

Transmittal Notice BLREM 2023-01

Date: 02/16/2023

Distribution: MnDOT Bridge Office Web Site

Issued by: MnDOT Bridge Office

Subject: MnDOT Bridge Load Rating and Evaluation Manual Update

The MnDOT Bridge Office Bridge Load Rating and Evaluation Manual (BLREM) is available for download in Adobe PDF at: <http://www.dot.state.mn.us/bridge/>.

Instructions (for two-sided printing):

1. Remove from the BLREM:
 - Memo to Raters #2022-01: Selection Guidance for Pier Evaluation of Existing Bridges
2. Print and insert in the BLREM:
 - Memo to Raters #2023-01: Selection Guidance for Pier Evaluation of Existing Bridges

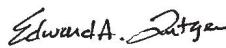
BLREM Update Summary

Revisions in the "FEBRUARY 2023" update consist of changes to:

Add Appendix J: Memos to Raters

- Memo to Raters #2022-01 is rescinded and replaced with Memo to Raters #2023-01: Revised Memo added to the BLREM to provide guidance on selection of existing piers for pier evaluation to aid in scoping efforts for upcoming projects.

For **technical questions** regarding this transmittal contact Yihong Gao, Bridge Ratings Engineer, at yihong.gao@state.mn.us or 651-366-4492.



Digitally signed by
Edward Lutgen
Date: 2023.02.16
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Ed Lutgen
State Bridge Engineer

Memo

Date: 02/16/2023

To: Bridge Evaluators, Load Rating Engineers, and Design Engineers

From: Sarah Sondag Sarah Sondag Digitally signed by Sarah Sondag
Date: 2023.02.16 13:08:51 -0600
Bridge Construction & Operations Engineer

RE: Memo to Raters #2023-01: Selection Guidance for Pier Evaluation of Existing Bridges

Introduction

Load rating of existing bridge piers has not been done in the past when scoping bridge repair projects, but due to our aging infrastructure and increasing dead and live loads, evaluation and analysis is now being pursued. The *AASHTO Manual for Bridge Evaluation* and the *MnDOT Bridge Rating and Evaluation Manual* are mainly focused on evaluation of superstructures rather than substructures. Using current design codes meant to envelope the loads and aging that will come in a new bridge's life often result in inadequate load ratings for existing piers. This memo contains guidance on selection of pier caps for evaluation.

Guidance on when pier evaluation is required

The guidance in this section addresses which pier caps need to be evaluated as part of the scoping of bridge preservation and rehabilitation projects. This guidance applies only to bridge repair projects which require preparation of bridge plans. For bridges with multiple piers or pier sections, only the individual piers or pier sections meeting the criteria below need to be analyzed unless criterion impacts all piers.

Pier cap analysis is required on bridge repair projects if ANY of the following is true:

1. Condition:

In accordance with the *MnDOT Bridge and Structure Inspection Program Manual (BSIPM)*, if the condition warrants an enhanced inspection, it is expected that enhanced pier inspections are performed in advance of analysis.

- a. Evidence of damage, distress, rebar corrosion, or stress related cracking has been found in the pier cap concrete or shotcrete repairs and one or more of these statements is true:
 - i. Any amount of pier cap being considered in Condition State 4 (Element 234 or 883 from BSIPM)
 - ii. At least 10% of the total Reinforced Concrete Pier Cap (Element 234) for the pier being considered is in Condition State 3 due to delamination or spalling.
 - iii. At least 20% of the total Reinforced Concrete Pier Cap (Element 234) for the pier being considered is in Condition State 3.

iv. Concrete Shear Cracking (Element 883) is in:

- (1) Condition State 3 for piers that have or had joints above the pier
- (2) Condition State 3 for locations or past locations of deck drain systems attached to the pier
- (3) Condition State 3 in a cantilever section with 2 or more beams. Beams with centerlines closer than 0.4 times the depth of the pier cap from the edge of the column are not considered to affect the cantilevered portion of the pier cap. The edge of the column is defined as the edge of a rectangular column or the face of the equivalent square column for round columns.

2. Geometry:

- a. The bridge has 3 or fewer beams, and new dead load is being added. Non-beam bridge structures, such as trusses or arch bridges, are considered to fit in the category of bridges with 3 or fewer beams.
- b. The project will change the location of or eliminate an open longitudinal joint between decks.

3. Loading:

- a. Design vehicle was an H series vehicle and new dead load is being added.
- b. The number of design lanes of live load on the bridge is being increased. Restriping within current gutter lines does not increase design lanes.
- c. The bridge has a sidewalk or median and the project will move the gutter line by more than 2 feet where it will change live loads in the pier cap.
- d. For beam bridges with 4 or more beams or for slab spans:
 - i. Dead load is being added to the pier that exceeds 7% of the current dead load.
 - ii. Dead load is being added to the pier that is less than 7% of the current dead load reaction and the pier cap meets any of the following condition levels:
 - (1) Concrete Shear Cracking (Element 883) in pier cap is in Condition State 3.
 - (2) If the pier has or had a joint above and/or deck drain system attached to the pier at any time in prior service history and:
 - At least 20% of the total Reinforced Concrete Pier Cap (Element 234) for the pier being considered is in Condition State 2 or
 - Any amount of the total Reinforced Concrete Pier Cap (Element 234) for the pier being considered is in Condition State 3.

For computation of dead load increases for bridges with 4 or more beams, the load may be calculated based on an equal distribution over the entire cross section except for unique situations where beams are disproportionately loaded.

4. Work Type:

- a. The work includes a superstructure replacement.
- b. The work includes a replacement deck that increases the dead load more than 5% of the current dead load or alters the beam locations more than 6".
- c. The work includes any widening of the pier.

Pier analysis will not be required for the following project types except as required by condition per BSIPM:

- Projects that do not require bridge plans such as painting or other coating application; crack sealing or flood sealing; deck patching.
- Projects where bridge work is limited to end post construction or reconstruction and/or expansion joint reconstruction at abutments only.
- Pile bent piers.
- Superstructures with integral diaphragms/pier caps which are part of superstructure evaluation.
- The next project for the bridge is in the State Transportation Improvement Program (STIP) or Capital Highway Investment Plan (CHIP) and is expected to be replacement.
- Piers where all beams are located above the columns do not require pier analysis unless issues based on section “1. Condition” warrant it. Beams located “above the columns” are defined as those where the beam centerline is located within the edges of the column.
- Pier infill walls are planned for the full length of the pier caps at all piers that meet any of the criteria above. The Bridge Construction & Scoping Engineer and Existing Structures & Design Engineer will jointly decide if analysis can be waived if partial length infill walls are planned.

Pier cap evaluation is required on all bridges that meet the criteria above. However, the Scoping Engineer can request a pier cap analysis on bridges not meeting the criteria. The Bridge Construction & Scoping Engineer and the Existing Structures Evaluation & Design Engineer will jointly decide if analysis is not needed for piers that meet the criteria.

For questions about this policy, please contact Jessica Duncan (Jessica.duncan@state.mn.us), or Sarah Sondag (sarah.sondag@state.mn.us or (651) 366-4507).

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