National Transportation Safety Board

Evaluation of Structural Distress and Actions to Control Cracking

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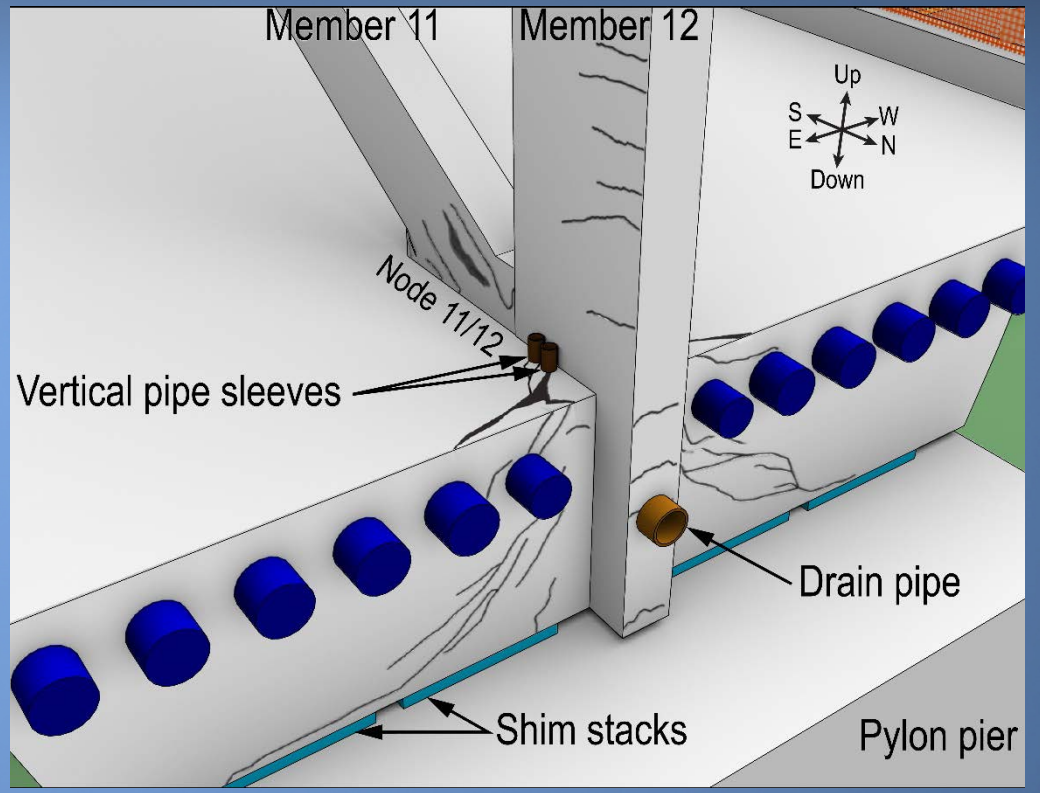
Overview

- Scale of cracking in member 11/12 nodal region
- FIGG's remedial plan to retension member 11
- Responsibilities and authorities for parties to close a bridge under construction for safety reasons
- FDOT oversight of Local Agency Program (LAP) projects

Cracking in Member 11/12 Nodal Region

- Structure showed notable cracking of reinforced concrete
- Extensive and large cracks in member 11/12 should have been recognized as abnormal
  - Cracks up to 0.016 inch wide – considered acceptable
  - Structural cracks in bridge were up to 0.75 inch wide – 40 times larger than typically acceptable
- Scale of cracking clear indication that load- resisting mechanisms were failing



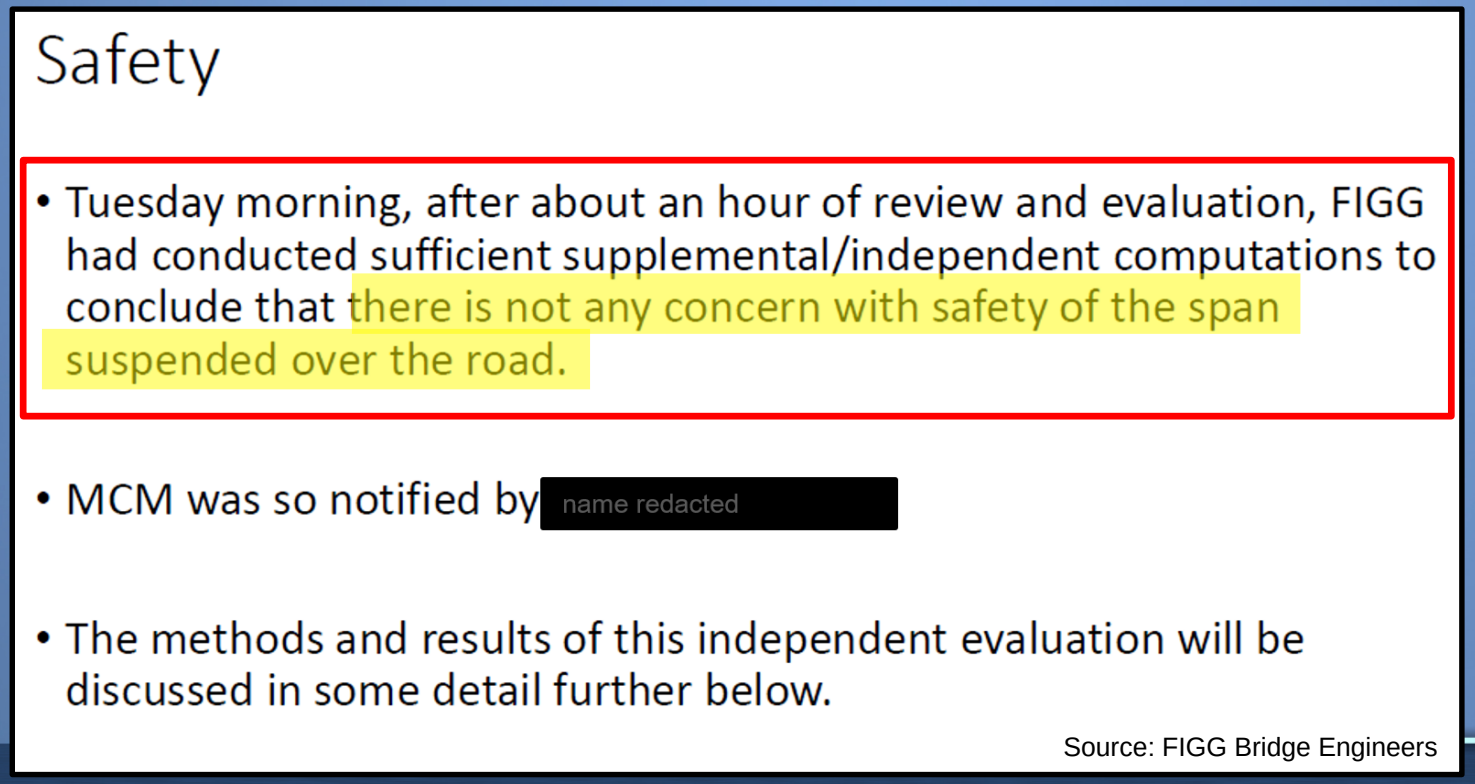
NTSB

FIGG Remedial Plan

- On March 15, 2018, FIGG presented a remedial plan to retension member 11
  - Not shown on FIGG design plans
  - Post-tensioning inspection contractor was not on site
- Retensioning was a change to design plans
  - Main span supported in a different manner
  - Severity of cracks in member 11/12 nodal region had worsened
  - Should have been internally and peer-reviewed by a P.E.

FIGG's March 15 Presentation

- FIGG EOR stated there was not any concern with safety of the span suspended over the roadway



Safety

- Tuesday morning, after about an hour of review and evaluation, FIGG had conducted sufficient supplemental/independent computations to conclude that there is not any concern with safety of the span suspended over the road.
- MCM was so notified by name redacted
- The methods and results of this independent evaluation will be discussed in some detail further below.

Source: FIGG Bridge Engineers

FIGG's March 15 Presentation (continued)

- FIGG EOR unable to identify origin of or reason for cracking (spalling) before retensioning
- Bridge collapsed immediately after retensioning member 11

Conclusions and Recommendations

- The diagonal type cracks, in excess of FDOT criteria, should be sealed with approved methods and materials (Epoxy injection, etc.)
- The spalled areas have not been replicated by the engineering analyses. However …
- The spalled areas are minor and it is recommended that they be prepared using normal procedures and poured back along with the up coming "pylon diaphragm" pour (different from and prior to the back span on falsework pours)

Source: FIGG Bridge Engineers

Responsibilities and Authorities Among Parties

- FIU, FDOT, FIGG, MCM, and Bolton Perez were aware of the cracks and their progression
- Remedial work as FIGG presented at meeting on March 15
  - Placing workers on structure without identifying failure origins
- Bolton Perez could have authorized work to be suspended, acting collectively with FDOT and FIU
- FIU, FDOT, FIGG, MCM, and Bolton Perez had implied authority to stop bridge work
  - Did not act on that authority

Past Projects FDOT Has Closed

- Project shutdown during construction does occur to protect public safety
- FDOT provided examples of bridge closures:
  - Memorial Causeway Bridge in 2004
  - Skyway Bridge in 2015
  - Interstate 4 Ultimate Project in 2018
- In all 3 instances, the EOR or construction engineering inspector told the contractor to cease operations to make remedial repairs

FDOT Local Agency Program Oversight

- Local agency program (LAP) certified agency must design, construct, and inspect project
- LAP projects ideal for low-risk ventures
- FIU received full local agency certification
  - No P.E.'s on staff
  - Relied on FIGG, MCM, and Bolton Perez
- FDOT responsible for oversight of LAP projects

Summary

- Distress in main span structure was active, particularly at member 11/12 nodal region
- All parties had authority to direct or authorize road closures but failed to do so
- FDOT to strengthen requirements in LAP agreements
  - Authority to immediately close a bridge when structural cracks are first detected
  - Require FDOT to monitor and inspect all uncommon or unique LAP bridge projects