



NTSB National Transportation Safety Board

Office of Highway Safety

IIC Opening Statement I-35W Bridge Collapse Minneapolis, MN

Mark Bagnard



Minnesota

WI

Minneapolis

St. Paul





I-35W Bridge

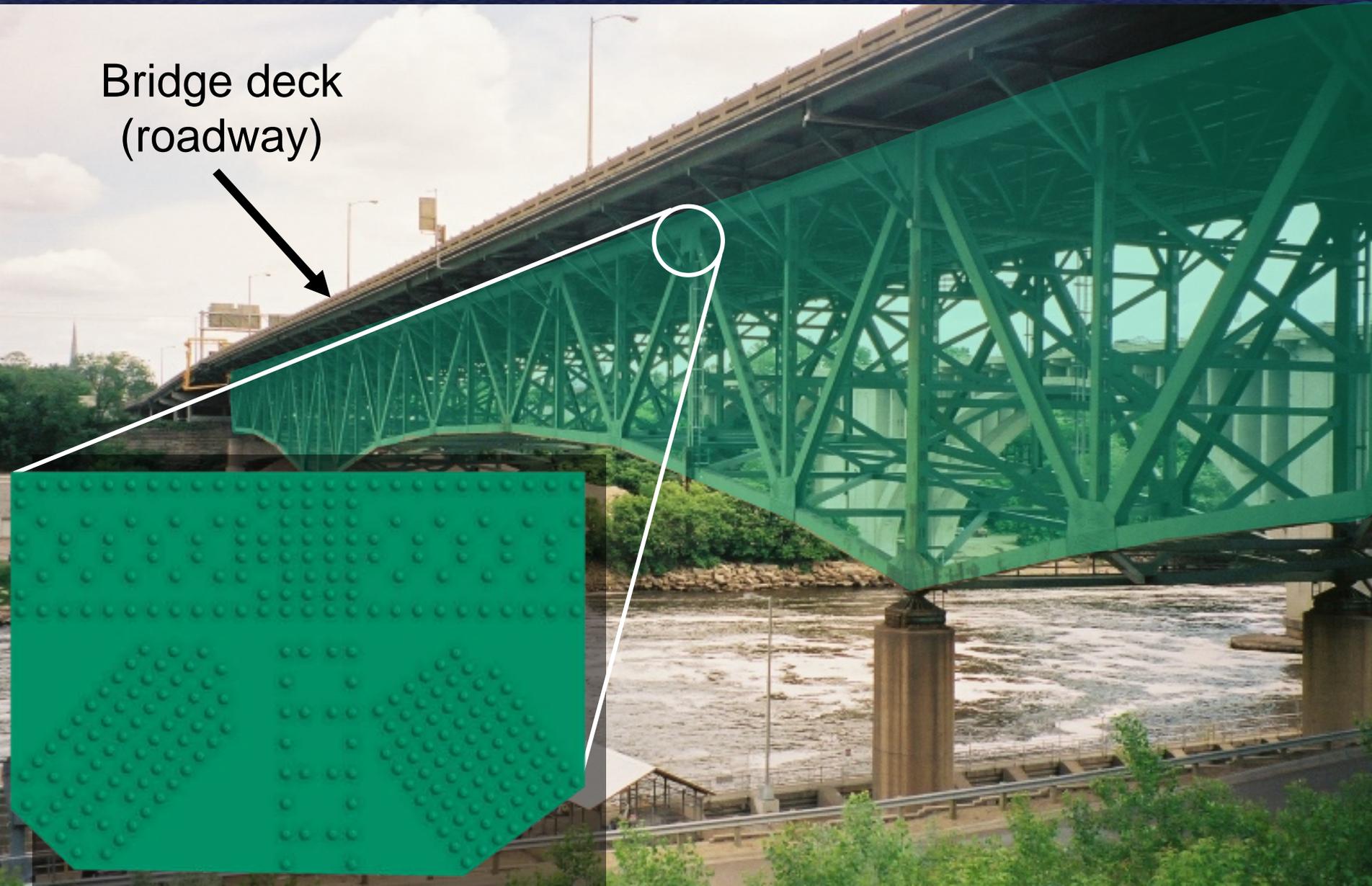
**Downtown
District**

I-35W Bridge Information

- Designed by Sverdrup & Parcel and Associates, Inc.
- Design certified by Sverdrup & Parcel in 1965
- Design approved by Minnesota Highway Department in 1965
- Bridge opened to traffic in 1967

I-35W Bridge Information

Bridge deck
(roadway)



Roadway Construction Work

- Repairs to bridge deck
- Project began on June 1, 2007
- Progressive Contractors, Inc.
- Overlaying roadway with new concrete

Collapse Video

LWR4



18:01:38 08/01/2007

Mn/DOT Traffic Camera





Source: MPD

Emergency Response

- Initial 911 call at 6:05 p.m.
- Multiple first responders dispatched at 6:07 p.m.
- First units arrived at 6:10 p.m.
- Unified Incident Command established in parking lot near bridge

Emergency Response



Source: MPD

Emergency Response

- 79 local and state agencies responded
- 15 federal agencies provided additional assistance

Emergency Response

- Search and recovery efforts lasted 20 days
- Sheriff's office recovered victims from waterway
 - Assisted by FBI and Navy dive teams
 - Last victim recovered on August 21

Emergency Response - Citizens



Emergency Response

- 111 vehicles on bridge when it collapsed
- 190 people on or near bridge
- 145 people transported to 12 area hospitals
- 13 victims fatalities
- Emergency response appropriate and well coordinated

Main command post

Water recovery command post





Home & Country
K102
All Time Favorites
CARRIE UNDERWOOD

No Trespassing
U.S. Government Property

Source: FHWA

Initial Investigation Activities

- Pre-collapse condition of bridge
 - Cracks
 - Corrosion
- History of bridge
 - Construction
 - Fatigue evaluations
 - Prior maintenance projects

Initial Investigation Activities

- Scope of maintenance work being performed at time of collapse
- Secured videotape of collapse for later detailed analysis
- Collapse was not the result of terrorism or other criminal activity

Wreckage Recovery

- NTSB to supervise removal of wreckage
- Victim recovery overlapped wreckage recovery
- Sheriff's office directed early wreckage removal efforts
- Recovery handled with no critical evidence lost or destroyed



Save at Gub then save at

PORTAL
E BARCEL

Source: FHWA



Source: FHWA



Source: FHWA



Wreckage Recovery

- Bohemian Flats city park
- Park leased through 2008 for storage and examination of bridge components
- Security measures





On Scene Investigative Staff

- Evidence Documentation
 - Robert Accetta
- Highway Construction
 - David Rayburn
 - George Black
- Bridge Design and Inspection
 - Dan Walsh

On Scene Investigative Staff

- Survival Factors
 - Ron Kaminski
 - Jennifer Morrison
- Investigative Support
 - Bob Barlett
 - Michele Beckjord
 - Bruce Magladry
 - Barbara Czech

On Scene Investigative Staff

- Structural Investigation
 - Jim Wildey
 - Vern Ellingstad
 - Joe Epperson
- Transportation Disaster Assistance
 - Erik Grosop
 - Debbie Hall

On Scene Investigative Staff

- Witness Information
 - Dennis Collins
- Investigator-In-Charge
 - Gary Van Etten
 - Mark Bagnard

Member On Scene and Staff

- Board Member Response
 - Chairman Mark Rosenker
 - Tom Doyle
 - Jeff Kennedy
- Government Affairs
 - Brenda Yager
- Public Affairs
 - Terry Williams
 - Peter Knudson

Other Investigative Staff

- Statistical Analysis
 - Jana Price
- Structural Modeling
 - Carl Schultheisz
 - Alan Kushner
- Video and Photographic Analysis
 - Doug Brazy

Other Investigative Staff

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 - Dan Horak
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 - Joe Panagiotou
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Parties to the Investigation

- Federal Highway Administration
- Jacobs Engineering Group, Inc.
- Minnesota Department of Transportation
- Progressive Contractors, Inc.

Other Investigative Participants

- FHWA Turner-Fairbank Highway Research Center
- University of Minnesota
- State University of New York at Stony Brook and SIMULIA
- Wiss, Janney, Elstner Associates, Inc.
- Sandia National Laboratories

Safety Issues

- Insufficient bridge design firm quality control procedures for designing bridges and insufficient state and federal procedures for reviewing and approving bridge design plans and calculations

Safety Issues

- Lack of guidance for bridge owners in regard to placement of construction loads on bridges during repair or maintenance activities
- Exclusion of gusset plates in bridge load rating guidance

Safety Issues

- Lack of inspection guidance for conditions of gusset plate distortion
- Inadequate use of technologies for accurately assessing condition of gusset plates on deck truss bridges

Investigative Tasks

- Examined more than 3,000 documents
- Examined and cataloged photographs and scans
 - 2,500 pre-collapse
 - 19,000 post-collapse
- Interviewed 15 individuals who participated in design and construction of bridge 40 years ago

Investigative Tasks

- Assessed design review process of 14 State Departments of Transportation
- Recovered and reconstructed main truss sections
- Documented and analyzed physical evidence
- Compared physical evidence to data collected from more than 350 finite element modeling evaluations

Investigative Findings

- Gusset plates were unable to support loads on bridge on day of collapse
- Failure of gusset plates resulted in total collapse of the bridge
- Gusset plates had inadequate capacity
- Design error in gusset plates

Safety Recommendation H-08-1

- Required bridge owners to conduct load capacity calculations for all structural members, including gusset plates, to verify stress levels
 - Whenever modifications were planned or operational changes significantly increase stresses
 - Included all non-load-path-redundant steel truss bridges within National Bridge Inventory

FHWA Technical Advisory

- Technical Advisory T 5140.29
 - Check gusset plate capacity during initial load ratings of newly opened bridges
 - Check gusset plate capacity during load rating calculations for future load ratings
 - Review past load rating calculations of bridges subjected to significant changes in stress levels

H-08-1 (Status)

- Response received from FHWA regarding actions taken
 - Issued Technical Advisory
 - Worked with AASHTO to develop guidance
 - Distributed guidance to bridge owners regarding evaluation of gusset plates
- Classified Open – Acceptable Response

Presentations

- Bridge description and collapse
- Construction activities on bridge at time of collapse
- Gusset plate inadequacy
- Finite element analysis

Presentations

- Design and review process
- Bridge load rating and bridge load analysis
- Bridge inspections
- Gusset plate inspections

