Office of Highway Safety

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

Mark Bagnard
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
Mn/DOT Traffic Camera
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

Source: MPD
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
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
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 Grosof
  – 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

• Structural Analysis
  – Joe Kolly
  – Dan Horak
  – Derek Nash
  – Joe Panagiotou
  – Frank Zakar
Other Investigative Staff

• Office of Highway Safety
  – Dwight Foster
  – Hank Hughes
  – Pete Kotowski
  – Jim LeBerte
# Report Development Staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Writer</td>
<td>Robert Moore</td>
<td></td>
</tr>
<tr>
<td>Presentation Editor</td>
<td>Sally Bennett</td>
<td></td>
</tr>
<tr>
<td>Audiovisual Support</td>
<td>Avis Clark</td>
<td></td>
</tr>
<tr>
<td>Proofreader</td>
<td>Gwynne O’Reagan</td>
<td></td>
</tr>
<tr>
<td>Photo Documentation</td>
<td>Alice Park</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Julie Perrot</td>
<td></td>
</tr>
<tr>
<td>Recommendations</td>
<td>Christy Spangler</td>
<td></td>
</tr>
<tr>
<td>Animations/Graphics</td>
<td>Debbie Stocker</td>
<td></td>
</tr>
</tbody>
</table>
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