



NTSB National Transportation Safety Board

Office of Highway Safety

Bridge Inspections

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Presentations

1. Bridge description and collapse
2. Construction activities on bridge at time of collapse
3. Gusset plate inadequacy
4. Finite element analysis
5. Design and review process
6. Bridge load rating and bridge load analysis
7. Bridge inspections
8. Gusset plate inspections

Overview

- Brief summary of National Bridge Inspection Program
- History of inspections on I-35W Bridge
- Guidance used for inspecting gusset plates
- AASHTO guidance used by states to perform bridge inspections does not include gusset plates as a CoRe element

Formation of NBI Program

- Safety Board has history of investigating bridge accidents
- 1967 Silver Bridge collapse in West Virginia (46 fatalities)
- Safety recommendations aroused national interest in bridge inspection
- Safety recommendations led to formation of NBI Program

Summary of NBI Program

- National Bridge Inspection (NBI) Program consists of
 - National Bridge Inspection Standards (NBIS)
 - National Bridge Inventory
- Highlights of NBIS
 - Inspect all bridges over 20 feet in length
 - Inspect at least every 24 months

NBIS Inspections

- I-35W Bridge inspections set by NBIS
 - Routine inspections (24 months)
 - Fracture critical member inspections (24 months)
 - Underwater inspections (60 months)

I-35W History of Inspections

NBIS

- Routine inspections
 - Conducted annually beginning 1971
- Fracture critical member inspections
 - Conducted annually beginning 1994
- Underwater inspections
 - Conducted every 4 years beginning 2000

• Subjected bridge to more frequent inspections than required by NBIS

additional

- Fatigue evaluation inspections



Snooper truck inspection
of I-35W bridge



Condition & Appraisal Ratings

- Condition ratings
 - Deck
 - Superstructure
 - Substructure
- Appraisal ratings
 - Deck geometry
 - Under-clearances
 - Approach roadway alignment

Numerical Values

- Condition and appraisal ratings:
each given numerical values (0 to 9)
 - Failed condition = 0
 - Excellent condition = 9

Status Ratings

- 3 types of status ratings
 - Not deficient
 - Structurally deficient
 - Functionally obsolete
- Structurally deficient
 - Condition rating of 4 or less
 - Poor condition = 4
 - Does not indicate unsafe condition but that bridge is in need of repair

I-35W Bridge Ratings

- Classified as Structurally Deficient since 1991
- Superstructure assigned condition rating of 4

Main Truss Members Poor Weld Details



LEISS
TRUSS

Floor Truss Members Pack Rust





Stringer Ends Surface Rust Corrosion

Expansion Hinge in Span 2 No Longer Functioning



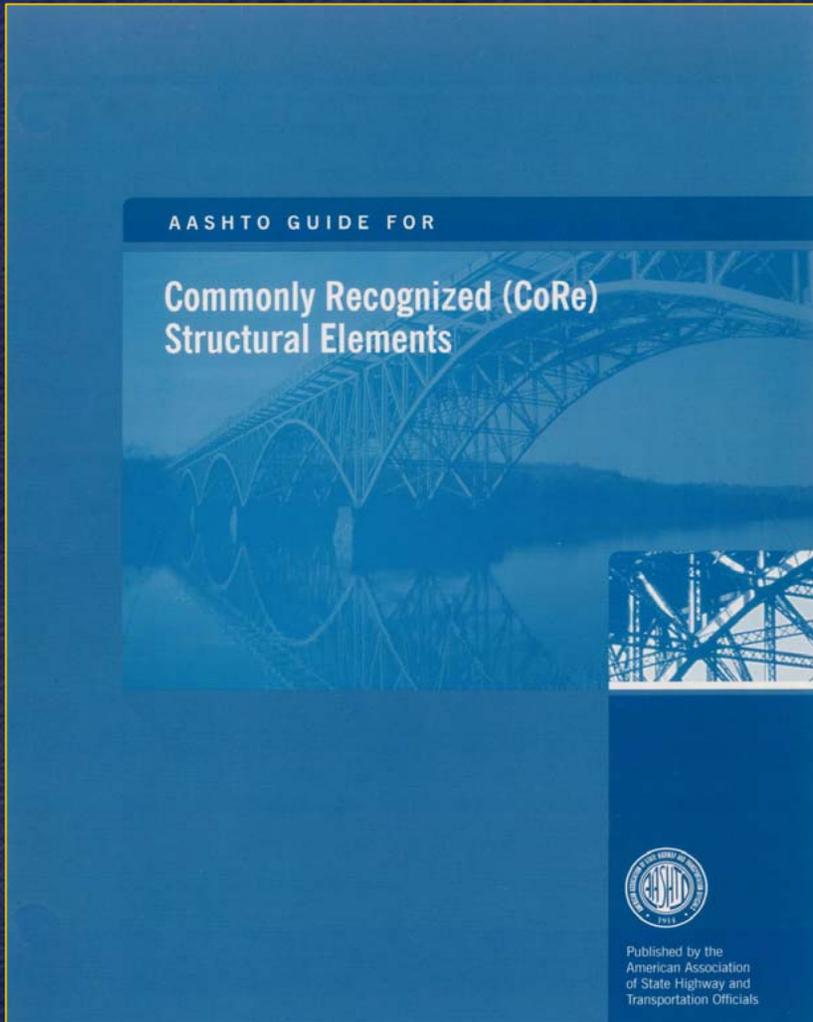
Findings

- No findings were considered a threat to load bearing capacity of structure
- No findings were determined to have played a role in collapse

Pontis Bridge Management System

- Used by Mn/DOT on routine inspections since 1994
- Licensed to 45 State DOTs
- Divides structure into elements to rate extent of deterioration
 - Beams
 - Pier columns
 - Decks

AASHTO CoRe Guide



- Contains element descriptions and rating procedures
- For use in any bridge management system, including Pontis

CoRe Elements

- CoRe elements
 - Expected deterioration
 - Can be inventoried
 - Meaningful interpretation
- Scale system and grouped by type
 - Deck
 - Superstructure
 - Substructure

Non-CoRe Elements

- Non-CoRe elements
 - Secondary members
 - Deterioration rate difficult to model
 - Difficult to write rating procedures
- Smart flags identify local problems
 - No specific action required
 - Grouped as miscellaneous type
 - Section loss, fatigue cracking, pack rust, traffic impact damage

Gusset Plates

- Gusset plates not included as CoRe element
- Significant problems would be noted in smart flags
- No specific action required for gusset plate problem noted in a smart flag
- Any distress conditions associated with gusset plates may not be used to determine condition rating

Example: Smart Flag

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Crew Number: 7627

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: METRO

BRIDGE 9340

I 35W OVER RR, MISS R, 2ND ST & RD

INSP. DATE: 06-15-2006

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
363	SECTION LOSS	2	06-15-2006	1 EA	0	1	0	0	N/A
			06-10-2005	1 EA	0	1	0	0	N/A

Notes: Section loss: pitting, flaking & surface rust on steel.

Summary

- Bridge was inspected at a frequency greater than required by NBIS
- Structurally deficient rating not a factor in collapse
- AASHTO guidance does not include gusset plates as CoRe element
- Staff proposes gusset plates be elevated to level commensurate with other CoRe elements

