inspection the following morning and found that all 12 steel H-piles supporting the two piers had buckled near the waterline and confirmed that the bridge should remain closed until a new structure is built. The steel H-piles failure is speculated to be caused by an overloaded vehicle crossing the structure illegally. ODOT has issued guidance to inspection staff statewide to obtain close access of steel piles in shallow to medium depth water that don't currently require an underwater inspection to ascertain their condition.



1. News Photo – October 2016 - West pile bent



2. ODOT Photo - July 2016 - Facing east



3. Photo - October 6, 2016 - Facing west from east bank



4. Photo - October 6, 2016 – Facing east from west bank



5. Photo -- October 6, 2016 - Facing west from east approach



6. Photo - - October 6, 2016 - Facing east from west bank

Current Report: The bridge is on the NHS and carries SR 14 over the Lake Rockwell/Cuyahoga River with an ADT of approximately 19,660. The bridge was constructed in 1985 and is a 164' long three span continuous multi beam steel structure. The substructure includes two pile bent piers with each having 6-unpainted steel H-piles. The bridge is listed as not requiring an underwater inspection. The load rating on file indicates the bridge had an operating load rating factor of 1.25 and an inventory load rating factor of 0.89 for the HS20 design vehicle, based on capacity of the superstructure. The bridge was not restricted for load. The most recent inspection of the bridge was completed in April 2016 which resulted in NBI condition ratings of: deck - 5, superstructure -7, and substructure - 7. The inspection interval of the bridge is annual, and is not to exceed 18 months. Ohio State Law requires annual inspections of all bridges greater than 10 feet. The *Ohio DOT Manual of Bridge Inspection* defines that "No routine inspection shall occur outside of an 18 month interval".

ODOT notified the OH FHWA Division Office and Resource Center (RC) of the event on the morning of 10/5/16. RC forwarded the news story to FHWA Office of Bridge and Structures (HIBS). HIBS contacted the OH Division Office for the bridge number (SFN 6700586) and additional information.

OH Division Office contacted Tim Keller, ODOT Bridge Engineer, who indicated they believe the 12 buckled steel H-piles were likely the result of an overloaded vehicle crossing the structure illegally. ODOT provided a photo from July 2016 showing the piles in rusty but seemingly good condition. As previously stated, the most recent NBI substructure condition rating was "7". The April 2016 bridge inspection report also indicated that 6 of the 12 steel H-piles had "rust at waterline," although there was no indication of section loss or extent of rust. As a follow-up, Mr. Keller contacted the District inspection staff to understand the level of inspection procedures performed. Through his discussions, he believes the previous bridge inspections were conducted appropriately in relation to ODOT inspection guidance but he is taking immediate actions to mitigate a similar future event.

The route had been restricted to 11' wide vehicles since this summer due to the adjacent causeway. Also, Mr. Keller indicated while the depth of water in the center of the channel is approximately 7', the water depth at the pile locations is less and the bridge is not on ODOT's list for underwater dive inspections. ODOT's requirement for having a bridge on the list is "*For structures that cannot be probed or inspected due to the water depth, turbidity or unsafe conditions during routine inspections shall receive an Underwater Dive Inspection*". ODOT traditionally has not taken channel soundings or cross sections during their bridge inspections. No water depth information is available from the inspection report. Recently a policy change has ODOT taking channel cross sections during bridge inspections. Lake Rockwell is a water supply reservoir for Akron and the water level fluctuates several feet throughout the

year.

ODOT's opinion was that the damage was possibly caused by an overloaded vehicle illegally crossing the bridge.

In response to this incident, ODOT has developed and implemented the following actions: 1. Include lessons learned in next refresher training later this year, 2. Instruct inspectors to obtain close access for condition rating of all bridges on steel bents in future inspections, 3. Emphasize the need to load rate substructures with excessive section loss.

On 10/18/16, ODOT issued guidance to all districts: inspectors, engineers, and planners regarding the design and inspection of bridges with steel bents. The following recommendations were provided:

1. **Get a good look** –Inspectors who inspect bridges with steel bents every year at the same time (esp. if during high water) should go back or change the month to inspect them during low flow. If unable to access the steel bents by (in order) wading in low-flow, with a boat or with the snooper and it's not on the underwater dive list, then it needs to be added to the underwater dive list. Access everywhere especially at the waterline. Use a hammer and scraper. Buy a pit gauge to measure section loss, use a UT gauge to measure section remaining, draw a sketch and as always take good notes.
2. **Always take photos!** - Take far away perspective photos and close photos from different angles (recommended for every inspection). Consider writing on the bridge and labeling the bridge item for the photo (ex. "Pier 1 Bent 3").
3. **Encase them** – Especially if they're in water. 7's shouldn't need confinement, 6's and worse typically need confinement unless an analysis proves otherwise. Consider bundling them into one project. Note that encasement of piles is not tracked in the inventory. If confinement or steel is added then the condition rating can come up to a 7. Inspectors are encouraged to write in the comments whether or not they are encased.
4. **Get the condition rating correct** – Steel sheaths without reinforcement and H-piles are to be inspected as steel. For element level steel with section loss the condition state is 3 (guidance below and [video tutorial here](#)). For the Substructure Summary and the 1-4 use the [2010 Manual](#) for assigning condition ratings (guidance also below). Note if there is section loss on most piles the condition rating is a 5-Fair or lower. If you have a 5, take measurements and send them for an evaluation whether a load rating is needed. If the rating is a 4-Poor then it needs rerated. Send in measurements for a rerating.

Information about the incident was also shared with local public agencies (LPA) for use on their inventories of bridges. LPAs in Ohio inspect their own bridges in accordance with State Law.

News Story - <http://fox8.com/2016/10/05/new-photos-released-of-bridge-in-streetsboro-after-emergency-closing/> and <http://www.paintsquare.com/news/?fuseaction=view&id=15610>

Previous Reports: None.

FHWA Response: Ohio Division Bridge Office believes the situation was handled correctly and appropriately resolved. Fortunately, the situation was discovered and the bridge was closed prior to anyone being injured. Ohio Division Office Bridge Engineers will work with ODOT in future to review corrosion inspection practice and documentation by inspectors and determine if improvements are warranted.

Attachments: None

For further information contact:

- Matt Shamis, Bridge Engineer, Ohio Division, 614-280-6847
- Kenny Tong, Materials and Structures Engineer, Ohio Division 614-280-6845
- Dennis O'Shea, Bridge Safety Engineer, North, HIBS-30, 302-734-3609